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electronic engineers master catalog

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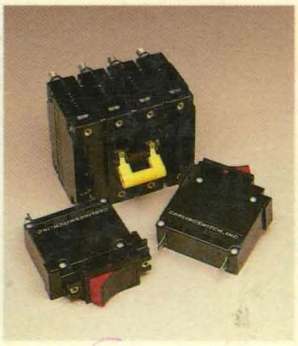
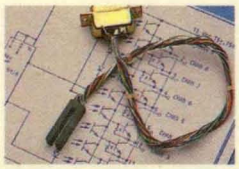

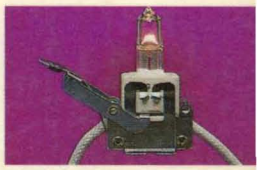
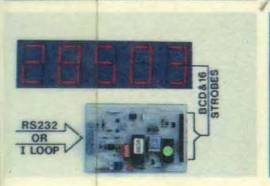

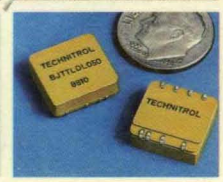

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2475 Fiber Optic Equipment & Accessories
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volume C Interconnections, packaging, and hardware
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how to use eem

The 32nd edition of EEM is arranged in four volumes each composed of related Product Sections. For user convenience, each volume contains its own Product index and Directory (green pages) and its own Manufacturers' and Sales Offices Directory (yellow pages). Every Product Heading and every manufacturer of electronic products is listed in each volume. Where, however, the Product Section is assigned to a volume other than that in use, a cross reference is made to the appropriate volume for further information.

To locate a specific product. Start by choosing the volume whose title describes the class of electronic product you are seeking. If you are not sure which volume is appropriate, pick up the first one at hand and look up the product heading in the green pages. There you will find either a list of that product's manufacturers or you will be referred to the proper volume. All products are identified by their generic terms. Please read the instructions on the first page of each section. Manufacturers with catalog data pages in this edition of EEM appear in bold face type and page numbers are shown. Manufacturers appearing in light face type have submitted verifying evidence that they supply the products shown. When you have located a product of interest, turn to the page(s) shown for further information. You will find these pages in each volume in the appropriate sections.

product selection guides

There are 35 Product Selection Guides included in this edition of EEM. They are located on the first pages of the Product Section to which they apply. Use these guides for basic selection parameters and then go to the EEM pages shown in the guide for more detailed information.

product selection index

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1600	Chemical Compounds (Adhesives, Cleaners, Coatings)			C•1123	
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*A Product Selection Guide precedes these Product Sections

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advertisers' index

To find a specific manufacturer's data pages, an alphabetical index of EEM participants appears in EEM starting on page **A**•4 of Volume A and on pages **B**•4, **C**•4 and **D**•4 of the other volumes.

trademark and logofinder directories

A comprehensive trademark directory is included at the end of the EEM yellow pages in Volume **C**.The EEM logofinder shows the symbols and graphics used by manufacturers as identifiers on their products. Use these pages to locate manufacturers of specific trademarks and logos.

manufacturers' index

In the EEM yellow pages you will find pertinent details on all manufacturers listed in EEM including local sales offices and/or distributors. Please refer to the detailed instructions on the first page of the EEM yellow pages for additional information.

to order a product found in eem

When you have located the product that suits your needs, call the manufacturer or the local sales rep or distributor as shown in the EEM yellow pages. Give the EEM data page number and specs from that page. You and the supplier will be talking on the same wave length which should simplify your ordering and buying.

to file manufacturers' catalogs and data

The EEM File System is revised and updated to reflect changes in EEM itself. Each new EEM File System contains a complete Product Index. This index tells you where to file which catalog. It also contains a cross reference identifying what should be filed in each section. In order to use the EEM File System all you need is a supply of standard letter size, third-cut manila file folders. You then use the pressure sensitive labels which are supplied with the system to go into as much detail as you want or need.
Each label fits the third-cut file folder exactly. There are over 300 of these labels in each system: 1 for the index, 1 each for the 61 EEM Product Sections, 24 for the alphabetical file of multiproduct catalogs, plus more than 200 additional labels for system expansion. The EEM File System also includes 61 Cross Reference Cards so you can quickly and easily find multiproduct catalogs. The EEM File System is complete and can save you countless hours of time and thousands of dollars. Send your check for $25.00 to: EEM File System, 645 Stewart Ave., Garden City, NY 11530 and we'll absorb postage and handling. Send a purchase order and add $2.00 for postage and handling. NY, CA and MA residents, please add sales tax.

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§ HBM, Inc., Marlboro, MA 01752, 508-624-4500 ..... B•1958
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§† Vibra-Metrics, Inc., Hamden, CT 06514, 203-288-6158;1-800-352-2001 ... B•1999
A. L. Design, Inc., Amherst, NY 14226 716-833-6272
Alpha-M Corp., Dallas, TX 75229 214-406-0424
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
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† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773 714-394-4481
† Cole Instrument Corp., Santa Ana, CA 92704 714-556-3100
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
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§ Endevco, San Juan Capistrano, CA 92675 714-493-8181
General Vibrations Mfg. Co., Manchester, CT 06040 203-646-0090
† Genisco Technology Corp., Transducers Products Div., Simi Valley, CA 93065 805-581-3985
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† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
§ IC Sensors, Inc., Milpitas, CA 95035 408-432-1800
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Pind Testers Inc., Irvine, CA 92718 714-380-1551
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† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Spectral Dynamics Division, Scientific-Atlanta, Inc., San Diego, CA 92123-0575 619-496-3400
† Sundstrand Data Control Inc., Sundstrand Corporation, Redmond, WA 98073-9701 206-885-3711
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§ Terra Technlg. Corp., Redmond, WA 98052 206-883-7300
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§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† INTELCO, Acton, MA 01720 508-264-4485
§ Jensen Tools, Inc., Axia, Inc., Phoenix, AZ 85044 602-968-6241
3 M Photodyne Inc., Camarillo, CA 93010 805-388-8378
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† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
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Telebyte Technology, Inc., Greenlawn, NY 11740 ..... 516-423-3232;800-835-3298
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§† M/A-COM Omni Spectra, Inc., Merrimack, NH 03054 603-424-4111
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 408-730-0300
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† Alarm Controls Corporation, Deer Park, NY 11729 516-586-4220
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
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§ Sofrel, Inc., Eden Prairie, MN 55344 ..... 612-937-8835;1-800-8-SOFREL
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† Systems Research Laboratories, Arvin/Calspan, Dayton, OH 45440 513-426-6000

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† Electro-Magentic Processes, Inc.:Member of ISC Defense & Space, Chatsworth, CA 91311-4858 818-882-6333
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† Rantec, Emerson Electric, Chatsworth, CA 91311 818-885-8223
† Sabre Communications Corp., Sioux City, IA 51102 712-258-6690
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† Collins Avionics Divisions, Rockwell Intl, Cedar Rapids, IA 52498 319-395-1000
† Electro-Magentic Processes, Inc.:Member of ISC Defense & Space, Chatsworth, CA 91311-4858 818-882-6333
§† Electro-Metrics, Penril Corp., Amsterdam, NY 12010 518-843-2600
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† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
† Transco Products, Inc., Camarillo, CA 93011-6003 805-987-8007
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Antenna Systems (MIL)-2440

† American Electronic Laboratories, Inc., Lansdale, PA 19446 215-822-2929
Compliance Design Inc., Boxboro, MA 01719 617-264-4668
† Electro-Magentic Processes, Inc.:Member of ISC Defense & Space, Chatsworth, CA 91311-4858 818-882-6333
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ..... 214-470-2106/2107
GTE Government Systems Corp., Mountain View, CA 94039 415-966-2000
† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000
† Lockheed Electronics Co., Inc., Lockheed Corporation, Plainfield, NJ 07061 201-757-1600
† Microwave Applications Group, Santa Maria, CA 93455 805-928-5711
† Microwave Products Div., Adams-Russell Elctrns. Co. Inc., Chatsworth, CA 91311 818-882-3434
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Rantec, Emerson Electric, Chatsworth, CA 91311 818-885-8223
† Sabre Communications Corp., Sioux City, IA 51102 712-258-6690
ST Research Corporation, Newington, VA 22122 703-550-7000
† Tecom Industries, Inc., Chatsworth, CA 91311 818-341-4010
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
† Transco Products, Inc., Camarillo, CA 93011-6003 805-987-8007
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

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Arresters, Electrical Surge/Lightning (MIL)-2440

§† **MCG Elctrns., Deer Park, NY 11729, 516-586-5125** ..... **B•1387**
§ **PolyPhaser Corporation, Gardnerville, NV 89410-1237, 702-782-2511;800-325-7170** ..... **B•1405**
Amber Inds., Inc., Dallas, TX 75379 214-490-9801
§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
§† EFI Elctrns., Salt Lake City, UT 84119 ..... 801-977-9009;800-221-1174
§† General Semiconductor Ind., Inc., Square D Company, Tempe, AZ 85281 602-968-3101
§† Joslyn Electronic Systems, Goleta, CA 93116 805-968-3551
Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016 312-824-1188
§ Lumex Opto/Comps., Inc., Palatine, IL 60067 312-359-2790
§† Noble U.S.A., Inc., Rolling Meadows, IL 60008 312-364-6038
Optrex/Satori, Torrance, CA 90505 213-378-9478
§† Power Integrity Corp., Greensboro, NC 27429-0682 ..... 919-379-9773;800-237-6260
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
§ World Products Inc., Sonoma, CA 95476 707-996-5201

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Assemblers/Disassemblers, Network-1900 — ***See Vol. D***

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Attenuators, Fiber Optic-2475

Contact East, N. Andover, MA 01845 508-682-2000
DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011 212-691-9050
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
GTE Fiberoptic Products, Williamsport, PA 17701 ... 717-326-6591;1-800-FBR-OPTICS
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† INTELCO, Acton, MA 01720 508-264-4485
† Light Control Systems Inc., Tyngsboro, MA 01879 617-649-9870
3 M Photodyne Inc., Camarillo, CA 93010 805-388-8378
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920

Attenuators, Fixed-3450 — ***See Vol. A***

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Attenuators, Impedance Matching-3450 — ***See Vol. A***

Attenuators, Logarithmic-3450 — ***See Vol. A***

Attenuators, Microwave-3450 — ***See Vol. A***

Attenuators, Programmable-3450 — ***See Vol. A***

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Attenuators, Switch Operated-3450 — ***See Vol. A***

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Attenuators, Variable-3450 — ***See Vol. A***

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EG & G Almond Instruments, Covina, CA 91724, 818-967-9521 ..... **D•1735**
† **Elcom Systems, Inc., Boca Raton, FL 33487, 305-994-1774** ..... **A•1779**
† **General Microwave Corporation, Amityville, NY 11701, 516-226-8900** .... **A•1784**
HC Power Inc., Irvine, CA 92714-5716, 714-261-2114 ..... **D•1795**
† Alan Industries Inc., Columbus, IN 47201 812-372-8869
§† Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
† Daico Industries, Inc., Compton, CA 90224 213-631-1143
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§† M/A-COM Omni Spectra, Inc., Merrimack, NH 03054 603-424-4111
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
Solitron/Microwave, Solitron Devices, Inc., Riviera Bch., FL 33404-9978 407-848-4311
† Tech Laboratories Inc., Palisades Pk., NJ 07650 201-944-2221

Attenuators (MIL), Inductive-2440

† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† Magnetic Component Engineering, Inc., Culver City, CA 90230 213-398-4761

Audible Alarms & Transducers-Also see Piezoelectric Ceramics; Transducers, Audio-1300 — ***See Vol. D***

Autoclaves-2550 — ***See Vol. D***

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Batteries, Gelled Electrolyte-3900 — ***See Vol. D***

Batteries, Lead Acid-3900 — ***See Vol. D***

Batteries, Lead Dioxide-3900 — ***See Vol. D***

Batteries, Lithium-3900 — ***See Vol. D***

Batteries, Lithium Manganese Dioxide-3900 — ***See Vol. D***

Batteries, Lithium Thionyl Chloride-3900 — ***See Vol. D***

Batteries, Mercury-3900 — ***See Vol. D***

Batteries, Mercury Oxide-3900 — ***See Vol. D***

Batteries, Nickel Cadmium-3900 — ***See Vol. D***

Batteries, Rechargeable-3900 — ***See Vol. D***

Batteries, Silver Cadmium-3900 — ***See Vol. D***

Batteries, Silver Oxide-3900 — ***See Vol. D***

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Batteries, Zinc Air-3900 — ***See Vol. D***

Batteries, Zinc Carbon-3900 — ***See Vol. D***

Batteries, Zinc Chloride-3900 — ***See Vol. D***

Batteries, Zinc Oxide-3900 — ***See Vol. D***

Batteries (MIL)-2440

Catalyst Research, Mine Safety Appliances Co., Inc., Baltimore, MD 21209, 301-296-7000, Ext. 304 ..... **D•1459,1461-1462**
Eagle-Picher, Joplin, MO 64801, 417-623-8000 ..... **D•1486-1488**
§† **Power Conversion, Inc., Hawker Siddeley Group, Ltd.-London, England, Saddle Brook, NJ 07662, 201-796-4800** ..... **D•1513**
SAFT America, Inc., Portable Battery Division, Valdosta, GA 31601, 912-247-2331 ..... **D•1525**

Sonnenschein Batteries Inc., Cheshire, CT 06410, 203-271-0091;800-4-DRYFIT ..... **D•1529**
Tadiran Elec. Inds. Inc., Port Washington, NY 11050, 516-621-4980 .. **D•1530-1531**
Alexander Batteries, New Product/OEM Divison, San Diego, CA 92128 619-480-4445
Engineered Assemblies Corp., Clifton, NJ 07011 ..... 201-340-0600;1-800-950-9111
Gates Energy Products, Gainesville, FL 32602 904-462-3911
Whittaker-Yardney Power Systems, Whittaker-Tech. Prods., Inc., Pawcatuck, CT 02891 203-599-1100

Battery Chargers — See Chargers, Battery (Vol. D), Power Supplies, Plug-in (Vol. D)

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Beads, Shielding, Ferrite — See Shielding, Beads, Ferrite (Vol. C)

Beam Splitters-3700

Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
† Plumer Precision Optics, Pennsburg, PA 18073 215-679-6272
Rolyn Optics Co., Covina, CA 91722-2199 ..... 818-915-5707/5717
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† UCE, Inc., Norwalk, CT 06854 203-838-7509

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Bimetals, Thermostatic-5300

Hold-Heet Products Corp., Chicago, IL 60640, 312-728-4454;312-728-4455 ..... **B•1539**
† American Etching & Mfg., Pacoima, CA 91331-2796 818-896-1187
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907 419-525-8500

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Boards, Display, Graphic-2450

Applied Data Systems, Baltimore, MD 21202, 800-541-2003;301-576-0335 ..... **B•1050**
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... **B•1066-1067**
ADAC Corp., Woburn, MA 01801 617-935-6668
Adage, Inc., Billerica, MA 01821 508-667-7070
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
† Aydin Corp., Horsham, PA 19044 215-657-7510
C & C Technology Inc., West Chicago, IL 60185 312-231-0015
§ Colorgraphic Communications Corp., Atlanta, GA 30366 404-455-3921
Dataq Instruments, Inc., Akron, OH 44311 216-434-4284
Digital Equip., Marlborough, MA 01752
DOW SWITCH, Wilmington, MA 01887 617-935-6395
† DY-4 Systems Inc., Nepean, Ont., CANADA K2H 9J4 613-596-9911
Dymec Silicon Transistor Corp., Winchester, MA 01890 617-729-7870
§ Dynatech Computer Company, Mountain View, CA 94039-7400 415-964-7400
† Eastern Electronics Mfg. Corp., National Patent Dev. Corp., East Hartford, CT 06108 203-528-9821
General Digital Corp., Manchester, CT 06040 203-647-9700
IDE Associates, Inc., Billerica, MA 01821 617-663-6878
Ironics Incorporated, Ithaca, NY 14850 607-277-4060
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
Matrox Electronic Systems, Ltd., Dorval, QU, CANADA H9P 2T4 514-685-2630
Mauell Corp., Dillsburg, PA 17019 717-432-8686
Micro Industries, Westerville, OH 43081 614-895-0404
Paracom Inc., West Chicago, IL 60185 312-293-9500
PERX,Inc., San Mateo, CA 94402 415-573-0801
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 312-438-4000
Raster Graphics, Inc., Bend, OR 97701 503-388-2584
Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§ Western Digital Corp., Irvine, CA 92714 714-863-0102

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Brakes, Clutches, Electromechanical-3500

Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... **B•1966**
Regdon Solenoid, Inc., Westmont, IL 60559, 312-789-0600 ..... **B•1670**
Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... **B•1316**
§ Altech Corp., Somerville, NJ 08876 201-359-4454
† Caribbean Assemblies, Inc., Casselberry, FL 32708 407-327-0602
Dial Products Co., Bayonne, NJ 07002 ..... 201-HE7-0720
§† Facet Enterprises, Inc., Elmira, NY 14902 607-737-8011
§ Machine Components Corp., Plainview, NY 11803 516-694-7222
§† Motion Control Group, American Precision Industries, Oceanside, CA 92054 619-439-7500
PIC Design, Remington Technologies, Inc., Middlebury, CT 06762 203-758-8272

Brakes, Magnetic-3500

† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529** ..... **B•1281, 1966**
Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ..... **B•1285**
Regdon Solenoid, Inc., Westmont, IL 60559, 312-789-0600 ..... **B•1670**
† **Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100** ..... **B•1037**
Vernitron Controls, Vernitron Corporation, San Diego, CA 92073, 619-428-5581 ..... **B•1313**
Ambi-Tech Inds., Hillsdale, NJ 07642 201-666-0504
§ B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
† Dial Products Co., Bayonne, NJ 07002 ..... 201-HE7-0720
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† Facet Enterprises, Inc., Elmira, NY 14902 607-737-8011
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
§† Motion Control Group, American Precision Industries, Oceanside, CA 92054 619-439-7500
† Perfect Gear & Instrument, Designatronics, Inc., New Hyde Park, NY 11040 516-328-3300
† PIC Design, Remington Technologies, Inc., Middlebury, CT 06762 203-758-8272
§ Square D Co., Palatine, IL 60067 312-397-2600
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200
† Sterling Instruments, New Hyde Pk., NY 11040 516-328-3300
† Techno, A DSG Company, New Hyde Park, NY 11040 516-328-3970

Brakes, Mechanical-3500

Jan Hardware Mfg. Co., Long Island City, NY 11101, 718-361-0800 ..... **C•1586**
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... **B•1281**
Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ..... **B•1285**
† **Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300** ..... **B•1305**
§† Facet Enterprises, Inc., Elmira, NY 14902 607-737-8011
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
PIC Design, Remington Technologies, Inc., Middlebury, CT 06762 203-758-8272
† Sterling Instruments, New Hyde Pk., NY 11040 516-328-3300
† Techno, A DSG Company, New Hyde Park, NY 11040 516-328-3970
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

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Brushes & Brush Assemblies-3500

Airflyte Elctrns. Co., Bayonne, NJ 07002, 201-436-2230 ..... **B•1228-1232**
† **Fabricast, S. El Monte, CA 91733, 818-443-3247** ..... **B•1247**
† **Graphite Metallizing Corp., Yonkers, NY 10702, 914-968-8400** ..... **B•1252**
† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 703-953-4751** ..... **B•1267-1268,1270,1276**
The J. M. Ney Company, Bloomfield, CT 06002, 203-242-2281 ..... **C•1619**
† Danmar Inds., Chatsworth, CA 91311 ..... 818-882-7979/5280
§† Eraser Co., Syracuse, NY 13221 315-454-3237
§† Facet Enterprises, Inc., Elmira, NY 14902 607-737-8011
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
Jonard Industries Corp., Tuckahoe, NY 10707 914-793-0700
Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
† Maurey Instrument Corp., Chicago, IL 60629 312-581-4555
† Micro-Products Engineering Co., Newark, NJ 07108 201-824-8467
Stackpole, Carbon Div., St. Marys, PA 15857 814-781-1234
§† Superior Carbon Products, Inc., Walnut Grove, MS 39189 601-253-2442
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
Thermotech Div. of Menasha Corp., Hopkins, MN 55343 612-933-9400
† Unit Industries, Fullerton, CA 92631 714-871-4161

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Cable, FEP Insulated-6000 — *See Vol. C*

Cable, Fiber Optic-2475

§† **Belden Wire and Cable, Cooper Industries, Richmond, IN 47375, 317-983-5200;800-BELDEN-1** ..... **C•1768**
§ **Daburn Electronics & Cable Corp., Northvale, NJ 07647, 201-768-5400** .. **C•1848**
Dymec Silicon Transistor Corp., Winchester, MA 01890, 617-729-7870 ..... **B•1206-1207**
Fiberoptic Systems, Inc., Simi Valley, CA 93063, 805-583-2088 ..... **B•1205**
Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727 ..... **B•1214**
§† **MERET, Inc., Santa Monica, CA 90404-4998, 213-828-7496** ..... **B•1215**
§ AMP, Harrisburg, PA 17105 717-564-0100
Andrew Corp., Orland Pk., IL 60462 800-255-1479
§† APEC Fiber Optics Corp., College Station, TX 77840 409-693-5397
§† AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
§† Berk-Tek Inc., New Holland, PA 17557 717-354-6200
§† BIW Cable Systems, Inc., N. Dighton, MA 02764 508-822-6600
Breeze-Illinois, TransTechnology Corp., Peoria, IL 61615-1584 309-693-3300
§ BRIntec Corp., Brand-Rex Cable Systems Division, Willimantic, CT 06226-1128 203-456-8000
§ Cablex, Inc., Englewood, CO 80112 303-792-5760
§ Canada Wire and Cable Limited, Don Mills, Ontario, CANADA M3C 3J4 416-424-5000
Canstar, Canada Wire & Cable, Ltd., North York, Ont., CANADA M2H 3H7 416-756-4100
CICOIL CORP., Valencia, CA 91355-3428 805-295-1295
§ Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
Computer System Products, Minneapolis, MN 55447 ..... 612-476-6866;800-422-2537
§ Custom Cable Corp., Westbury, NY 11590 516-334-3600
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
† Electro Weave, Worcester, MA 01604 617-752-8932
Fiberguide Industries Inc., Stirling, NJ 07980 201-647-6601
Fiberoptics Technology, Inc., Pomfret, CT 06258 ..... 203-928-0443, 800-433-5248
† Fibronics International Inc., Communications Way, Hyannis, MA 02601-1892 508-778-0700

† Force, Inc., Christiansburg, VA 24073 703-382-0462
§† General Cable Co., Fiber Optics Div., S. Plainfield, NJ 07080 201-769-3200
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
W. L. Gore & Assocs., Inc., Phoenix, AZ 85076 602-526-1290
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
§† Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ Light Control Systems Inc., Tyngsboro, MA 01879 617-649-9870
† Manage, Inc., Fibre Optics Elctrns. Sys. Grp., Chicopee, MA 01014 413-592-9123
§ Math Assocs., Westbury, NY 11590 516-334-6800
† 3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
Micro-Coax Components, Inc., a UTI Company, Collegeville, PA 19426 .. 215-489-3700
Microdot, Interconnect Systems Division, Montgomeryville, PA 18936 ... 215-699-5373
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Olympic Wire & Cable, Fairfield, NJ 07006 201-227-7996
† Optelecom, Inc., Gaithersburg, MD 20877 301-840-2121
† Optical Cable Corp., Salem, VA 24153-0999 703-389-9900
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
§ Photoswitch Div., Allen Bradley Co., Waltham, MA 02154 617-466-8000
Raychem Corp., Elctrns. Grp., Menlo Park, CA 94025 415-361-3860
Rehlander Assocs., Beverly, MA 01915 617-922-5961
§† Remee Products Corp., Florida, NY 10921 914-651-4431
§ Siecor Electro-Optic Products, Siecor Corporation, Research Triangle Park, NC 27709 ..... 1-800-888-LAN1;919-481-5100
§† SpecTran Corp., Sturbridge, MA 01566 508-347-2751
§† Standard Wire & Cable Co., Rancho Dominguez, CA 90220 ..... 213-609-1811; 800-447-0006/821-527
§ Storm Products Co., Hinsdale, IL 60521 312-323-9121
§ Thomas & Betts Corporation, Bridgewater, NJ 08807 201-685-1600
† United Wire & Cable Corp., Worcester, MA 01604 617-757-3872
Welch Allyn, Inc., Industrial Products Division, Skaneateles Falls, NY 13153-0187 315-685-8945
§† Western Electronic Products Co., San Clemente, CA 92672 714-492-4677
§† Whitmor Wire & Cable, Valencia, CA 91355 805-257-2400
† Woven Electronics, Woven Electronics Corporation, Simpsonville, SC 29681 803-963-5131

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Cable, Heater-6000 — ***See Vol. C***

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Cable, Thermocouple-6000 — ***See Vol. C***

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Cable, Woven Conductor-6000 — ***See Vol. C***

Cable & Assemblies (MIL)-2440

American Insulated Wire Corp., Leviton Mfg. Co., Pawtucket, RI 02862, 401-726-0700 ..... C•1763
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492, 203-265-8910 ..... C•1266
Belden Wire and Cable, Cooper Industries, Richmond, IN 47375, 317-983-5200;800-BELDEN-1 ..... C•1768
§† Brim Electronics, Fair Lawn, NJ 07410, 201-796-2886 ... C•1820,1826,1828-1829
Caton Connector Corp., Kingston, MA 02364, 617-585-4315 ..... C•1303-1304
Comm/Scope, Inc., Network Cable Div., Hickory, NC 28603, 704-324-2200;800-982-1708 ..... C•1831
Component Mfg. Svc., Inc., W. Bridgewater, MA 02379, 508-580-0111 ... C•1309
§† Daburn Electronics & Cable Corp., Northvale, NJ 07647, 201-768-5400 ..... C•1848-1849,1851
† GSI Corp., Timonium, MD 21093, 301-252-1768 ..... C•1860-1861
† Jettron Products Inc., E. Hanover, NJ 07936, 201-887-0571 ..... C•1392-1393
§† Judd Wire Inc., Turners Falls, MA 01376, 413-863-4357 ..... B•1019
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-9440 ..... C•1871
Mueller Elec. Co., Cleveland, OH 44114, 216-771-5225 ..... C•1458
National Wire & Cable Corp., Los Angeles, CA 90031-1780, 213-225-5611 ..... C•1886,1889-1896
§ Pomona Electronics, Pomona, CA 91766, 714-623-3463 ..... C•1477
Precision Interconnect, Portland, OR 97224, 503-620-9400 ..... C•1918
Ritz Electronics/Relco, New Dundee, Ont., CANADA N0B 2E0, 519-696-2616 ..... C•1087
Rowe Industries, Inc., Toledo, OH 43612, 419-729-9761 ..... C•1518-1519
† Trompter Electronics, Inc., Sterling Holding, Westlake Village, CA 91359-5069, 818-707-2020 ..... C•1554
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 213-316-9984 ..... C•1087
ABL Electronics Supply, Inc., Yorktown Hgts., NY 10598 914-962-2253
† Accurate Electronics, Elyria, OH 44036 216-366-6330
Adirondack Wire & Cable, ACS Industries Inc., Woonsocket, RI 02895 1-401-769-1600
Advanced Techn. Research Labs., Alexandria, VA 22312 703-750-2920
† Advance Wire & Cable, The Advance Group, Belmont, CA 94002 415-592-4550
Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
Alpha Wire Corp., Elizabeth, NJ 07207-0711 201-925-8000
Amphenol Interconnect Products, Endicott, NY 13760 607-754-4444
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
† Automation Elctrns., R.J.A. Inds., Inc., Chatsworth, CA 91311 818-998-5124
† Breeze-Illinois, TransTechnology Corp., Peoria, IL 61615-1584 309-693-3300
§† BRIntec Corp., Brand-Rex Cable Systems Division, Willimantic, CT 06226-1128 203-456-8000
Burton Electrical Engineering, Wyle Laboratories, El Segundo, CA 90245-0217 213-772-1406
† Cable Systems, Inc., Everett, MA 02149 617-389-7080
† Cabletest Products Co., Melrose, MA 02176 617-665-2932
§ Cablex, Inc., Englewood, CO 80112 303-792-5760
† CAD Engrg. & Assembly Inc., Mentor, OH 44060 216-255-7744
† Capulum Cable Technology, Ltd., Nepean, Ontario, CANADA K2H 9C1 .. 613-726-1966
† Cardinal Control Co., Kensington, CT 06037 203-828-6379
† CICCIL CORP., Valencia, CA 91355-3428 805-295-1295
† Coaxitube Corp., Salisbury, MD 21801 301-546-3911
Communication Devices, Inc., Scarborough, Ont., CAN M1H3A4 416-439-6320
Computer System Products, Minneapolis, MN 55447 ..... 612-476-6866;800-422-2537
Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412 312-455-8830
§ Control Cable, Inc., Baltimore, MD 21207 301-298-4411
§ Cooner Wire Co., Chatsworth, CA 91311 818-882-8311
† CSD Industries, Inc., dba C Enterprises , San Marcos, CA 92069 ..... 619-744-8182; 800-334-3815;800-423-3345
† DataCon, Inc., Burlington, MA 01803 617-273-5300
† De Anza Mfg. & Svcs. Inc., Sunnyvale, CA 94089 408-734-2020
§† Dearborn Wire & Cable, Inc., Wheeling, IL 60090 ..... 312-459-1000;800-323-0198
† Diagostic Instrument Corp., Ayer, MA 01432 508-772-4572
† Dilwol, Burlington, Ontario, CANADA L7N 3G2 416-335-2343
† Electroprep, Inc., Cataumet, MA 02534 617-563-5559
† Electro-Support Systems, Temecula, CA 92390 714-676-2751
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
† Excel Specialty Corp., Chicago, IL 60660 312-262-4781
† The First Electronics Corp., Boston, MA 02125 617-288-2430
† Gavitt Wire & Cable, Brookfield, MA 01506 508-867-6476
† W. L. Gore & Assocs., Inc., Phoenix, AZ 85076 602-526-1290
† W. L. Gore & Assocs., Newark, DE 19714 302-738-4880
Hudson Industries, Hudson, NH 03051 603-880-7712
ITT Sealectro, Trumbull, CT 06611 203-372-4118
Judd Wire Inc., San Marcos, CA 92069 619-744-7720
† Lamtech Electronics, Garland, TX 75042 214-272-3504
† Lynn Electronics, Feasterville, PA 19047 ..... 215-677-6700;800-523-6075
§ Markel Corp., Norristown, PA 19404 215-272-8960
§† 3M-Electronic Products Division, Austin, TX 78769-2963 512-984-1800
§† Microdot, Interconnect Systems Division, Montgomeryville, PA 18936 ... 215-699-5373
National Telephone & Electronics Inc., Miami, FL 33172 305-592-0551
† N.E.D. Cable Co., Div. of Electro-Prep, Inc., Salem, MA 01970 617-745-9911
† Olympic Wire & Cable, Fairfield, NJ 07006 201-227-7996
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
§† Precision Tube, N. Wales, PA 19454 215-699-5801
† Product Technology, Inc., Irvine, CA 92714 714-474-8998
Pulse Tronic Inc., Ville St. Laurnet, Que., CANADA H4L 4Z8 514-747-6028
† Reactel, Inc., Rockville, MD 20850 301-279-5535
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
† Storm Products Co., Hinsdale, IL 60521 312-323-9121
§ Support Systems Intl. Corp., Richmond, CA 94804 415-234-9090
† Techdyne, Inc., Lance Wire & Cable Div., Hamden, CT 06514 203-288-5571

† Tech Laboratories Inc., Palisades Pk., NJ 07650 201-944-2221
† Tevelec, Ltd., Mississauga, Ontario, CANADA L4W 2W6 416-624-5241
† Victor Elec. Wire & Cable, W. Warwick, RI 02893 .. 401-821-1700;SALES 401-821-7800
Weico Wire & Cable, Edgewood, NY 11716 516-254-2970
§† Western Electronic Products Co., San Clemente, CA 92672 714-492-4677
† Western Reserve Electronics, Twinsburg, OH 44087 216-425-4951
Whitmor Wire & Cable, Valencia, CA 91355 805-257-2400
§† Wilco Wire & Cable Co., Inc., San Jose, CA 95133 408-926-8880
† Wire-Pro, Inc., Salem, NJ 08079 ..... 609-935-7601;609-935-7651
† Zippertubing Co., Los Angeles, CA 90061 213-321-3901

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Cable (MIL), Flat-2440

Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492, 203-265-8910 ..... C•1266
§† Daburn Electronics & Cable Corp., Northvale, NJ 07647, 201-768-5400 .. C•1848
† GSI Corp., Timonium, MD 21093, 301-252-1768 ..... C•1860-1861
† Advanced Circuit Technology, Nashua, NH 03062 ..... 603-880-6000;800-234-FLEX
§† Alpha Wire Corp., Elizabeth, NJ 07207-0711 201-925-8000
Amphenol Interconnect Products, Endicott, NY 13760 607-754-4444
§† Brim Electronics, Fair Lawn, NJ 07410 201-796-2886
§† BRIntec Corp., Brand-Rex Cable Systems Division, Willimantic, CT 06226-1128 203-456-8000
§ Cablex, Inc., Englewood, CO 80112 303-792-5760
† CICOIL CORP., Valencia, CA 91355-3428 805-295-1295
Dearborn Wire & Cable, Inc., Wheeling, IL 60090 ..... 312-459-1000;800-323-0198
† FLEX-Link Products, Inc., San Fernando, CA 91340 818-898-1451
† W. L. Gore & Assocs., Inc., Phoenix, AZ 85076 602-526-1290
† W. L. Gore & Assocs., Newark, DE 19714 302-738-4880
§ 3M-Electronic Products Division, Austin, TX 78769-2963 512-984-1800
Omega Engineering, Stamford, CT 06907 800-826-6342
§† Panduit Corp., Tinley Park, IL 60477-0981 800-777-3300
Raychem Corp., Elctrns. Grp., Menlo Park, CA 94025 415-361-3860
§ Support Systems Intl. Corp., Richmond, CA 94804 415-234-9090
† Tech Laboratories Inc., Palisades Pk., NJ 07650 201-944-2221
† Temp-Flex Cable, Inc., S. Grafton, MA 01560 508-839-5987
Weico Wire & Cable, Edgewood, NY 11716 516-254-2970
§ Wilco Wire & Cable Co., Inc., San Jose, CA 95133 408-926-8880
† Wire-Pro, Inc., Salem, NJ 08079 ..... 609-935-7601;609-935-7651

Cable (MIL), RF-2440

ABL Electronics Supply, Inc., Yorktown Hgts., NY 10598, 914-962-2253 ..... C•1761-1762
§† Comm/Scope, Inc., Network Cable Div., Hickory, NC 28603, 704-324-2200;800-982-1708 ..... C•1831,1833
§† Daburn Electronics & Cable Corp., Northvale, NJ 07647, 201-768-5400 .. C•1848
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-9440 ..... C•1868,1871
National Wire & Cable Corp., Los Angeles, CA 90031-1780, 213-225-5611 ..... C•1887-1890
Breeze-Illinois, TransTechnology Corp., Peoria, IL 61615-1584 309-693-3300
§† Brim Electronics, Fair Lawn, NJ 07410 201-796-2886
§† BRIntec Corp., Brand-Rex Cable Systems Division, Willimantic, CT 06226-1128 203-456-8000
Carol Cable Co. Inc., Pawtucket, RI 02862 401-724-9605
Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
† Danmar Inds., Chatsworth, CA 91311 ..... 818-882-7979/5280
Dearborn Wire & Cable, Inc., Wheeling, IL 60090 ..... 312-459-1000;800-323-0198
§ Electronic Resources Inc., Sunnyvale, CA 94089 408-745-1420
§† FL Surprenant Div., Clinton, MA 01510 617-368-1401
† W. L. Gore & Assocs., Inc., Phoenix, AZ 85076 602-526-1290
† W. L. Gore & Assocs., Newark, DE 19714 302-738-4880
Microdot, Interconnect Systems Division, Montgomeryville, PA 18936 ... 215-699-5373
† Plastoid Corporation, Hamburg, NJ 07419 201-827-7141
Raychem Corp., Elctrns. Grp., Menlo Park, CA 94025 415-361-3860
Remee Products Corp., Florida, NY 10921 914-651-4431
§† Specialty Cable Corporation, Wallingford, CT 06492 ..... 800-456-SPEC
† Storm Products Co., Hinsdale, IL 60521 312-323-9121
§ Support Systems Intl. Corp., Richmond, CA 94804 415-234-9090
§† Teledyne Thermatics, Teledyne Inds., Inc., Elm City, NC 27822 919-236-4311
Weico Wire & Cable, Edgewood, NY 11716 516-254-2970
§† Western Electronic Products Co., San Clemente, CA 92672 714-492-4677
† Whittaker Corp., Electronic Resources Div., Simi Valley, CA 93063 805-584-4100
§ Wilco Wire & Cable Co., Inc., San Jose, CA 95133 408-926-8880
† Wire-Pro, Inc., Salem, NJ 08079 ..... 609-935-7601;609-935-7651

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Calibrators, Crystal-2900 — ***See Vol. D***

Calibrators, Current-2900 — ***See Vol. D***

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Capacitors (MIL), Fixed-2440

† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102, 516-547-5700 ..... A•1007-1011
ASC, Canoga Pk., CA 91304, 818-710-8555 ..... A•1014-1016
† AVX Corporation, Myrtle Bch., SC 29577, 803-448-9411 ..... A•1019-1020,1022-1023, B•1008
§† Component Research Co. Inc., Santa Monica, CA 90404, 213-829-3615 .. A•1026
CSI Capacitors, CSI Technologies, San Marcos, CA 92069, 619-747-4000 ..... A•1067
§† Electronic Concepts, Inc., Eatontown, NJ 07724, 201-542-7880 ..... A•1070-1071,1073,1075
Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705, 714-979-4440 ..... A•1076
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475 ..... A•1085
† Johanson Dielectrics, Burbank, CA 91505, 818-848-4465 ..... A•1094
§† Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676 ..... A•1095
† Kemet Electronics Corporation, Greenville, SC 29606, 803-963-6621 ..... A•1096-1097
† Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., Indianapolis, IN 46241, 317-856-3731 ..... A•1108-1111
† Mepco/Centralab, North American Philips Corporation, Columbia, SC 29212-3198, 803-772-2500 ..... A•1122
† Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 201-679-3366 ..... A•1126,1129-1133
NWL Capacitors, NWL Transformers, Riviera Bch., FL 33404, 305-848-9009 ..... A•1147
Nytronics Components Grp., Inc., Darlington, SC 29532, 803-393-5421 ..... A•1149,1151-1152,1155,1157-1161
Oxley, Inc., Branford, CT 06405, 203-488-1033 ..... B•1025
§† Tusonix, Inc., Tucson, AZ 85740-7144, 602-744-0400 ..... A•1181
Wesco Electrical Co., Greenfield, MA 01301, 413-774-4358 ..... A•1186-1189,1192-1193
§† American Capacitor Corporation, Irwindale, CA 91706 818-814-4444
† Cera-Mite Corp., Grafton, WI 53024 414-377-3500
§ Chicago Condenser Corp., Chicago, IL 60622 312-227-7070
§† Cornell-Dubilier Elctrns./Sangamo Comps., New Bedford, MA 02744, MA 02741 508-996-8561
† Cornell-Dubilier Elctrns., Wayne, NJ 07470 201-694-8600
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052 716-652-3600
§ Electronic Resources Inc., Sunnyvale, CA 94089 408-745-1420
§† Electron Products, Irwindale, CA 91706 818-960-2299
† Elmag Division, Lindgren RF Enclosures, Riviera Bch., FL 33404 407-881-9292
† Kahgan Electronics Corp., Hempstead, NY 11550 516-538-2300
† KD Components, Inc., Santa Ana, CA 92707 714-545-7108
† LSI Jennings, San Jose, CA 95122-2696 408-292-4025
Maida Development Co., Hampton, VA 23663 804-723-0785
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, Riviera Beach, FL 33404 407-881-3200
† Mepco/Centralab, North American Philips Corporation, Los Angeles, CA 90039 818-240-4880
† Mepco/Centralab, North American Philips Corporation, El Paso, TX 79915 915-779-3961
† Mepco/Centralab, North American Philips Corporation, Mineral Wells, TX 76067 817-325-7871
Microcap, Inc., A MicroSemi Company, Escondido, CA 92025 619-480-1906
§† Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
§† Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Philips Circuit Assemblies, A Subdivision of North American Philips Corp., West Lafayette, IN 47906 317-463-2536
Pico Electronics, Inc., Mt. Vernon, NY 10552 ..... 914-699-5514;800-431-1064
Presidio Components, Inc., San Diego, CA 92121 619-578-9390
† Rogers Corp., Rogers, CT 06263 203-774-9605
SFE Technologies, San Fernando, CA 91340 818-365-9411
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
Southern Electronics, F-Dyne, Burbank, CA 91502 818-845-2458
† Spectrum Control, Inc., Erie, PA 16505 814-455-0966
§† Sprague Electric Company, Distbn.Div., Mansfield, MA 02048-9102 617-339-8900
§† Sprague Electric Company:The Components Group, Hudson, NH 03051 603-881-7200
Sprague Electric Company, FIL-MAG Business Unit, San Diego, CA 92154-3483 619-575-9353
§† Susco Elctrns., Farmingdale, NY 11735 516-249-4848
† Tansitor Electronics, Bennington, VT 05201 802-442-5473
Unitrode Passive Comp. Div., Sun Valley, CA 91352 818-767-6770

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Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705, 714-979-4440 ..... A•1076
Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676 ..... A•1095
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 201-679-3366 ..... A•1130,1132-1133
Nytronics Components Grp., Inc., Darlington, SC 29532, 803-393-5421 .. A•1160
Oxley, Inc., Branford, CT 06405, 203-488-1033 ..... B•1025
Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1174-1175
§† Tusonix, Inc., Tucson, AZ 85740-7144, 602-744-0400 ..... A•1181
† Voltronics Corporation, E. Hanover, NJ 07936, 201-887-1517 ..... A•1185
§ Electronic Resources Inc., Sunnyvale, CA 94089 408-745-1420
Kemet Electronics Corporation, Greenville, SC 29606 803-963-6621
† LSI Jennings, San Jose, CA 95122-2696 408-292-4025
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, Riviera Beach, FL 33404 407-881-3200
† Mepco/Centralab, North American Philips Corporation, Los Angeles, CA 90039 818-240-4880
† Mepco/Centralab, North American Philips Corporation, El Paso, TX 79915 915-779-3961
† Mepco/Centralab, North American Philips Corporation, Mineral Wells, TX 76067 817-325-7871
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 508-475-7831
† Philips Circuit Assemblies, A Subdivision of North American Philips Corp., West Lafayette, IN 47906 317-463-2536
Pico Electronics, Inc., Mt. Vernon, NY 10552 ..... 914-699-5514;800-431-1064
Stetco, Inc., Franklin Pk., IL 60131 312-671-4208

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§† Dialight Corp., A Cambridge Elctrns. Inds. Co., Manasquan, NJ 08736, 201-223-9400 ..... B•1141
§ Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1158
§ Inter-Market, Glenview, IL 60025, 312-729-5330 ..... B•1178
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
Lamb Industries, Inc., Portland, OR 97225, 503-297-8878 ..... B•1164
Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1020,1167
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§ Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1188,1191-1195
† Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1198
§ Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900 ..... B•1199-1203
§ Arcolectric Corp., Canoga Park, CA 91304 818-700-1933
† Atlantic Optical Moulding, Webster, MA 01570 617-943-1746
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
Display Devices, Inc., Encinitas, CA 92024 619-753-0113
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† Electrical Industries Corp., Murray Hill, NJ 07974 201-464-3200
§† Electro-Mech Components, Inc., South El Monte, CA 91733-3689 818-442-7180
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
§† Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016 312-824-1188
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
NOBEX Div., Griffith Plastics Corp., Burlingame, CA 94010 415-342-8170
§† Oak Switch Systems, Crystal Lake, IL 60014 815-459-5000
Risk, George, Inds., Kimball, NE 69145 308-235-4645
Schott Electronics, Seymour, CT 06483 203-881-0102
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
§† Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
§ Sylvania Miniature Lighting, GTE Corporation, Hillsboro, NH 03244 603-464-5533
§† VCH Incorporated, Chicago Miniature, Buffalo Grove, IL 60089 312-459-3400

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§† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
† Presidio Components, Inc., San Diego, CA 92121 619-578-9390

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HBM, Inc., Marlboro, MA 01752, 508-624-4500 ..... B•1958
† A. L. Design, Inc., Amherst, NY 14226 716-833-6272
§ Automatic Timing & Controls Co., King of Prussia, PA 19406 ..... 215-337-5500; 800-441-8245
BLH Electronics, Inc., Canton, MA 02021-9111 617-821-2000
§ Data Instruments, Inc., Acton, MA 01720 508-264-9550
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
§† Dillon, W. C., Weigh-Tronix, Inc., Fairmont, MN 56031 507-238-4461
† Entran Devices, Fairfield, NJ 07006 ..... 201-227-1002;800-635-0650
§ GSE, Core Inds., Farmington Hills, MI 48024 313-476-7875
§ Helm Instrument Co., Inc., Maumee, OH 43537 419-893-4356
§† Interface, Inc., Scottsdale, AZ 85260 602-948-5555
§† Kistler-Morse, Redmond, WA 98073 206-881-8000
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
Omega Engineering, Stamford, CT 06907 800-826-6342
† PCB Piezotronics, Depew, NY 14043-2495 716-684-0001
§† Revere Corporation of America, Wallingford, CT 06492 203-269-7701
Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000
Sensotec, Inc., Columbus, OH 43212 614-486-7723
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471 203-481-5721

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A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269, 201-231-8300 ..... B•1127
§ Clairex Electronics, Clairex Corporation, Mt. Vernon, NY 10550, 914-664-6602 ..... B•1320
§ EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1321
† Silicon Detector Corp., Camarillo, CA 93010, 805-484-2884 ..... B•1348-1349
Advanced Detector Corp., Applied Solar Energy Corp., Industry, CA 91746 818-369-6886
A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
† Centronic, Inc., Morgan Crucible Co., Electronics Div., Newbury Park, CA 91320-1702 805-499-5902
EG&G, Inc., Photon Devices, Salem, MA 01970 617-745-3200
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
† Infrared Industries, Inc., Orlando, FL 32826 407-282-7700
Optoelectronics/Textron, Petaluma, CA 94975-0039 707-763-5900
§ Raytheon Co., Quincy, MA 02169 617-479-5300
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Silicon Sensors, Dodgeville, WI 53533 608-935-2707
† Silonex Inc., Plattsburgh, NY 12901 518-561-3160
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085

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A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269, 201-231-8300 ..... B•1127
Clairex Electronics, Clairex Corporation, Mt. Vernon, NY 10550, 914-664-6602 ..... B•1320
EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1321
§† Optek Technology Inc., McKinney, TX 75069, 214-542-9461 ..... B•1333
Opto Diode Corp., Newbury Park, CA 91320, 805-499-0335 ..... B•1334
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Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 ..... B•1347
A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006 201-575-5586

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§ Clairex Electronics, Clairex Corporation, Mt. Vernon, NY 10550, 914-664-6602 ..... B•1320
§ EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1321
Energy, Ltd., Bladensburg, MD 20710, 301-699-1144 ..... D•2195
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Silicon Detector Corp., Camarillo, CA 93010, 805-484-2884 ..... B•1348-1349
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§ A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
† Atlantic Solar Products, Baltimore, MD 21237 ..... 301-686-2500;800-237-6527
§ C&D Charter Power Systems, Plymouth Meeting, PA 19462 215-828-9000
† Centronic, Inc., Morgan Crucible Co., Electronics Div., Newbury Park, CA 91320-1702 805-499-5902
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
† Dionics, Westbury, NY 11590 516-997-7474
EG&G, Inc., Photon Devices, Salem, MA 01970 617-745-3200
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Hoppecke Battery Systems, Inc., Bulter, NJ 07405 201-492-0045
§ Johnson Controls, Inc., Specialty Battery Div., Milwaukee, WI 53212 414-961-6500
§ Panasonic Industrial Co., Battery Sls. Div., Secaucus, NJ 07096-1511 ... 201-348-5266
Philips ECG, American Philips Co., Waltham, MA 02254 617-890-6107
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
† Silonex Inc., Plattsburgh, NY 12901 518-561-3160
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
§ Xenotronix Inc., Valencia, CA 91355 805-257-4793

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† Tenney Engineering, Union, NJ 07083, 201-686-7870 ..... D•1209
† Bemco, Pacoima, CA 91331 818-899-5296
† Cincinnati Sub-Zero Prods., Cincinnati, OH 45241 513-772-8810
Cooke Vacuum Prods., Inc., Norwalk, CT 06854 203-853-9500
§† Despatch Industries, Minneapolis, MN 55440-1320 612-331-1873
Nordion International, Kanata, Ontario, CANADA K2K 1X8 613-592-2790
Ransco Industries, Inc., Sub. Despatch Ind., Inc., Oxnard, CA 93033 805-487-7777
Vactronic Lab. Equip. Inc., Bohemia, NY 11716 516-567-0520

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† Tenney Engineering, Union, NJ 07083, 201-686-7870 ..... D•1209
† Ark Elctrns. Corp., Southampton, PA 18966 215-322-6510
† Bemco, Pacoima, CA 91331 818-899-5296
† FTS Systems, Inc., Stone Ridge, NY 12484 914-687-0071
† Ransco Industries, Inc., Sub. Despatch Ind., Inc., Oxnard, CA 93033 805-487-7777
† Thermotron Industries, A Venturedyne, Ltd. Co., Holland, MI 49423 616-392-1491

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† **Optima Enclosures, Tucker, GA 30084-5088, 404-496-4000** ..... **C•1062**
† Diagostic Instrument Corp., Ayer, MA 01432 508-772-4572
† General Technology Corp., Albuquerque, NM 87109 505-345-5591
Marway Prods. Inc., Santa Ana, CA 92703 714-973-1800
Prototek, Inc., Hamilton, OH 45015 513-874-5094
† STRONGBOX, Culver City, CA 90231-2726 213-305-8288
† Trilobyte Computer Corporation, San Leandro, CA 94577 415-895-1100

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† **Abbott Technologies, Inc., Burbank Division, Transformers, Burbank, CA 91506, 818-841-3630** ..... **A•2219**
§† **Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 213-537-5200** ..... **A•1202,1204-1205**
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... **A•1208-1209**
§† **Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0160, 605-665-9301** ..... **A•1233,1236-1237,1239**
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§† **Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050** ... **A•1253,2344-2345**
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•1278**
† **Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 201-626-4700** ..... **A•2419**
§† **RCD Components, Inc., Manchester, NH 03103, 603-669-0054** ..... **A•2043**
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... **A•1293-1297,2436**
† **Tamura Corporation of America, Carson, CA 90746-3516, 213-638-1790** ..... **D•2079**
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314** ..... **A•1303**
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
† Automatic Coil Corp., Sub. Designatronics, Inc., Miami, FL 33147 305-696-6660
§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Bicron Electronics, Canaan, CT 06018 203-824-5125
§† Capcon, Inc., New York, NY 10001 212-243-6275
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
§† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052 716-652-3600
† Elnetic Electronics, Inc., Los Angeles, CA 90009-8232 213-515-1546
§† Jeffers Electronics, Nogales, AZ 85621 602-287-5851
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetic Component Engineering, Inc., Culver City, CA 90230 213-398-4761
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
OPT Industries Inc., Phillipsburg, NJ 08865 201-454-2600
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
§† United Transformer Co.:Div. of Opt Industries Inc., Phillipsburg, NJ 08865 201-454-2600
† Vitec Electronic Corporation, Visalia, CA 93291 209-739-1077
† Wirebenders, Inc., Phoenix, AZ 85021 602-861-1856

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† Balzers Optical Corporation, Marlboro, MA 01752 617-481-9860
† Duplicon, Inc., S. Boston, MA 02127 617-269-5484
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257

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† **Airpax Co., Cambridge Division, Cambridge, MD 21613, 301-228-4600** ... **B•1352**
§ **Carlingswitch, Inc., Plainville, CT 06062-1156, 203-793-9281** ..... **B•1359-1361**
§ **Curtis Industries, Milwaukee, WI 53218-0699, 414-535-1500** ..... **A•1646-1647**
† **E-T-A Circuit Breakers, Chicago, IL 60648, 312-647-8303** ..... **B•1363-1366**
§† **Heinemann Electric Co., Lawrenceville, NJ 08648-0800, 609-882-4800** ..... **B•1370-1373**
§† **Mechanical Products Inc., Jackson, MI 49204, 517-782-0391** ..... **B•1401**
§† **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000** ..... **B•1406**
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† **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621** ..... **B•1615**
§ **Schurter, Inc., Petaluma, CA 94952, 707-778-6311** ..... **B•1408**
§ Altech Corp., Somerville, NJ 08876 201-359-4454
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
Aromat Corp, New Providence, NJ 07974 201-464-3550
Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
† Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ FIC Corp., Rockville, MD 20852 ..... 301-881-8124;800-638-6594
Fuses Unlimited, D.E.I., Chatsworth, CA 91311 818-882-1515
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
§ Inmark Corp., Norwalk, CT 06854 203-866-8474
International Mircoelectronics, Arlington, TX 76003 817-561-2244
§ Klockner Moeller, Natick, MA 01760 508-655-1910
§ Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016 312-824-1188
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Nedco Electronics, Inc., Morton Grove, IL 60053 312-967-0500
Pyle-National Division, BRIntec Corp., Chicago, IL 60651 312-342-6300
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ SL Waber, Inc., Mt. Laurel, NJ 08054 ..... 609-866-8888;800-257-8384
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Palatine, IL 60067 312-397-2600
Sylvania GTE Control Devices, Standish, ME 04084 207-642-4535
§ Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077
§ Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
§ Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800
§ USD Products, Cooper Industries, Chicago, IL 60656 312-867-4600
§ Weber, Inmark Corporation-Importer, Norwalk, CT 06850 203-866-8474

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§ **Mechanical Products Inc., Jackson, MI 49204, 517-782-0391** ..... **B•1401**
† Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
§ Fiskars Electronics Corporation, Littleton, MA 01460 508-486-9551

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§† **All-States, Inc., Chicago, IL 60640, 312-728-0525** ..... **C•1150**
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492, 203-265-8910 ..... **C•1266**
§† **Daburn Electronics & Cable Corp., Northvale, NJ 07647, 201-768-5400** .. **C•1848**

§† **Panduit Corp., Tinley Park, IL 60477-0981, 800-777-3300** ..... **C•1908-1909**
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
§† Brim Electronics, Fair Lawn, NJ 07410 201-796-2886
§† Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007 312-981-6000
§ Control Cable, Inc., Baltimore, MD 21207 301-298-4411
§† Heyco Molded Products, Inc., Kenilworth, NJ 07033 ..... 201-245-0033;800-526-4182
† Micro Plastics Inc., Flippin, AR 72634 501-453-2261
† Nylon Molding Corp., Monrovia, CA 91016 818-358-2305
§† Tyton Corp., Milwaukee, WI 53223 414-355-1130

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§† **Atlee Inc., North Andover, MA 01845, 508-681-1003** ..... **B•1354, C•1732**
§ **Bel Fuse, Jersey City, NJ 07302, 201-432-0463** ..... **B•1357**
§† **Bussmann:Cooper Industries, St. Louis, MO 63178, 314-394-2877** ..... **C•1295**
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§ **Daburn Electronics & Cable Corp., Northvale, NJ 07647, 201-768-5400** ..... **C•1848,1850**
§† **FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594** ..... **B•1367**
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§† **Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016, 312-824-1188** ..... **B•1381**
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§ **Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722** ..... **A•1666**
§ **Schurter, Inc., Petaluma, CA 94952, 707-778-6311** ..... **C•1521-1522**
† **Shogyo International Corp., Great Neck, NY 11021, 516-466-0911** ..... **C•1525,1527,1920**
§† **Zierick Manufacturing Corp., Mt. Kisco, NY 10549, 914-666-2911;800-882-8020** ..... **C•1580**
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§ Acme Model Engineering Co., Ridgefield, NJ 07657 201-943-7650
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AMP, Harrisburg, PA 17105 717-564-0100
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
Augat/RDI, Carol Stream, IL 60188 312-682-4100
Autoswage Products, Shelton, CT 06484 203-929-1401
§† Beswick:Cooper U.K. Ltd., Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
§ Components Corp., Denville, NJ 07834 201-627-0290
§ Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
Doran Manufacturing Co., Cincinnati, OH 45225 513-681-5424
ebm Industries, Inc., Farmington, CT 06032 203-674-1515
EG & G Birtcher, EG & G, Inc., El Monte, CA 91734-1268 818-442-2572
§† Electronic Essentials, Woodside, NY 11377 718-898-8300
§† Ercona, Patchogue, NY 11772 516-758-0700
§ FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
§ Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
† Fuses Unlimited, D.E.I., Chatsworth, CA 91311 818-882-1515
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Gould Shawmut, Newburyport, MA 01950 ..... 508-462-6662/3131
§ Heyco Molded Products, Inc., Kenilworth, NJ 07033 ..... 201-245-0033;800-526-4182
§ Ideal Industries, Sycamore, IL 60178 815-895-5181
International Mircoelectronics, Arlington, TX 76003 817-561-2244
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 312-949-8505
§† Keystone Electronics Corp., Astoria, NY 11105-2017 718-956-8900
§ Marathon Special Prods., Bowling Green, OH 43402 419-352-8441
Miniature Metal Forming Div., Torrance, CA 90509 213-370-3679
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ National Tel-Tronics, Meadville, PA 16335 814-724-6440
§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
§ Richco Plastic Co., Chicago, IL 60680 312-539-4060
§ San-O Industrial Corp., Bohemia, NY 11716 516-567-5556
Schaffner EMC, Inc., Instr. Div., Union, NJ 07083 ..... 201-851-0644;800-367-5566
Seastrom Manufacturing Co., Inc., Glendale, CA 91201 213-245-9121
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
† Tech-Etch, Inc., Plymouth, MA 02360 508-747-0300
§ USD Products, Cooper Industries, Chicago, IL 60656 312-867-4600
§ Weidmuller, Inc., Richmond, VA 23236 804-794-2877

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§† **FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594** ..... **B•1367**
† **Mueller Elec. Co., Cleveland, OH 44114, 216-771-5225** ..... **C•1456**
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Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
† Jettron Products Inc., E. Hanover, NJ 07936 201-887-0571

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§† Berg, W. M., Inc., East Rockaway, NY 11518 516-599-5010
Dial Products Co., Bayonne, NJ 07002 ..... 201-HE7-0720
§† Facet Enterprises, Inc., Elmira, NY 14902 607-737-8011
† Globe Motors, Dayton, OH 45404 513-228-3171
Micro Mo Electronics, Inc., St. Petersburg, FL 33701 813-822-2529
† Perfect Gear & Instrument, Designatronics, Inc., New Hyde Park, NY 11040 516-328-3300
† Precision Mechanisms, Westbury, NY 11590 ..... 516-ED3-5955
† Sterling Instruments, New Hyde Pk, NY 11040 516-328-3300
† Techno, A DSG Company, New Hyde Park, NY 11040 516-328-3970
§ Vemaline Prods. Div., Warwick, RI 02887 401-739-7600
† Vernitech:Vernitron Corp., Deer Pk, NY 11729 516-586-5100

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† **Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300** ..... **B•1305**
† **Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100** ..... **B•1037,1316**
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§ B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
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§† Facet Enterprises, Inc., Elmira, NY 14902 607-737-8011
† Machine Components Corp., Plainview, NY 11803 516-694-7222
§† Motion Control Group, American Precision Industries, Oceanside, CA 92054 619-439-7500
† Perfect Gear & Instrument, Designatronics, Inc., New Hyde Park, NY 11040 516-328-3300
PIC Design, Remington Technologies, Inc., Middlebury, CT 06762 203-758-8272
† Sterling Instruments, New Hyde Pk, NY 11040 516-328-3300
† Techno, A DSG Company, New Hyde Park, NY 11040 516-328-3970

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Adams Rite Products, Inc., Glendale, CA 91204 818-241-5121
§† Berg, W. M., Inc., East Rockaway, NY 11518 516-599-5010
§† Facet Enterprises, Inc., Elmira, NY 14902 607-737-8011
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
Micro Mo Electronics, Inc., St. Petersburg, FL 33701 813-822-2529
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† Vernitech:Vernitron Corp., Deer Pk, NY 11729 516-586-5100

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§† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•1253,2344-2345,2352
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† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1278
† Piconics, Tyngsboro, MA 01879, 508-649-7501 ..... A•1286
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 201-826-4700 ..... A•2419
§† RCD Components, Inc., Manchester, NH 03103, 603-669-0054 ..... A•2043
† Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1298
† Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•1673,2469, D•2079
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† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1303,1306-1307
† Automatic Coil Corp., Sub. Designatronics, Inc., Miami, FL 33147 305-696-6660
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
Hisonic, Inc., Olathe, KS 66061 913-782-0012
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetic Component Engineering, Inc., Culver City, CA 90230 213-398-4761
Magnetico Inc., Holtsville, NY 11742 516-654-1166
Neshaminy Transformer, Neshaminy Electronics Corp., Furlong, PA 18925 215-794-7411
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
OPT Industries Inc., Phillipsburg, NJ 08865 201-454-2600
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02154 617-899-8400
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
† Sigma Electronics Inc., Houston, TX 77099 713-933-4700
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
§† United Transformer Co.:Div. of Opt Industries Inc., Phillipsburg, NJ 08865 201-454-2600
Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
Varo Electron Devices:An Imo Inds. Co., Garland, TX 75046 214-487-4129
† Wirebenders, Inc., Phoenix, AZ 85021 602-861-1856
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2238
§† Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 213-537-5200 ..... A•1202-1204
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† Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1298
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§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Automatic Coil Corp., Sub. Designatronics, Inc., Miami, FL 33147 305-696-6660
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
§† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052 716-652-3600
EI & S Corporation, Stoneham, MA 02180 617-438-5300
† Electro Assemblies Corp., Northbrook, IL 60062 312-498-6520
Fil-Coil Company, Inc., Garden City, NY 11530 516-228-9445
Lenox-Fugle Electronics, S. Plainfield, NJ 07080 201-756-1164
† Magnetic Component Engineering, Inc., Culver City, CA 90230 213-398-4761
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† North Hills Electronics, Glen Cove, NY 11542 516-671-5700
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† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
Stanford Applied Engrg. Inc., Santa Clara, CA 95054 408-988-0700
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
§† United Transformer Co.:Div. of Opt Industries Inc., Phillipsburg, NJ 08865 201-454-2600
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§† West-Cap Arizona, Sub. of SFE Technologies, Tucson, AZ 85706 602-294-2646
† Wirebenders, Inc., Phoenix, AZ 85021 602-861-1856

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† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† E-Systems, Greenville Div., Greenville, TX 75401 214-455-3450
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† Analog Equipment Corporation, Palm Bch. Gardens, FL 33418 407-622-3715
† California Microwave, Sunnyvale, CA 94086 408-732-4000
† Condor Systems, Inc., San Jose, CA 95124 408-371-9580
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ..... 214-470-2106/2107
† E-Systems, Greenville Div., Greenville, TX 75401 214-455-3450
† E-Systems, Melpar Div., Falls Church, VA 22046 703-560-5000
GTE Government Systems Corp., Mountain View, CA 94039 415-966-2000

Hadron, Inc., Fairfax, VA 22030 703-359-6100
†LNR Communications, Inc., Hauppauge, NY 11788 516-273-7111
†Lockheed Electronics Co., Inc., Lockheed Corporation, Plainfield, NJ 07061 201-757-1600
Locus, State College, PA 16804 814-466-6275
Locus, Alexandria, VA 22303 703-960-1000
†Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
New Wave Instruments, Provo, UT 84604 801-373-4909
†Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

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Airflyte Elctrns. Co., Bayonne, NJ 07002 201-436-2230
†Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
†Danmar Inds., Chatsworth, CA 91311 ..... 818-882-7979/5280
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 312-949-8505
POWR-UPS Corp., Shirley, NY 11967 ..... 516-345-5700;1-800-333-POWR
§Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
Serial Lab Prods., Inc., Marlboro, MA 01752 617-481-1684
Tech Laboratories Inc., Palisades Pk, NJ 07650 201-944-2221

Comparators, Analog — See Comparators, Voltage (Vol. D)

Comparators, Attenuation-3400 — *See Vol. D*

Comparators, Capacitance — See Bridges, Capacitance (Vol. D)

Comparators, Digital-2900 — *See Vol. D*

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Comparators, Inductance — See Bridges, Inductance (Vol. D)

Comparators, Optical-2900 — *See Vol. D*

Comparators, Phase-2900 — *See Vol. D*

Comparators, Resistance — See Bridges, Resistance (Vol. D)

Comparators, Voltage-2900 — *See Vol. D*

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Computers, Micro-2025 — *See Vol. D*

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Computers, Mini, High End-2025 — *See Vol. D*

Computers, Mini, Low End-2025 — *See Vol. D*

Computers, Mini, Midrange-2025 — *See Vol. D*

Computers, Personal-2025 — *See Vol. D*

Computers, Small Business-2025 — *See Vol. D*

Computer Sets (MIL), Digital Data-2440

†ACS Communications Systems, Herndon, VA 22070 703-471-0892
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
Computer Doctors, College Park, MD 20740 ..... 1-800-RAM-STAR;301-474-3095
Dianachart Inc., Rockaway, NJ 07866 201-625-2299
§†LSI Logic Corp., Milpitas, CA 95035 408-433-8000
†Plessey Electronic Systems Corp., Wayne, NJ 07470 201-633-6000
†Trilobyte Computer Corporation, San Leandro, CA 94577 415-895-1100

Computer Systems (MIL)-2440

§Air Land Systems Corporation, Fairfax, VA 22031 703-573-1100
†Aydin Corp., Horsham, PA 19044 215-657-7510
†Codar Technology, Inc., Longmont, CO 80501 303-776-0472
§†Compucart, Versa Tec, Tampa, FL 33606 ..... 800-237-9024;813-251-2431
Continental Resources, Computer & Peripherals Div., Bedford, MA 01730 ..... 617-275-0850;800-937-4688
Control Module, Enfield, CT 06082 203-745-2433
§Cyber Sys., Inc., Anaheim, CA 92806 714-722-2051
Data Engineering, Inc., Margate, FL 33063 305-971-0400
†Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
†DY-4 Systems Inc., Nepean, Ont., CANADA K2H 9J4 613-596-9911
§†Dynatech Computer Company, Mountain View, CA 94039-7400 415-964-7400
Harris Corp., Computer Systems Div., Ft. Lauderdale, FL 33309 305-974-1700
†Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
Innovative Electronics, Inc., Dynatech Corporation, Miramar, FL 33025 305-432-0300
†Matrox Electronic Systems, Ltd., Dorval, QU, CANADA H9P 2T4 514-685-2630
†Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
†Orbit Instrument of Cal., Cypress, CA 90630 714-527-0561
†Plessey Electronic Systems Corp., Wayne, NJ 07470 201-633-6000
Serial Lab Prods., Inc., Marlboro, MA 01752 617-481-1684
§Spectral Dynamics Division, Scientific-Atlanta, Inc., San Diego, CA 92123-0575 619-496-3400
§SYMBICON, Amherst, NH 03031 603-673-8898
†Trilobyte Computer Corporation, San Leandro, CA 94577 415-895-1100
Zendex Corp., Dublin, CA 94568 415-828-3000

Computing Equipment, Peripheral — See Converters, Digital To Paper Tape (Vol. D), Printers (Vol. D), Terminals, Data Display (Vol. D), etc.

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Conductive Floor Coatings & Cleaners-1600 — *See Vol. C*

Conductive Plastic Materials & Parts-4525 — *See Vol. C*

Conduit, Electrical-6000 — *See Vol. C*

Connecting Blocks, Data-2100 — *See Vol. C*

Connecting Blocks, Modular Telephones-2100 — *See Vol. C*

Connector Adapters-2100 — *See Vol. C*

Connector Backshells-2100 — *See Vol. C*

Connector Blocks, Mother Board-2100 — *See Vol. C*

Connector Boxes & Strips, Power Outlet-2500 — *See Vol. C*

Connectors, AC Power-2100 — *See Vol. C*

Connectors, Antenna — See Connectors, RF, Coaxial & Triaxial (Vol. C)

Connectors, Audio-2100 — *See Vol. C*

Connectors, Back Panel — See Connectors, Wirewrap (Z-3 Level) (Vol. C)

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Connectors, Edgeboard — See Connectors, Printed Circuit, Card Edge (Vol. C)

Connectors, Elastomeric-2100 — *See Vol. C*

Connectors, Fiber Optic-2475

A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269, 201-231-8300 ..... B•1127
Air Electro Inc., Van Nuys, CA 91406, 213-873-6400;818-988-4400 ..... C•1310
§ AMP, Harrisburg, PA 17105, 717-564-0100 ..... C•1157
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492, 203-265-8910 ..... C•1267
Component Mfg. Svc., Inc., W. Bridgewater, MA 02379, 508-580-0111 ... C•1309
Hirose Electric U.S.A., Inc. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), Simi Valley, CA 93065, 805-522-7958 ..... C•1378-1380
§† Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727 ..... B•1214
Jan Hardware Mfg. Co., Long Island City, NY 11101, 718-361-0800 ..... C•1586
§ LEMO U.S.A., Inc., Santa Rosa, CA 95406, 707-578-8811, 800-444-LEMO (5366) ..... C•1401-1405
§† MERET, Inc., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1215
MOLEX, Inc., Lisle, IL 60532, 312-969-4550 ..... B•1815, C•1881
Mueller Elec. Co., Cleveland, OH 44114, 216-771-5225 ..... C•1458
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1219,1995
Texas Instruments, Connector System, Attleboro, MA 02703, 508-699-5269;508-699-3450 ..... C•1542
Thomas & Betts Corporation, Bridgewater, NJ 08807, 201-685-1600 ..... C•1551-1553
§ A.C. Interface Inc., Irvine, CA 92718 714-472-9524
§ Amphenol, Bendix Connector Operations, Sidney, NY 13838 607-563-5011
§† AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
Braxton Mfg., Watertown, CT 06795 203-274-6781
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
§ Control Cable, Inc., Baltimore, MD 21207 301-298-4411
Dowty RFL Inds. Inc./Communications Div., The Dowty Grp. PLC, Boonton, NJ 07005-0239 201-334-3100
DuPont Electronics, Wilmington, DE 19880-0013 800-237-4357
§ Dynacast, Div. Coats & Clark Inc., Yorktown Heights, NY 10598 914-245-0060
§ Ercona, Patchogue, NY 11772 516-758-0700
Flight Connector, TransTechnology Electronics, Peoria, IL 61615-1584 .. 309-693-3300
§† General Cable Co., Fiber Optics Div., S. Plainfield, NJ 07080 201-769-3200
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
GTE Fiberoptic Products, Williamsport, PA 17701 ... 717-326-6591;1-800-FBR-OPTICS
§ GTE Products Corp., Williamsport, PA 17701 717-326-6591
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ Richard Hirschmann of America Inc., Riverdale, NJ 07457 201-835-5002
§† Honeywell Optoelectronics, Richardson, TX 75081 214-470-4271
† Hughes Aircraft Co., Connecting Devices Div., Irvine, CA 92714 714-660-5701
ITT Cannon:Military/Aerospace Div., Santa Ana, CA 92705-5684 714-557-4700
JAE Electronics Inc., Santa Ana, CA 92705-5504 714-250-8770
† Light Control Systems Inc., Tyngsboro, MA 01879 617-649-9870
§ Math Assocs., Westbury, NY 11590 516-334-6800
† 3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
§ Methode Electronics, Inc., Chicago, IL 60656 312-867-9600
§† Micro-Coax Components, Inc., a UTI Company, Collegeville, PA 19426 .. 215-489-3700
Microdot, Interconnect Systems Division, Montgomeryville, PA 18936 ... 215-699-5373
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Optelecom, Inc., Gaithersburg, MD 20877 301-840-2121
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
Radiall, Inc., Stratford, CT 06497 203-386-1030
Raychem Corp., Elctrns. Grp., Menlo Park, CA 94025 415-361-3860
Rehlander Assocs., Beverly, MA 01915 617-922-5961
§ RMS Company, Connector Division, Minneapolis, MN 55432 612-786-1520
Sabritec, Irvine, CA 92714 714-660-1970
Security Plastics, Inc., Miami Lakes, FL 33014 305-823-5440
Seiko Instruments U.S.A., Inc., Components Div., Torrance, CA 90505 213-517-7770
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Souriau, Inc., Valencia, CA 91355 805-257-4830
§† SpecTran Corp., Sturbridge, MA 01566 508-347-2751
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
Swiss Jewel Company, Philadelphia, PA 19106 ..... 215-925-2867;800-922-0118
§ TELTEC, INC., Minneapolis, MN 55425 612-854-9632
§ U.S. Components, Inc., Unitech PLC., Bohemia, NY 11716 516-589-8080

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Connectors, LCD-2100 — *See Vol. C*

Connectors, Magnetron-2100 — *See Vol. C*

Connectors, Missile (Umbilicals, Interstage, Post Boost)-2440

† AirBorn, Inc., Addison, TX 75001-0519, 214-931-3200 ..... C•1132
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492, 203-265-8910 ..... C•1267
† Rowe Industries, Inc., Toledo, OH 43612, 419-729-9761 ..... C•1519
† Alden Products Co., Brockton, MA 02403 508-583-0160
§† Amphenol, Bendix Connector Operations, Sidney, NY 13838 607-563-5011
§† CINCH Cylindrical Division, Labinal Comps. & Systems, Inc., Minneapolis, MN 55428 612-537-1010
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Detoronics Corporation, S. El Monte, CA 91733 818-579-7130
Flight Connector, TransTechnology Electronics, Peoria, IL 61615-1584 .. 309-693-3300
† Hughes Aircraft Co., Connecting Devices Div., Irvine, CA 92714 714-660-5701
§ Hugin Industries Inc., Los Altos, CA 94022 415-961-2950
Hypertronics Corp., Hudson, MA 01749 ..... 508-568-0451;800-225-9228
† ITT Cannon:Military/Aerospace Div., Santa Ana, CA 92705-5684 714-557-4700
§ ITT Sealectro, Trumbull, CT 06611 203-372-4118
Pyle-National Division, BRIntec Corp., Chicago, IL 60651 312-342-6300
† Sabritec, Irvine, CA 92714 714-660-1970
§† Souriau, Inc., Valencia, CA 91355 805-257-4830
§† Viking Connetors Co., Criton Technologies, Chatsworth, CA 91311 818-341-4330

Connectors, Mixed Contact Configurations-2100 — *See Vol. C*

Connectors, Printed Circuit Board, Programmable-2100 — *See Vol. C*

Connectors, Piggy Back — See Connectors, Wirewrap (Z-3 Level) (Vol. C)

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Connectors, Printed Circuit, Card Edge-2100 — *See Vol. C*

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Connectors (MIL), Flat Cable-2440

AirBorn, Inc., Addison, TX 75001-0519, 214-931-3200 ..... C•1132
§ AMP, Harrisburg, PA 17105, 717-564-0100 ..... C•1157
§ Carrot Components Corporation, Camarillo, CA 93010, 805-484-0540 ..... C•1297-1299
§† CW Industries, Southhampton, PA 18966, 215-355-7080 ..... C•1320-1321
JAE Electronics Inc., Santa Ana, CA 92705-5504, 714-250-8770 ..... C•1390
§† Panduit Corp., Tinley Park, IL 60477-0981, 800-777-3300 ..... C•1466-1468
§ Thomas & Betts Corporation, Bridgewater, NJ 08807, 201-685-1600 ..... C•1551-1553
Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§† Alpha Wire Corp., Elizabeth, NJ 07207-0711 201-925-8000
§ Aromat Corp., New Providence, NJ 07974 201-464-3550
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
Autosplice, Inc., Woodside, NY 11377 718-429-0500
Autoswage Products, Shelton, CT 06484 203-929-1401
Beau Products Div., Vernitron Corp., Laconia, NH 03247 603-524-5101
Flight Connector, TransTechnology Electronics, Peoria, IL 61615-1584 .. 309-693-3300
§ Fujitsu of America, Santa Clara, CA 95054 408-562-1000
MACOM, Inc., Burlington, MA 01803 617-272-3000
§† 3M-Electronic Products Division, Austin, TX 78769-2963 512-984-1800
Pulse Tronic Inc., Ville St. Laurnet, Que., CANADA H4L 4Z8 514-747-6028
Raychem Corp., Elctrns. Grp., Menlo Park, CA 94025 415-361-3860
Robinson Nugent, Inc., New Albany, IN 47150 812-945-0211
Souriau, Inc., Valencia, CA 91355 805-257-4830
§ Support Systems Intl. Corp., Richmond, CA 94804 415-234-9090
TELTEC, INC., Minneapolis, MN 55425 612-854-9632

Connectors (MIL), Power-2440

Caton Connector Corp., Kingston, MA 02364, 617-585-4315 .. C•1300-1301,1304
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-9440 ..... C•1415
Mueller Elec. Co., Cleveland, OH 44114, 216-771-5225 ..... C•1458

U.S. Terminals, Cincinnati, OH 45243, 513-561-8145 ..... **C•1557**
† Alden Products Co., Brockton, MA 02403 508-583-0160
Amphenol Canada Corporation, An LPL Company, Scarborough, Ontario, CANADA M1B 2X6 416-291-4401
§ Anderson Power Products, Div. of High Voltage Engineering, Boston, MA 02135 617-787-5880
† Burndy Corporation, Norwalk, CT 06852 203-838-4444
Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007 312-981-6000
§† CINCH Cylindrical Division, Labinal Comps. & Systems, Inc., Minneapolis, MN 55428 612-537-1010
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Flight Connector, TransTechnology Electronics, Peoria, IL 61615-1584 .. 309-693-3300
† Hypertronics Corp., Hudson, MA 01749 ..... 508-568-0451;800-225-9228
§ Ideal Industries, Sycamore, IL 60178 815-895-5181
§† ITT Cannon:Military/Aerospace Div., Santa Ana, CA 92705-5684 714-557-4700
MACOM, Inc., Burlington, MA 01803 617-272-3000
§† 3M-Electronic Products Division, Austin, TX 78769-2963 512-984-1800
§† Panduit Corp., Tinley Park, IL 60477-0981 800-777-3300
Pyle-National Division, BRIntec Corp., Chicago, IL 60651 312-342-6300
Sabritec, Irvine, CA 92714 714-660-1970
Souriau, Inc., Valencia, CA 91355 805-257-4830
§ Thomas & Betts Corporation, Bridgewater, NJ 08807 201-685-1600
§† U.S. Components, Inc., Unitech PLC., Bohemia, NY 11716 516-589-8080
§† Wire-Pro, Inc., Salem, NJ 08079 ..... 609-935-7601;609-935-7651

Connectors (MIL), Printed Circuit-2440

† AirBorn, Inc., Addison, TX 75001-0519, 214-931-3200 ..... **C•1132**
§ AMP, Harrisburg, PA 17105, 717-564-0100 ..... **C•1157**
Atlee Inc., North Andover, MA 01845, 508-681-1003 ..... **C•1704**
Beau Products Div., Vernitron Corp., Laconia, NH 03247, 603-524-5101 ..... **C•1293**
Connector Corp., Chicago, IL 60646, 312-539-3108 ..... **C•1314-1315**
§† CW Industries, Southhampton, PA 18966, 215-355-7080 ..... **C•1320-1321**
§† Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ..... **C•1326-1327**
Mueller Elec. Co., Cleveland, OH 44114, 216-771-5225 ..... **C•1458**
§† Panduit Corp., Tinley Park, IL 60477-0981, 800-777-3300 ..... **C•1466,1468**
§† Texas Instruments, Connector System, Attleboro, MA 02703, 508-699-5269;508-699-3450 ..... **C•1542-1544,1546**
§ Thomas & Betts Corporation, Bridgewater, NJ 08807, 201-685-1600 ..... **C•1551-1553**
§† U.S. Components, Inc., Unitech PLC., Bohemia, NY 11716, 516-589-8080 ..... **C•1555**
WECO Electrical Connectors, Inc., Mooers, NY 12958, 518-298-4810 ..... **C•1564-1565**
WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4, 514-694-9136 ..... **C•1564-1565**
§† Alpha Wire Corp., Elizabeth, NJ 07207-0711 201-925-8000
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
Autosplice, Inc., Woodside, NY 11377 718-429-0500
Autoswage Products, Shelton, CT 06484 203-929-1401
§† Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007 312-981-6000
Components Corp., Denville, NJ 07834 201-627-0290
Conductive Rubber Technology, Santa Barbara, CA 93103 805-965-6511
† CTS Corporation, Elkhart, IN 46514 219-293-7511
† CTS Corporation, Connector Division, New Hope, MN 55428 612-533-3533
† CTS Corporation, Systems Division, Eden Prairie, MN 55344 612-941-9100
DuPont Electronics, Wilmington, DE 19880-0013 800-237-4357
EBY Company, Philadelphia, PA 19124 215-537-4700
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
Flight Connector, TransTechnology Electronics, Peoria, IL 61615-1584 .. 309-693-3300
Holmberg Elctrns., Inman, SC 29349 803-472-4141
† Hypertronics Corp., Hudson, MA 01749 ..... 508-568-0451;800-225-9228
Industrial Electronic Hardware Corp., (IEH Corp.), New York, NY 10012 212-677-1881
§† ITT Cannon:Military/Aerospace Div., Santa Ana, CA 92705-5684 714-557-4700
§† 3M-Electronic Products Division, Austin, TX 78769-2963 512-984-1800
§† Methode Electronics, Inc., Chicago, IL 60656 312-867-9600
† Microdot, Interconnect Systems Division, Montgomeryville, PA 18936 ... 215-699-5373
† Milross Controls, Inc., Southampton, PA 18966 215-355-0200
Oxley, Inc., Branford, CT 06405 203-488-1033
† PCD, Peabody, MA 01960 508-532-8800
Pulse Tronic Inc., Ville St. Laurnet, Que., CANADA H4L 4Z8 514-747-6028
Pyle-National Division, BRIntec Corp., Chicago, IL 60651 312-342-6300
Souriau, Inc., Valencia, CA 91355 805-257-4830
§ Sullins Electronics Corp., San Marcos, CA 92069 619-744-0125
TELTEC, INC., Minneapolis, MN 55425 612-854-9632
§† Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800
† Trompter Electronics, Inc., Sterling Holding, Westlake Village, CA 91359-5069 818-707-2020
§† Wire-Pro, Inc., Salem, NJ 08079 ..... 609-935-7601;609-935-7651

Connectors (MIL), RF-2440

AirBorn, Inc., Addison, TX 75001-0519, 214-931-3200 ..... **C•1132**
§† AMP, Harrisburg, PA 17105, 717-564-0100 ..... **C•1157**
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492, 203-265-8910 ..... **C•1267**
§ Coax Connection, Yorktown Hgts., NY 10598, 914-962-2303;800-431-2103 ..... **C•1308**
Concord Electronics Corporation, New York, NY 10012, 1-212-777-6571 ..... **C•1313**
DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011, 212-691-9050 ..... **C•1330**
Jettron Products Inc., E. Hanover, NJ 07936, 201-887-0571 ..... **C•1392-1393**
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 201-679-3366 ..... **C•1442**
Mueller Elec. Co., Cleveland, OH 44114, 216-771-5225 ..... **C•1458**
North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... **A•2365**
§ Pomona Electronics, Pomona, CA 91766, 714-623-3463 ..... **C•1477,1623**
Rowe Industries, Inc., Toledo, OH 43612, 419-729-9761 ..... **C•1518-1519**
§† Adams-Russell, Anzac Div., Burlington, MA 01803 671-273-3333
§† Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
§† Applied Engineering Products, New Haven, CT 06525 203-387-5282
Breeze-Illinois, TransTechnology Corp., Peoria, IL 61615-1584 309-693-3300
† C.E. Precision Assemblies, Inc., Chandler, AZ 85226 602-940-0740
§† CINCH Cylindrical Division, Labinal Comps. & Systems, Inc., Minneapolis, MN 55428 612-537-1010
† Compac, Holbrook, NY 11741 516-585-3400
§ Compar, D.G.W. Electronics Corporation, Markham, Ontario, CANADA L3R 4Z4 416-475-8500
Delta Electronics Mfg. Corp., Beverly, MA 01915 617-927-1060
§ Electronic Resources Inc., Sunnyvale, CA 94089 408-745-1420
Flight Connector, TransTechnology Electronics, Peoria, IL 61615-1584 .. 309-693-3300
§† ITT Sealectro, Trumbull, CT 06611 203-372-4118
§† M/A-COM Omni Spectra, Inc., Merrimack, NH 03054 603-424-4111
Microdot, Interconnect Systems Division, Montgomeryville, PA 18936 ... 215-699-5373
§† Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 408-730-0300
Pyle-National Division, BRIntec Corp., Chicago, IL 60651 312-342-6300
† Sabritec, Irvine, CA 92714 714-660-1970
§† Specialty Connector Co., Franklin, IN 46131 317-738-2800
§ Support Systems Intl. Corp., Richmond, CA 94804 415-234-9090
† Trompter Electronics, Inc., Sterling Holding, Westlake Village, CA 91359-5069 818-707-2020
† Whittaker Corp., Electronic Resources Div., Simi Valley, CA 93063 805-584-4100

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§ Alusett U.S.A., Inc., Pleasantville, NY 10570 914-747-3477
† Amco Engineering, Schiller Pk., IL 60176 ..... 312-671-6670;800-833-3156
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400

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† LSI Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... **B•1571**
The J. M. Ney Company, Bloomfield, CT 06002, 203-242-2281 ..... **D•2241**
† American Aerospace Controls, Farmingdale, NY 11735 516-694-5100
ICC, Inc., Orange, CA 92665 714-998-8310
§ Payne Engineering, Scott Depot, WV 25560 304-757-7353
† PCD, Peabody, MA 01960 508-532-8800
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621

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† AMP, Harrisburg, PA 17105, 717-564-0100 ..... **C•1157**
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492, 203-265-8910 ..... **C•1266**
Hiram Jones Electronics, No. Hollywood, CA 91605, 213-875-0213 ..... **C•1373**
The J. M. Ney Company, Bloomfield, CT 06002, 203-242-2281 ..... **C•1463,1619, D•2241**
§ U.S. Components, Inc., Unitech PLC., Bohemia, NY 11716, 516-589-8080 ..... **C•1555**
§† Amphenol, Bendix Connector Operations, Sidney, NY 13838 607-563-5011
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
Autosplice, Inc., Woodside, NY 11377 718-429-0500
§† CINCH Cylindrical Division, Labinal Comps. & Systems, Inc., Minneapolis, MN 55428 612-537-1010
§ Compar, D.G.W. Electronics Corporation, Markham, Ontario, CANADA L3R 4Z4 416-475-8500
† Danmar Inds., Chatsworth, CA 91311 ..... 818-882-7979/5280
Delbert Blinn Co., Pomona, CA 91769 714-629-3900
§† Flight Connector, TransTechnology Electronics, Peoria, IL 61615-1584 .. 309-693-3300
ICC, Inc., Orange, CA 92665 714-998-8310
Pulse Tronic Inc., Ville St. Laurnet, Que., CANADA H4L 4Z8 514-747-6028
United Foam Plastics, Georgetown, MA 01833 508-352-2200

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Ballantine Laboratories, Inc., Sub. of E.S.I. Inc., Boonton, NJ 07005, 201-335-0900 ..... **D•1221**
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John Fluke Mfg. Co., Inc., Everett, Wa 98206, WA 98206 206-356-5400

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† **Abbott Transistor Labs, Power Supplies, Los Angeles, CA 90034, 213-936-8185** ..... **D•1545**
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† **Arnold Magnetics, Camarillo, CA 93010, 805-484-4221** ..... **D•1631-1632,1635**
† **EMCO High Voltage Co., Sutter Creek, CA 95685, 209-223-3626** ..... **D•1751**
† **Interpoint Corporation, Redmond, WA 98073-9705, 206-882-3100** ..... **A•1751, D•1828-1830,1833**
† **Modular Devices, Shirley, NY 11967, 516-345-3100** ..... **D•1919**
North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... **D•1933**
Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... **D•1947**
§† **Reliability, Inc., Houston, TX 77218, 713-492-0550** ..... **D•2037**
Wilmore Electronics Co., Hillsborough, NC 27278, 919-732-9351 ... **D•2142-2143**
† Adtech Power Inc., Anaheim, CA 92806 714-634-9211
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
† ATC Power Systems, Inc., Nashua, NH 03063 603-882-1366
† Boeing Electronics, Seattle, WA 98124-6269 206-657-7474
† Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
† EG & G Almond Instruments, Covina, CA 91724 818-967-9521
† Engineered Magnetics, Inc., A Fleet Aerospace Company, Rancho Dominguez, CA 90221 213-635-9555
FDK America, Inc., Fuji Electrochemical Co., Ltd., Cerritos, CA 90701 213-404-1770
Intepro Systems Inc., Lexington, MA 02173 617-863-9500
Interelectronics Corp., Congers, NY 10920 ..... 914-EL8-8000
Keltec Florida, Inc., Microwave Pro, Amstar Electronics Group, Ft. Walton Bch., FL 32549-2917 904-244-0043
† Logitek, Inc., Ronkonkoma, NY 11779 516-467-4200
† MIL Electronics, Inc., Dracut, MA 01826 508-453-8000
† Power Functions Engineering, Garland, TX 75042 214-278-0996
† Rantec, Emerson Electric, Chatsworth, CA 91311 818-885-8223
Rantec Division, Emerson Electric Co., Los Osos, CA 93402 805-528-5858
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803 516-349-8686
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5 416-630-8108
† Tri-Mag, Inc., Visalia, CA 93291 209-651-2222
† Trio Laboratories, Inc., Plainview, NY 11803 516-349-0400
§ Tripp-Lite, Chicago, IL 60610 312-329-1777
Varo Electron Devices:An Imo Inds. Co., Garland, TX 75046 214-487-4129
† Westcor Corporation, Los Gatos, CA 95032 408-395-7050

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† **Georator Corp., Manassas, VA 22110-0070, 703-368-2101** ..... **D•2198**
† **Unitron Inc., Dallas, TX 75238, 214-340-8600** ..... **D•2175-2177**
† Abacus Controls Inc., Somerville, NJ 08876 201-526-6010
Abbott Technologies, Inc., Sun Valley Division, Power Supplies, Sun Valley, CA 91352 818-841-3630
Abbott Transistor Labs, Power Supplies, Los Angeles, CA 90034 213-936-8185
§† Adams-Russell, Anzac Div., Burlington, MA 01803 671-273-3333
Advance Conversion Devices Co., Randolph, NJ 07869 201-989-0095
Analogic/3H, Burlingame, CA 94010 408-734-5970
† Anghel Laboratories, Inc., Fairfield, NJ 07006 201-575-1116
† Avtel Div., Unitron Inc., Dallas, TX 75238 214-340-8600
† California Microwave, Sunnyvale, CA 94086 408-732-4000
† EG & G Rotron, Custom Div., Woodstock, NY 12498 914-679-5201
Electronic Systems Div., Servo Corp. of America, Hicksville, NY 11802 .. 516-938-9700
† Engineered Magnetics, Inc., A Fleet Aerospace Company, Rancho Dominguez, CA 90221 213-635-9555
§ Fiskars Electronics Corporation, Littleton, MA 01460 508-486-9551
HDS Inc., Reston, VA 22091 703-620-6200
† LNR Communications, Inc., Hauppauge, NY 11788 516-273-7111
† Magnum Microwave Corp., Fremont, CA 94538 415-657-9898
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
† Modular Devices, Shirley, NY 11967 516-345-3100
† NH Research, Incorporated, Instrumentation Products Division, Irvine, CA 92714 714-474-3900
Pacific Power Source Corp., Huntington Bch., CA 92649 .. 714-898-2691;800-854-2433
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† Trio Laboratories, Inc., Plainview, NY 11803 516-349-0400
Varo Electron Devices:An Imo Inds. Co., Garland, TX 75046 214-487-4129

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§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
† Plessey Electronic Systems Corp., Wayne, NJ 07470 201-633-6000
† Tracor Flight Systems, Inc., Tracor, Inc., A Westmark Co., Santa Ana, CA 92705 714-662-0333

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† Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727 ..... B•1214
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1212
§ Motorola Semiconductor Prods. Sector, Phoenix, AZ 85018-6606, 602-244-6900 ..... A•2191-2192
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1326-1327,1329
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1219,1995
† ADC Telecommunications, Inc., Minneapolis, MN 55435 612-835-6800
AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
Canstar, Canada Wire & Cable, Ltd., North York, Ont., CANADA M2H 3H7 416-756-4100
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
§ Computrol:An AEG Co., Ridgefield, CT 06877 203-431-2000
Corning Glass Works, Telecommunications Products Division, Corning, NY 14831 607-974-7732
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ 3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
Siecor Electro-Optic Products, Siecor Corporation, Research Triangle Park, NC 27709 ..... 1-800-888-LAN1;919-481-5100
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
† York Technology, Inc., Burbank, CA 91502 818-955-8927

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TRM, Inc., Manchester, NH 03103, 603-627-6000 ..... A•1861,1863
§† Adams-Russell, Anzac Div., Burlington, MA 01803 671-273-3333
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Channel Microwave, TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
MACOM, Inc., Burlington, MA 01803 617-272-3000
§† M/A-COM Omni Spectra, Inc., Merrimack, NH 03054 603-424-4111
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
† Norsal Industries, Central Islip, NY 11722 516-234-1200
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6102
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† TRAK Microwave Ltd., TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
† Transco Products, Inc., Camarillo, CA 93011-6003 805-987-8007
† Werlatone, Inc., Brewster, NY 10509 914-279-6187

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† B-D Crystal Entprs., Inc., Subsidiary of HY-Q Int'l, Erlanger, KY 41018, 606-283-5000 ..... A•1350
† Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... A•1355-1357
† Colorado Crystal Corp., Loveland, CO 80537, 303-667-9248 ..... A•1361
Croven Crystals, Whitby, ON, CANADA L1N 5S5, 416-668-3324 ..... A•1371
† CTS Corp., Frequency Control Div., (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411 ..... A•1372,1374-1376
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1408
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1416,1418-1421
Micro Crystal Division, SMH, New York, NY 10010, 212-505-5340 ... A•1429-1430
Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ... A•1436-1437
§† M-Tron Industries, Yankton, SD 57078, 605-665-9321 ..... A•1438
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1440
§ NEL Frequency Controls, Inc., Burlington, WI 53105, 414-763-3591 ..... A•1455
Oscillatek, K & L Microwave, Olathe, KS 66062, 913-829-1777 ..... A•1459-1461
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310, 305-563-1333;800-327-1282 ..... A•1482
§† Atomergic Chemetals Corp., Farmingdale, NY 11735-1527 516-694-9000
Cirtech, EG & G, Shawnee Mission, KS 66223 913-681-2801
§† Crystek Corp, Ft. Myers, FL 33906 813-936-2109
† CTS Corporation, Elkhart, IN 46514 219-293-7511
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
† Piezo Crystal, Carlisle, PA 17013 717-249-2151
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013 717-243-5929
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
† Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

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§ Bussmann:Cooper Industries, St. Louis, MO 63178, 314-394-2877 ..... C•1295
INRESCO, Inc., Pt. Pleasant, NJ 08742 201-892-5881
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
Phase Control Electronics, Glendale, NY 11385 718-441-4278
Triac Electronic Systems, Inc., Glendale, NY 11385 718-441-4759
§ World Products Inc., Sonoma, CA 95476 707-996-5201

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Data Links, Fiber Optic-2475

AMP, Harrisburg, PA 17105, 717-564-0100 ..... **C•1157**
Amplifier Research, Souderton, PA 18694-9990, 215-723-8181 ..... **D•1003**
§ **Dymec Silicon Transistor Corp., Winchester, MA 01890, 617-729-7870** ..... **B•1206-1207**
§† **Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727** ..... **B•1214**
† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 703-953-4751** ..... **B•1208-1211,1213**
§† **MERET, Inc., Santa Monica, CA 90404-4998, 213-828-7496** ..... **B•1215**
† **Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121** ..... **B•1216**
Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... **B•1217**
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... **B•1219,1995**
Abom Electronics Inc., San Jose, CA 95131 408-436-5444
† ADC Telecommunications, Inc., Minneapolis, MN 55435 612-835-6800
§† APEC Fiber Optics Corp., College Station, TX 77840 409-693-5397
Artel Communications Corp., Hudson, MA 01749 617-562-2100
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
Atlantic Scientific Corporation, Melbourne, FL 32901 1-800-544-4737
Augat Inc., Attleboro, MA 02703 617-222-2202
§† Belden Wire and Cable, Cooper Industries, Richmond, IN 47375 ..... 317-983-5200; 800-BELDEN-1
§ Canoga-Perkins Corp., Chatsworth, CA 91311 818-718-6300
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
§ Comdata Corp., Morton Grove, IL 60053 312-470-9600
§ Computrol:An AEG Co., Ridgefield, CT 06877 203-431-2000
ETM Electromatic Inc, Newark, CA 94560 415-797-1100
Fibronics International Inc., Communications Way, Hyannis, MA 02601-1892 508-778-0700
† Force, Inc., Christiansburg, VA 24073 703-382-0462
† Foundation Instruments Inc., Nepean, ON, CANADA K2E 7J6 613-226-4000
Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Richard Hirschmann of America Inc., Riverdale, NJ 07457 201-835-5002
§ Honeywell Optoelectronics, Richardson, TX 75081 214-470-4271
§ ICS Electronics Corp., San Jose, CA 95131 408-432-9009
§ ITT Gilfillan, ITT Corp., Van Nuys, CA 91409 818-988-2600
JAE Electronics Inc., Santa Ana, CA 92705-5504 714-250-8770
Jaycor, San Diego, CA 92138 619-453-6580
Kinetic Systems Corp., Lockport, IL 60441 815-838-0005
§† Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
† Lightwave Communications, Inc., Ridgefield, CT 06877 203-438-3591
† Manage, Inc., Fibre Optics Elctrns. Sys. Grp., Chicopee, MA 01014 413-592-9123
† Math Assocs., Westbury, NY 11590 516-334-6800
§ 3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
§ Mitsubishi Elctrns. America, Inc., Semiconductor Div., Sunnyvale, CA 94086 408-730-5900
§ Motorola Semiconductor Prods. Sector, Phoenix, AZ 85018-6606 602-244-6900
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Ortel Corp., Alhambra, CA 91803 818-281-3636
§ Scientific Technologies, Optical Sensor Div. Inc., Hayward, CA 94544 ... 415-471-9717
Siecor Electro-Optic Products, Siecor Corporation, Research Triangle Park, NC 27709 ..... 1-800-888-LAN1;919-481-5100
Signatron, A Unit of Sundstrand Corp., Lexington, MA 02173 617-861-1500
SpecTran Corp., Sturbridge, MA 01566 508-347-2751
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§ Telemet, Geotel, Inc., Hauppauge, NY 11788 516-436-7260
§ TELTEC, INC., Minneapolis, MN 55425 612-854-9632
§ Thomas & Betts Corporation, Bridgewater, NJ 08807 201-685-1600
Zexco, Van Nuys, CA 91401 818-997-7895

Data Links, Freespace Communications-2475

§ American Laser Systems, Inc., Goleta, CA 93117 805-967-0423
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000
HDS Inc., Reston, VA 22091 703-620-6200
† ISC Datacom, ISC Defense & Space, Sunnyvale, CA 94089 408-747-0300
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Zexco, Van Nuys, CA 91401 818-997-7895

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Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 703-953-4751 ..... **B•1208-1211,1213**
† Alden Electronics, Inc., Westboro, MA 01581 508-366-8851
Cyber Sys., Inc., Anaheim, CA 92806 714-722-2051
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700

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Decade Boxes, Capacitance-2900 — *See Vol. D*

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Decommutators, PCM-3500

† Aydin Corp., Horsham, PA 19044 215-657-7510
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
Fairchild - Weston - Telemetry, Sarasota, FL 34230 813-371-0811
† Metraplex Corp., Frederick, MD 21701 301-662-8000

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Decoys (MIL), Buoy-2440

§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000

Decoys (MIL), IR Flare-2440

§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100

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Andersen Laboratories, Bloomfield, CT 06002, 203-286-9090 ..... A•1505
† Automatic Coil Corp., Sub. Designatronics, Inc., Miami, FL 33147, 305-696-6660 ..... A•1506-1508
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•1510,1520-1523
Control Electronics, Neurotech Corp., Farmingdale, NY 11735, 516-694-0125 ..... A•1540
Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299 ..... A•1553-1555
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400** ..... A•1564-1566,1568-1572
JBM Electronics, Inc., Manchester, NH 03102, 603-623-0222 .. A•1578,1582-1583
† **Kappa Networks, Inc., Rahway, NJ 07065, 201-396-9400;1-800-223-0603** ..... A•1585-1586,1600-1601,1603
† **KR Electronics, Inc., Avenel, NJ 07001, 201-636-1900** ..... A•1704
Nytronics Components Grp., Inc., Darlington, SC 29532, 803-393-5421 ..... A•1605-1607
§† **RCD Components, Inc., Manchester, NH 03103, 603-669-0054** ..... A•2043
Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 ..... A•1622-1623
† **Technitrol, Philadelphia, PA 19134, 215-426-9105** ..... A•1630-1632,1634,1636-1637, B•1036
§ Datatronics, Ltd., Blue Jay, CA 92317 714-336-3561
§ FDK America, Inc., Fuji Electrochemical Co., Ltd., Cerritos, CA 90701 213-404-1770
Matthey Electronics, Television Equipment Associates, South Salem, NY 10590 914-763-8893
Nano Pulse Industries, Brea, CA 92670 714-529-2600
† Phonon Corporation, Simsbury, CT 06070 203-651-0211
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291

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Detection & Ranging Systems (MIL)-2440

† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
§ MERET, Inc., Santa Monica, CA 90404-4998 213-828-7496
§ Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
§† Sensall, Rosemount Corp., Hauppauge, NY 11788 516-273-6600
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400

Detection Systems, Laser-3700

Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
Eltec Instruments Inc., Daytona Bch., FL 32020 904-253-5328
† Force, Inc., Christiansburg, VA 24073 703-382-0462
§ Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
§ SC Technology, Inc., Livermore, CA 94550 415-373-9230
Spiricon, Inc., Logan, UT 84321 801-753-3729

Detector Arrays, Infrared-3700

§ **Clairex Electronics, Clairex Corporation, Mt. Vernon, NY 10550, 914-664-6602** ..... B•1320
§ **Marktech International Corp., Menands, NY 12204, 518-436-5865** ..... B•1172
§ **Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757** ..... B•1346
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
Eltec Instruments Inc., Daytona Bch., FL 32020 904-253-5328
General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
§† Optek Technology Inc., McKinney, TX 75069 214-542-9461
Ortel Corp., Alhambra, CA 91803 818-281-3636
Silicon Detector Corp., Camarillo, CA 93010 805-484-2884
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
Spiricon, Inc., Logan, UT 84321 801-753-3729
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085

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§ **MERET, Inc., Santa Monica, CA 90404-4998, 213-828-7496** ..... B•1215
§ **NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000** .... B•1325-1326
§ A.C. Interface Inc., Irvine, CA 92718 714-472-9524
Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
† Centronic, Inc., Morgan Crucible Co., Electronics Div., Newbury Park, CA 91320-1702 805-499-5902
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011 212-691-9050
§ Efector, Inc., Exton, PA 19341 ..... 215-524-2000;800-441-8246
EG&G, Inc., Photon Devices, Salem, MA 01970 617-745-3200
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
Fibronics International Inc., Communications Way, Hyannis, MA 02601-1892 508-778-0700
§ General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
§† Germanium Power Devices, Andover, MA 01810 508-475-5982
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
§† Motorola Semiconductor Prods. Sector, Phoenix, AZ 85018-6606 602-244-6900
§† Optek Technology Inc., McKinney, TX 75069 214-542-9461
Opto Technology, Inc., Wheeling, IL 60090 312-537-4277
† Ortel Corp., Alhambra, CA 91803 818-281-3636
Photon, Inc., Los Gatos, CA 95030 408-354-5600
Rehlander Assocs., Beverly, MA 01915 617-922-5961
§ Scientific Technologies, Optical Sensor Div. Inc., Hayward, CA 94544 ... 415-471-9717
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430 201-529-8757
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Detector Corp., Camarillo, CA 93010 805-484-2884
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§ Skan-A-Matic, Electro Corporation, Sarasota, FL 34230-3049 813-355-8411
Spiricon, Inc., Logan, UT 84321 801-753-3729
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
Welch Allyn, Inc., Industrial Products Division, Skaneateles Falls, NY 13153-0187 315-685-8945

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K-Tronics, K. T. Elctrns. Inc., Sunnyvale, CA 94086, 1-800-888-ELCO ... B•1375
§ **Qualitec Technologies, Inc., Palo Alto, CA 94303-1706, 408-984-1763** ... D•1336
§ **ROD-L Electronics, Inc., Menlo Park, CA 94025, 415-322-0711** ..... D•1338-1339
Shalltronix Corp., Selma, NC 27576, 919-965-6346 ..... D•1346
† AEMC Corporation, Boston, MA 02111 ..... 617-451-0227;800-343-1391
§† Brim Electronics, Fair Lawn, NJ 07410 201-796-2886
§ Current Ring Co. Inc., Ballwin, MO 63011 800-325-8653
§ Ericson Manufacturing Co., Willoughby, OH 44094 216-951-8000
† GreenLee Textron Inc.:Subsidiary of Textron Inc., Rockford, IL 61109 ... 815-397-7070
Hipotronics Inc., Brewster, NY 10509 914-279-8091
† Hughes Aircraft Co., Microelctrns. Sys. Div., Irvine, CA 92715 714-752-3800
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 812-386-1000
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
§ Square D Co., Palatine, IL 60067 312-397-2600
§ Sunshine Scientific Instruments, Philadelphia, PA 19115 215-673-5600

§ Syracuse Electronics, Pass & Seymour, Inc., Syracuse, NY 13221 315-468-6211
Trinetics Inc., Mishawaka, IN 46545-4899 219-259-8535

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Amperex Electronic Company, A Div. of North American Philips Corporation, Slatersville, RI 02876, 401-762-3800 ..... B•1317-1318
† Analog Modules, Inc., Longwood, FL 32750, 407-339-4355 ..... D•1004
§ Clairex Electronics, Clairex Corporation, Mt. Vernon, NY 10550, 914-664-6602 ..... B•1320
HEI, Inc., Optoelectronics Div., Victoria, MN 55386, 612-443-2500 ..... B•1322
§ Marktech International Corp., Menands, NY 12204, 518-436-5865 ... B•1172-1173
§ Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1346
§ A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
† Barnes Engineering Div., EDO Corporation, Shelton, CT 06484 203-926-1777
Burleigh Instruments, Fishers, NY 14453 716-924-9355
§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
† Centronic, Inc., Morgan Crucible Co., Electronics Div., Newbury Park, CA 91320-1702 805-499-5902
† Cincinnati Elctrns., Cincinnati, OH 45241 513-733-6100
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
§ Data Instruments, Inc., Acton, MA 01720 508-264-9550
§ Dexter Research Ctr., Inc., Dexter, MI 48130 313-426-3921
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
EG&G, Inc., Photon Devices, Salem, MA 01970 617-745-3200
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
ElectroPhysics Corp., Nutley, NJ 07110 201-667-2262
Eltec Instruments Inc., Daytona Bch., FL 32020 904-253-5328
Gamma Scientific Inc., San Diego, CA 92123 619-279-8034
General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
§† Germanium Power Devices, Andover, MA 01810 508-475-5982
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386 612-443-2500
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
§† Honeywell Optoelectronics, Richardson, TX 75081 214-470-4271
Hy-Cal Engineering, El Monte, CA 91731 818-444-4000
† Infrared Industries, Inc., Orlando, FL 32826 407-282-7700
§ Leybold Inficon Inc., E. Syracuse, NY 13057 315-434-1100
§† MERET, Inc., Santa Monica, CA 90404-4998 213-828-7496
§† Mikron Instr., Wyckoff, NJ 07481 201-891-7330
§ Motorola Semiconductor Prods. Sector, Phoenix, AZ 85018-6606 602-244-6900
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
Optoelectronics/Textron, Petaluma, CA 94975-0039 707-763-5900
Opto Technology, Inc., Wheeling, IL 60090 312-537-4277
Ortel Corp., Alhambra, CA 91803 818-281-3636
Philips Electronics Ltd, Philips Comps., Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02154 617-899-8400
Rodann Electronics Mfg. Co., Brea, CA 92621 714-529-1301
† Scientech, Inc., Boulder, CO 80303 ..... 303-444-1361;800-525-0522
§ Scientific Technologies, Optical Sensor Div. Inc., Hayward, CA 94544 ... 415-471-9717
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Detector Corp., Camarillo, CA 93010 805-484-2884
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§ Skan-A-Matic, Electro Corporation, Sarasota, FL 34230-3049 813-355-8411
Spiricon, Inc., Logan, UT 84321 801-753-3729
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
† Thermometrics, Inc., Edison, NJ 08817-4695 201-287-2870
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006 201-575-5586
§ Victory Engineering Corp., Springfield, NJ 07081 201-379-5900

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Detectors (MIL), IR-2440

† Alan Industries Inc., Columbus, IN 47201 812-372-8869
† Cincinnati Elctrns., Cincinnati, OH 45241 513-733-6100
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
§† Laser Precision Corp., Utica, NY 13502 315-797-4449
Silicon Detector Corp., Camarillo, CA 93010 805-484-2884
Spiricon, Inc., Logan, UT 84321 801-753-3729
Texas Instrs., Data Sys. Group, Dallas, TX 75380-9063 1-800-527-3500

Detectors (MIL), Radar-2440

§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
§ Sparkomatic, Milford, PA 18337 717-296-6444

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Diode Arrays (Incl. Photo)-3700

American Microsemiconductor, Inc., Madison, NJ 07940, 201-377-9566 .. A•2155
Dialight Corp., A Cambridge Elctrns. Inds. Co., Manasquan, NJ 08736, 201-223-9400 ..... B•1133-1140
§ EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1321
† Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400 ..... A•2178-2179
HEI, Inc., Optoelectronics Div., Victoria, MN 55386, 612-443-2500 ... B•1322-1323
† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 .... A•1749
K & M Electronics, W. Springfield, MA 01089, 413-781-1350 ..... A•1963
Motorola Semiconductor Prods. Sector, Phoenix, AZ 85018-6606, 602-244-6900 ..... A•2186
§† Optek Technology Inc., McKinney, TX 75069, 214-542-9461 ..... B•1333
Opto Diode Corp., Newbury Park, CA 91320, 805-499-0335 ..... B•1334
Philips ECG, American Philips Co., Waltham, MA 02254, 617-890-6107 .. A•2197
† Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 ..... B•1347
Advanced Detector Corp., Applied Sclar Energy Corp., Industry, CA 91746 818-369-6886
§ A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
† Assembly Specialists, Acton, MA 01720 617-263-9100
† Atlantic Solar Products, Baltimore, MD 21237 ..... 301-686-2500;800-237-6527
† Basic Electronics, Inc., Stanton, CA 90680 714-530-2400
§ Bradford Electronics, Inc., Bradford, PA 16701 814-362-5700
† Dionics, Westbury, NY 11590 516-997-7474
EG&G, Inc., Photon Devices, Salem, MA 01970 617-745-3200
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 408-738-4266
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
§† General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386 612-443-2500
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Hitachi America, Ltd., San Jose, CA 95131 408-435-8300
§† Honeywell Optoelectronics, Richardson, TX 75081 214-470-4271

ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
† Ledtronics, Inc., Torrance, CA 90505 213-549-9995
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
Marktech International Corp., Menands, NY 12204 518-436-5865
§† MERET, Inc., Santa Monica, CA 90404-4998 213-828-7496
† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
Optoelectronics/Textron, Petaluma, CA 94975-0039 707-763-5900
Opto Technology, Inc., Wheeling, IL 60090 312-537-4277
§ Pioneer Components, Brooklyn, NY 11234 718-444-3880
§ Rohm Corporation, Irvine, CA 92718 714-855-2131
§ SC Technology, Inc., Livermore, CA 94550 415-373-9230
§ Semtech, Newbury Park, CA 91320 805-498-2111
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Silicon Detector Corp., Camarillo, CA 93010 805-484-2884
† Solid State Devices, La Mirada, CA 90638 213-921-9660
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 407-848-4311
Spiricon, Inc., Logan, UT 84321 801-753-3729
Sprague Electric Company, Distbn.Div., Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, The Semiconductor Group, Worcester, MA 01613-2036 617-853-5000
§ SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
Thor Electronics, Linden, NJ 07036 201-486-3300
§† VCH Incorporated, Chicago Miniature, Buffalo Grove, IL 60089 312-459-3400
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402

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§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269, 201-231-8300 ..... B•1127
Amperex Electronic Company, A Div. of North American Philips Corporation, Slatersville, RI 02876, 401-762-3800 ..... B•1318-1319
§ AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1129
§ Arcoiectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... B•1130-1131
§ Clairex Electronics, Clairex Corporation, Mt. Vernon, NY 10550, 914-664-6602 ..... B•1320
§ Dialight Corp., A Cambridge Elctrns. Inds. Co., Manasquan, NJ 08736, 201-223-9400 ..... B•1133-1138,1140
§ EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1321
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... C•1585
† Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1144-1145
§ Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970 ..... B•1151
HEI, Inc., Optoelectronics Div., Victoria, MN 55386, 612-443-2500 ... B•1322-1323
§ Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1086
§ Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1159,1161
Inter-Market, Glenview, IL 60025, 312-729-5330 ..... B•1178
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475 ..... A•1085
§ JKL Components Corporation, Pacoima, CA 91331, 818-896-0019 ..... B•1163
† Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1020,1167
§ Marktech International Corp., Menands, NY 12204, 518-436-5865 ... B•1172-1173
§† MERET, Inc., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1215
Mineico Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261 .. B•1175
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1324
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1817-1821
§ Optek Technology Inc., McKinney, TX 75069, 214-542-9461 ..... B•1333
Opto Diode Corp., Newbury Park, CA 91320, 805-499-0335 ..... B•1334
† Oxley, Inc., Branford, CT 06405, 203-488-1033 ..... B•1025,1179
Philips ECG, American Philips Co., Waltham, MA 02254, 617-890-6107 .. A•2197
§ Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... A•2200, B•1180-1182,1339,1344
§ Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122
§ Shokai Far East, Ltd., Hartsdale, NY 10530, 914-681-0700 ..... B•1187
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 ..... B•1347
† Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1188-1195
§† Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1198
Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900 ..... B•1199-1203
§† A.C. Interface Inc., Irvine, CA 92718 714-472-9524
§ A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
§ Alpha Dist. Corp., Richfield, OH 44286 216-659-7100
Altair Exchange Corporation, Northridge, CA 91324 ..... 818-701-6977;800-824-5620
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
Communication Devices, Inc., Scarborough, Ont., CAN M1H3A4 416-439-6320
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
§ Data Display Products, Los Angeles, CA 90009 213-640-0442
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
Ei North America, New York, NY 10021 212-517-5622
§ Electro-Mech Components, Inc., South El Monte, CA 91733-3689 818-442-7180
† Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
§ Everlight - USA, Glendora, CA 91740 213-697-5067
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
† Fema Elctrns. Corp., E. Brunswick, NJ 08816 201-238-1223
† Fibronics International Inc., Communications Way, Hyannis, MA 02601-1892 508-778-0700
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386 612-443-2500
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Hitachi America, Ltd., San Jose, CA 95131 408-435-8300
§† Honeywell Optoelectronics, Richardson, TX 75081 214-470-4271
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
§ IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
§ Instrument Design Engrg. Assoc., Inc., Brea, CA 92621 213-697-4332
§† Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
§† Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
§ Ledco Div., St. Paul, MN 55107 612-222-2791
§ Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016 312-824-1188
§ Lumex Opto/Comps., Inc., Palatine, IL 60067 312-359-2790
† Math Assocs., Westbury, NY 11590 516-334-6800
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
† Micropac Inds., Inc., General Sensors Div., Garland, TX 75040 214-272-3571
§ Mitsubishi Elctrns. America, Inc., Semiconductor Div., Sunnyvale, CA 94086 408-730-5900
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Opto Technology, Inc., Wheeling, IL 60090 312-537-4277
§ Oshino Electric Lamp Works, Ltd., Shinagawa-Ku, Tokyo, JAPAN 03-471-8548
Philips Electronics Ltd, Philips Comps., Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§ Pioneer Components, Brooklyn, NY 11234 718-444-3880
† Rebco International, San Jose, CA 95136 408-723-2932
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Rohm Corporation, Irvine, CA 92718 714-855-2131
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
Schroff Incorporated, Schroff GMBH, Warwick, RI 02886 401-732-3770
§ Schroff UK Ltd., Hemel Hempstead, Herts, ENGLAND HP2 4SG 0442-40471/6
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§ Solid State, Inc., Bloomfield, NJ 07003 201-429-8700
Stetco, Inc., Franklin Pk, IL 60131 312-671-4208
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Teknational Inds., Inc., Rochester, NY 14620-1103 716-232-1291
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
§† VCH Incorporated, Chicago Miniature, Buffalo Grove, IL 60089 312-459-3400
§ Wamco, Inc., Fountain Valley, CA 92708 714-545-5560
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

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Diodes, Liquid Crystal (LCDs)-3700

A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269, 201-231-8300 ..... B•1127
Densitron Corporation, Densitron International, Torrance, CA 90505, 213-530-3530 ..... B•1062-1063
Ocular Inc., Richardson, TX 75080, 214-437-2561 ..... B•1099-1101
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1339,1344,1346
§ Atomergic Chemetals Corp., Farmingdale, NY 11735-1527 516-694-9000
† Fema Elctrns. Corp., E. Brunswick, NJ 08816 201-238-1223
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ Optrex/Satori, Torrance, CA 90505 213-378-9478
Philips Electronics Ltd, Philips Comps., Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§ Rebco International, San Jose, CA 95136 408-723-2932
§ Sam Sung Elctrn. Dvcs., America, Inc., La Mirada, CA 90638 213-802-8425

§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
† UCE, Inc., Norwalk, CT 06854 203-838-7509
VL Electronics, Inc., Varitronix LTD., Los Angeles, CA 90039 213-661-8883

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Diodes, Microwave Detector-4800 — *See Vol. A*

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Diodes, Photoelectric-3700

§ Clairex Electronics, Clairex Corporation, Mt. Vernon, NY 10550, 914-664-6602 ..... B•1320
§ EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1321
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1324-1326,1328-1331
§ Optek Technology Inc., McKinney, TX 75069, 214-542-9461 ..... B•1333
Opto Diode Corp., Newbury Park, CA 91320, 805-499-0335 ..... B•1334
† Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 ..... B•1347
§ Advanced Detector Corp., Applied Solar Energy Corp., Industry, CA 91746 818-369-6886
§ A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
† Centronic, Inc., Morgan Crucible Co., Electronics Div., Newbury Park, CA 91320-1702 805-499-5902
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
EG&G, Inc., Photon Devices, Salem, MA 01970 617-745-3200
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§† Honeywell Optoelectronics, Richardson, TX 75081 214-470-4271
Marktech International Corp., Menands, NY 12204 518-436-5865
§† MERET, Inc., Santa Monica, CA 90404-4998 213-828-7496
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Philips Electronics Ltd, Philips Comps., Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
† Silicon Detector Corp., Camarillo, CA 93010 805-484-2884
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
Sprague Electric Company, Distbn.Div., Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, The Semiconductor Group, Worcester, MA 01613-2036 617-853-5000
§† Thor Electronics, Linden, NJ 07036 201-486-3300
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006 201-575-5586
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 312-364-7277

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Diodes (MIL)-2440

† Voltage Multipliers, Inc., Visalia, CA 93291, 209-651-1402 .. A•2208-2209, B•1039
Cir-Q-Tel, Inc., Beltsville, MD 20805 301-946-1800
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
§† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
Fenwal Electronics/APD, Kidde, Inc., Milford, MA 01757 508-478-6000
† Koep Precision Standards, Inc., South Plainfield, NJ 07080 ..... 201-757-2220/2277
MACOM, Inc., Burlington, MA 01803 617-272-3000
Micronetics, Norwood, NJ 07648 201-767-1320
§† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
Semicon Components, Inc., Div. of Semicon, Inc., Burlington, MA 01803 617-272-9015
Sprague Electric Company, Distbn.Div., Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, The Semiconductor Group, Worcester, MA 01613-2036 617-853-5000

Diplexers, Antenna-1900 — *See Vol. D*

Direction Finding Sets & Systems (MIL)-2440

† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ..... 214-470-2106/2107
† E-Systems, Melpar Div., Falls Church, VA 22046 703-560-5000
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Glatzer Industries Corp., New Rochelle, NY 10801 914-576-2700
† Lockheed Electronics Co., Inc., Lockheed Corporation, Plainfield, NJ 07061 201-757-1600
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840

Discharge Systems, Energy-4000 — *See Vol. D*

Discriminators-1900 — *See Vol. D*

Disks, Alignment, Flexible Disk Drive-2000 — *See Vol. D*

Disks, Computer Memory — See Memory Systems, Disk (Vol. D)

Disks, Diagnostic, Flexible Disk Drive-2000 — *See Vol. D*

Disks, Magnetic 3Ñ″-2000 — *See Vol. D*

Disks, Magnetic, 5Ö″ Flexible-2000 — *See Vol. D*

Disks, Magnetic, 8″ Flexible-2000 — *See Vol. D*

Disks, Magnetic, Front-loading Cartridge-2000 — *See Vol. D*

Disks, Magnetic, Pack-2000 — *See Vol. D*

Disks, Magnetic, Sub-4″-2000 — *See Vol. D*

Disks, Magnetic, Top-loading Cartridge-2000 — *See Vol. D*

Disks, Magnetic, Winchester Module-2000 — *See Vol. D*

Disks, Memory, Flexible — See Memory Systems, Disk, Flexible (Vol. D)

Disks, Optical Encoder — See Encoders, Shaft Angle, Optical (Vol. B)

Dispensers, Adhesive-1600 — *See Vol. C*

Dispensers, DIP & IC — See Machines, Component Handling (Vol. D)

Display Modules-2450

Amperex Electronic Company, A Div. of North American Philips Corporation, Slatersville, RI 02876, 401-762-3800 ..... B•1047
AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1048-1049,1129
Applied Data Systems, Baltimore, MD 21202, 800-541-2003;301-576-0335 ..... B•1050
Canyon Elctrns., Phoenix, AZ 85021, 602-944-4421 ..... B•1051
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1052
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... B•1053
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-564-3131 ..... B•1056
Densitron Corporation, Densitron International, Torrance, CA 90505, 213-530-3530 ..... B•1062-1063
Dialight Corp., A Cambridge Elctrns. Inds. Co., Manasquan, NJ 08736, 201-223-9400 ..... B•1065
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 .. B•1066-1067,1073
Electronics Research Associates Inc., Winsted, CT 06098, 203-379-2731 ..... B•1075
Electro-Numerics, Inc., Irvine, CA 92714, 714-250-1501 ..... D•1391
§† Excel Technology Intl. Corp., Belle Mead, NJ 08502, 201-874-4747 .. B•1078-1079
Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173, 312-517-1144 ..... B•1082-1084
§ Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1086,1166
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1087
§ IVO Industries, Inc., Eatontown, NJ 07724, 201-542-5151;800-932-0489 ..... B•1089, D•1149
MicroDimensions, Inc., Mentor, OH 44060, 216-974-8070 ..... B•1091
§† NES, Inc. (Nationwide Electronic Systems), Carpentersville, IL 60110, 312-426-5900 ..... B•1098, D•1153,1406-1408,1410-1411
Ocular Inc., Richardson, TX 75080, 214-437-2561 ..... B•1099-1101
Optrex/Satori, Torrance, CA 90505, 213-378-9478 ..... B•1102-1104
Seiko Instruments U.S.A., Inc., Components Div., Torrance, CA 90505, 213-517-7770 ..... B•1109
Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA ..... B•1991-1992
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... B•1117-1121
VL Electronics, Inc., Varitronix LTD., Los Angeles, CA 90039, 213-661-8883 ..... B•1123
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1125
American Control Technology, Inc., West Dundee, IL 60118 312-426-6780

§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5121
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
C-Tek Inc., Wakefield, MA 01880 617-246-1720
† Data Check Corporation, San Diego, CA 92126 619-578-0101
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
† DCI Inc., Olathe, KS 66061 913-782-5672
§ Digitran Division, Xcel Corporation, Pasadena, CA 91107 818-791-5600
Endicott Research Group, Endicott, NY 13760 607-754-9187
§ Everlight - USA, Glendora, CA 91740 213-697-5067
§ Extech Instruments Corp., Waltham, MA 02154 617-890-7440
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 312-884-1444
† Infodex, Inc., Wolcott, CT 06716 203-879-4944
Kinetic Systems Corp., Lockport, IL 60441 815-838-0005
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
Kristel Corporation, West Chicago, IL 60185 312-293-0850
† K-Systems of Texas, Inc., El Paso, TX 79936 915-598-9769
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459 203-283-8261
NEI Ferranti-Packard Electronics, Mississauga, Ont., CANADA L4W 2P1 416-624-3020
† Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
Sam Sung Elctrn. Dvcs., America, Inc., La Mirada, CA 90638 213-802-8425
§ Three-Five Sys., Inc., Phoenix, AZ 85201 602-496-0035

Display Power Supplies — See Converters, DC to DC (Vol. D), Power Supplies, AC Output (Vol. D)

Displays, CRT-2450

Computron Display Systems, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... B•1053
Data Ray Corp., Broomfield, CO 80020, 303-469-5173 ..... B•1058-1060
Genstar Rental Electronics, Inc., Woodland Hills, CA 91367, 800-331-3440 (in CA);800-227-8409 ..... D•1277
§ Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1086
† Infodex, Inc., Wolcott, CT 06716, 203-879-4944 ..... B•1010-1011,1088
§ Leader Instruments Corp., Hauppauge, NY 11788-3694, 516-231-6900 ... D•1316
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1125
ASC Systems, St. Clair Shores, MI 48081 313-779-8700
Aspect Electronics Inc., Sunnyvale, CA 94086 408-737-2290
Aydin Corp., Horsham, PA 19044 215-657-7510
† CELCO, Mahwah, NJ 07430 201-327-1123
† Collins Avionics Divisions, Rockwell Intl., Cedar Rapids, IA 52498 319-395-1000
§ Colorgraphic Communications Corp., Atlanta, GA 30366 404-455-3921
§ Computerware, Inc., Vienna, VA 22180 703-821-8200
§ Conrac Display Products, Inc., A Mark IV Industries Co., Duarte, CA 91010 818-303-0095
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-564-3131
† Data Check Corporation, San Diego, CA 92126 619-578-0101
§ Data Rentals/Sls., Inc, Burbank, CA 91505 818-843-1221
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
Digital Equip., Marlborough, MA 01752
Digitran Division, Xcel Corporation, Pasadena, CA 91107 818-791-5600
§ Dotronix, New Brighton, MN 55112 612-633-1742
§ Everlight - USA, Glendora, CA 91740 213-697-5067
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000
Hitachi America, Ltd., San Jose, CA 95131 408-435-8300
† Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
† ISC Cardion Electronics, Inc., Woodbury, NY 11797 516-921-7300
† Kaiser Electronics, Kaiser Aerospace & Elctrns., San Jose, CA 95134 ... 408-432-3000
Kikusui International Corp., Torrance, CA 90503 ..... 213-371-4662;800-545-8784
§ Krenz Electronic, Inc., San Clemente, CA 92672 714-361-6866
Kristel Corporation, West Chicago, IL 60185 312-293-0850
Lee Data Corporation, Minneapolis, MN 55344 612-828-0300
Matrix Corp., Raleigh, NC 27610 919-833-2000
§ Matrox Electronic Systems, Ltd., Dorval, QU, CANADA H9P 2T4 514-685-2630
§ Metra Instruments, Inc., San Jose, CA 95131 408-432-1110
§ Mitsubishi Electronics, Torrance, CA 90502 213-217-5732
§ Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
† Systems Research Laboratories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§† Teltron, Inc., Birdsboro, PA 19508 215-582-2711
Texscan Instruments, Texscan Corporation, Indianapolis, IN 46226 317-545-4196
§ Thor Electronics, Linden, NJ 07036 201-486-3300
U.S. Instr. Rentals, San Mateo, CA 94403 800-824-2873
XKD Corporation, Los Gatos, CA 95030 408-395-3700
† Zenith CRT & Components Operations, Glenview, IL 60025 312-391-7733
Zenith Components Group, Zenith Electronics Corp., Glenview, IL 60025 312-391-7733

Displays, Dot Matrix-2450

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1043
§ Amperex Electronic Company, A Div. of North American Philips Corporation, Slatersville, RI 02876, 401-762-3800 ..... B•1047
§ AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ... B•1048,1129
CBM America Corp., Santa Monica, CA 90404, 213-828-8245 ..... D•1082-1083
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-564-3131 ..... B•1055,1057
§ Densitron Corporation, Densitron International, Torrance, CA 90505, 213-530-3530 ..... B•1062
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 .. B•1066-1071,1073
§† Electronics Research Associates Inc., Winsted, CT 06098, 203-379-2731 ..... B•1075
§ Everlight - USA, Glendora, CA 91740, 213-697-5067 ..... B•1143
Fujitsu of America, Santa Clara, CA 95054, 408-562-1000 ..... B•1080
Hamlin LCD, A Div. of Standish Inds., Lake Mills, WI 53551, 414-648-2315 ..... B•1081
Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1086,1166
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1087
§ IVO Industries, Inc., Eatontown, NJ 07724, 201-542-5151;800-932-0489 .. B•1089
† Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1167
MicroDimensions, Inc., Mentor, OH 44060, 216-974-8070 ..... B•1091
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1093
Ocular Inc., Richardson, TX 75080, 214-437-2561 ..... B•1099-1101
Optrex/Satori, Torrance, CA 90505, 213-378-9478 ..... B•1102-1104
Sam Sung Elctrn. Dvcs., America, Inc., La Mirada, CA 90638, 213-802-8425 ..... B•1106
§ Seiko Instruments U.S.A., Inc., Components Div., Torrance, CA 90505, 213-517-7770 ..... B•1109
§ Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1110-1111,1113-1116
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ... B•1117-1118,1120-1121
VL Electronics, Inc., Varitronix LTD., Los Angeles, CA 90039, 213-661-8883 ..... B•1123
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1125
§ A.C. Interface Inc., Irvine, CA 92718 714-472-9524
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5121
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 312-360-3500
§ Chrono-log Corp., Havertown, PA 19083 215-853-1130
§ Colorgraphic Communications Corp., Atlanta, GA 30366 404-455-3921
Communication Devices, Inc., Scarborough, Ont., CAN M1H3A4 416-439-6320
Computerwise, Olathe, KS 66062 913-829-0600
Crystaloid Electronics, Hudson, OH 44236 216-655-2429
§† Digital Electronics, Hayward, CA 94544-7831 415-471-4700
Digital Equip., Marlborough, MA 01752
Dotronix, New Brighton, MN 55112 612-633-1742
† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
† EEV Inc., Elmsford, NY 10523 914-592-6050
† Ferna Elctrns. Corp., E. Brunswick, NJ 08816 201-238-1223
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 312-884-1444
Hamlin, Lake Mills, WI 53551 414-648-2361
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Hitachi America, Ltd., San Jose, CA 95131 408-435-8300
§ Instrument Design Engrg. Assoc., Inc., Brea, CA 92621 213-697-4332
International Instrumentation, Inc., Westlake Vlg., CA 91361 805-495-7673
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Noritake Co., Inc., Noritake Co., Limited (Japan), Torrance, CA 90505 213-373-6704
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
† Orbit Instrument of Cal., Cypress, CA 90630 714-527-0561
Philips Electronics Ltd, Philips Comps., Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§ Rohm Corporation, Irvine, CA 92718 714-855-2131
Shapiro Scientific Inst., Corona del Mar, CA 92625 714-675-1024
§ Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
§† Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§ Texas Instruments, Data/Image Sensing (Opto), Dallas, TX 75265 214-995-6611
Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
§ Thor Electronics, Linden, NJ 07036 201-486-3300
§ Three-Five Sys., Inc., Phoenix, AZ 85201 602-496-0035
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
† UCE, Inc., Norwalk, CT 06854 203-838-7509

Displays, Edge Lighted & Back Lighted-2450

AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1048
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... B•1073
Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173, 312-517-1144 ..... B•1082-1084
§ Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1110-1111,1113-1116
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122
VL Electronics, Inc., Varitronix LTD., Los Angeles, CA 90039, 213-661-8883 ..... B•1123
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1125
American Control Technology, Inc., West Dundee, IL 60118 312-426-6780
† Barrington Plastics, Mt. Laurel, NJ 08054 609-235-5151
Communication Devices, Inc., Scarborough, Ont., CAN M1H3A4 416-439-6320
† Control Displays, Inc., Colmar, PA 18915 215-822-3383
Crystaloid Electronics, Hudson, OH 44236 216-655-2429
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-564-3131
Display Devices, Inc., Encinitas, CA 92024 619-753-0113
† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
† Ferna Elctrns. Corp., E. Brunswick, NJ 08816 201-238-1223
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Optrex/Satori, Torrance, CA 90505 213-378-9478
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Shapiro Scientific Inst., Corona del Mar, CA 92625 714-675-1024

† Spectra Lux Corp., Kirkland, WA 98034 206-747-0560
§ Sunshine Scientific Instruments, Philadelphia, PA 19115 215-673-5600
Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
§ Three-Five Sys., Inc., Phoenix, AZ 85201 602-496-0035
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
† UCE, Inc., Norwalk, CT 06854 203-838-7509

Displays, Electroluminescent-2450

§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1052
Densitron Corporation, Densitron International, Torrance, CA 90505, 213-530-3530 ..... B•1062
Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173, 312-517-1144 ..... B•1082-1084
Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1086
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1087
† Infodex, Inc., Wolcott, CT 06716, 203-879-4944 ..... B•1010-1011,1088
§ Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1110-1113
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1124-1125
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
Bonar Kard-O-Lite, Inc., King of Prussia, PA 19406 215-277-2910
Communication Devices, Inc., Scarborough, Ont., CAN M1H3A4 416-439-6320
§† Digital Electronics, Hayward, CA 94544-7831 415-471-4700
Endicott Research Group, Endicott, NY 13760 607-754-9187
Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 312-884-1444
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
† Orbit Instrument of Cal., Cypress, CA 90630 714-527-0561
Shapiro Scientific Inst., Corona del Mar, CA 92625 714-675-1024
Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
§ Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† UCE, Inc., Norwalk, CT 06854 203-838-7509
VL Electronics, Inc., Varitronix LTD., Los Angeles, CA 90039 213-661-8883

Displays, Electromagnetic-2450

§ Densitron Corporation, Densitron International, Torrance, CA 90505, 213-530-3530 ..... B•1062
NEI Ferranti-Packard Electronics, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ..... B•1095
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... B•1117-1121
IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459 203-283-8261

Displays, Electromechanical-2450

§† Densitron Corporation, Densitron International, Torrance, CA 90505, 213-530-3530 ..... B•1062
Electrodynamics, Inc., A Talley Inds. Co.; Rolling Meadows, IL 60008, 312-259-0740 ..... D•1145
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261 .. B•1175
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... B•1117-1121
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1125
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
NEI Ferranti-Packard Electronics, Mississauga, Ont., CANADA L4W 2P1 416-624-3020
† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Schroff Incorporated, Schroff GMBH, Warwick, RI 02886 401-732-3770

Displays, Fiber Optic-2450

AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1049
§† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 312-884-1444
† Galileo Electro-Optics Corp., Sturbridge, MA 01566 508-347-9191
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
§ Mitsubishi Electronics, Torrance, CA 90502 213-217-5732
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300

Displays, Graphic-2450

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1042-1043
§ Amperex Electronic Company, A Div. of North American Philips Corporation, Slatersville, RI 02876, 401-762-3800 ..... B•1047
§ AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1129
Applied Data Systems, Baltimore, MD 21202, 800-541-2003;301-576-0335 ..... B•1050
Bergquist, Minneapolis, MN 55435, 800-328-3882 ..... B•1858
Bonar Kard-O-Lite, Inc., King of Prussia, PA 19406, 215-277-2910 ..... B•1132
CBM America Corp., Santa Monica, CA 90404, 213-828-8245 ..... D•1082-1083
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1052
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-564-3131 ..... B•1055-1056
† DCI Inc., Olathe, KS 66061, 913-782-5672 ..... B•1061
§† Densitron Corporation, Densitron International, Torrance, CA 90505, 213-530-3530 ..... B•1062-1063
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... B•1073
Dixson, Inc., Grand Junction, CO 81503, 303-242-8863 (ext 223) ..... D•1382
Endicott Research Group, Endicott, NY 13760, 607-754-9187 ..... B•1076-1077
Everlight - USA, Glendora, CA 91740, 213-697-5067 ..... B•1143
§† Excel Technology Intl. Corp., Belle Mead, NJ 08502, 201-874-4747 .. B•1078-1079
§ Fujitsu of America, Santa Clara, CA 95054, 408-562-1000 ..... B•1080
Genstar Rental Electronics, Inc., Woodland Hills, CA 91367, 800-331-3440 (in CA);800-227-8409 ..... D•1277
Hamlin LCD, A Div. of Standish Inds., Lake Mills, WI 53551, 414-648-2315 ..... B•1081
Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1166
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1087
IVO Industries, Inc., Eatontown, NJ 07724, 201-542-5151;800-932-0489 .. B•1089
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... B•1869
MicroDimensions, Inc., Mentor, OH 44060, 216-974-8070 ..... B•1091
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1092
§ Optrex/Satori, Torrance, CA 90505, 213-378-9478 ..... B•1102-1104
Sam Sung Elctrn. Dvcs., America, Inc., La Mirada, CA 90638, 213-802-8425 ..... B•1106-1108
§ Seiko Instruments U.S.A., Inc., Components Div., Torrance, CA 90505, 213-517-7770 ..... B•1109
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1183
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... B•1120
VL Electronics, Inc., Varitronix LTD., Los Angeles, CA 90039, 213-661-8883 ..... B•1123
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1125
† Adage, Inc., Billerica, MA 01821 508-667-7070
† Alden Electronics, Inc., Westboro, MA 01581 508-366-8851
ASC Systems, St. Clair Shores, MI 48081 313-779-8700
† Aydin Corp., Horsham, PA 19044 215-657-7510
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5121
† Barrington Plastics, Mt. Laurel, NJ 08054 609-235-5151
§ Colorgraphic Communications Corp., Atlanta, GA 30366 404-455-3921
Colt Electronics Co., Inc., Lenexa, KS 66219 913-888-1673
§ Conrac Display Products, Inc., A Mark IV Industries Co., Duarte, CA 91010 818-303-0095
Crystaloid Electronics, Hudson, OH 44236 216-655-2429
Data Ray Corp., Broomfield, CO 80020 303-469-5173
§† Digital Electronics, Hayward, CA 94544-7831 415-471-4700
Digital Equip., Marlborough, MA 01752
Dotronix, New Brighton, MN 55112 612-633-1742
† Ferna Elctrns. Corp., E. Brunswick, NJ 08816 201-238-1223
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 312-884-1444
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
Hamlin, Lake Mills, WI 53551 414-648-2361
† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000
† Infodex, Inc., Wolcott, CT 06716 203-879-4944
Keltron Corp., Miniprinters Div., Waltham, MA 02154 617-894-8700
KMC Systems, Inc., Midland Pk, NJ 07432 201-447-0007
Matrox Electronic Systems, Ltd., Dorval, QU, CANADA H9P 2T4 514-685-2630
Mauell Corp., Dillsburg, PA 17019 717-432-8686
§ Metra Instruments, Inc., San Jose, CA 95131 408-432-1110
§ Mitsubishi Electronics, Torrance, CA 90502 213-217-5732
§ Noritake Co., Inc., Noritake Co., Limited (Japan), Torrance, CA 90505 213-373-6704
Raster Graphics, Inc., Bend, OR 97701 503-388-2584
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
† Systems Research Laboratories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
Taliq Corp., Sunnyvale, CA 94089 408-745-0750
† Tektronix, Inc., Beaverton, OR 97077 800-835-9433
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831

Displays, Graphic Systems-2000 — *See Vol. D*

Displays, Head Up (HUD)-2450

§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 312-884-1444
† Galileo Electro-Optics Corp., Sturbridge, MA 01566 508-347-9191
† Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
† Kaiser Electronics, Kaiser Aerospace & Elctrns., San Jose, CA 95134 ... 408-432-3000

Displays, Indicator Lights-2450

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1042
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... B•1073
† Electronics Research Associates Inc., Winsted, CT 06098, 203-379-2731 ..... B•1075
§ IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1087
† Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1167
§ Marktech International Corp., Menands, NY 12204, 518-436-5865 ... B•1172-1173
Sam Sung Elctrn. Dvcs., America, Inc., La Mirada, CA 90638, 213-802-8425 ..... B•1106-1108
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
Capitol Switch Inc., Danbury, CT 06810 203-744-3300
Communication Devices, Inc., Scarborough, Ont., CAN M1H3A4 416-439-6320
Crosspoint, Div. of Info-Lite, Fairview, NJ 07022 201-941-4455
§ Dreefs Switch, Inc., Waukegan, IL 60087 ..... 312-662-7667;800-323-9605
† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076

Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 415-347-8217
§† JKL Components Corporation, Pacoima, CA 91331 818-896-0019
† Korry Electronics Co., Criton Technologies, Seattle, WA 98109 206-281-1300
§† Ledco Div., St. Paul, MN 55107 612-222-2791
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459 203-283-8261
Mouser Electronics, Mansfield, TX 76063 800-346-6873
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
§ Rohm Corporation, Irvine, CA 92718 714-855-2131
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
§ Three-Five Sys., Inc., Phoenix, AZ 85201 602-496-0035
§† VCH Incorporated, Chicago Miniature, Buffalo Grove, IL 60089 312-459-3400
§† Wamco, Inc., Fountain Valley, CA 92708 714-545-5560
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Displays, Intelligent-2450

Applied Data Systems, Baltimore, MD 21202, 800-541-2003;301-576-0335 ..... B•1050
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1052
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... B•1072
Electronics Research Associates Inc., Winsted, CT 06098, 203-379-2731 ..... B•1075
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1087
§ Marktech International Corp., Menands, NY 12204, 518-436-5865 ... B•1172-1173
MicroDimensions, Inc., Mentor, OH 44060, 216-974-8070 ..... B•1091
VL Electronics, Inc., Varitronix LTD., Los Angeles, CA 90039, 213-661-8883 ..... B•1123
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Somerville, NJ 08876 201-359-4454
American Control Technology, Inc., West Dundee, IL 60118 312-426-6780
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5121
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
§ Colorgraphic Communications Corp., Atlanta, GA 30366 404-455-3921
Colt Electronics Co., Inc., Lenexa, KS 66219 913-888-1673
§ Corman Technologies Inc., Waterloo, Ontario, CANADA N2V 1N2 519-884-4430
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-564-3131
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
† Fema Elctrns. Corp., E. Brunswick, NJ 08816 201-238-1223
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 312-884-1444
† ISC Cardion Electronics, Inc., Woodbury, NY 11797 516-921-7300
Keltron Corp., Miniprinters Div., Waltham, MA 02154 617-894-8700
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
§ Krenz Electronic, Inc., San Clemente, CA 92672 714-361-6866
§ Optrex/Satori, Torrance, CA 90505 213-378-9478
Pacific Communications, Santa Ana, CA 92705 714-546-0147
§ Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
§† Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§ Three-Five Sys., Inc., Phoenix, AZ 85201 602-496-0035
UCE, Inc., Norwalk, CT 06854 203-838-7509

Displays, Laser-2450

† Laser Concepts, Omega Organization Intl., Seattle, WA 98133 206-364-7881

Displays, Light-emitting Diode (LED)-2450

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1042-1043
§ AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ... B•1049,1129
Canyon Elctrns., Phoenix, AZ 85021, 602-944-4421 ..... B•1051
Crouzet Controls, Inc., Schaumburg, IL 60173-5419, 312-843-2200 ..... B•1711
§ C-Tek Inc., Wakefield, MA 01880, 617-246-1720 ..... D•1142
DCI Inc., Olathe, KS 66061, 913-782-5672 ..... D•1380
Densitron Corporation, Densitron International, Torrance, CA 90505, 213-530-3530 ..... B•1062
§ Dialight Corp., A Cambridge Elctrns. Inds. Co., Manasquan, NJ 08736, 201-223-9400 ..... B•1065
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... B•1066-1068,1070-1071,1073
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... B•1732
§† Electronics Research Associates Inc., Winsted, CT 06098, 203-379-2731 ..... B•1075
§ Everlight - USA, Glendora, CA 91740, 213-697-5067 ..... B•1143
§ Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970 ..... B•1151
§ Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1086,1166
§† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1087
Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1158
§ Inter-Market, Glenview, IL 60025, 312-729-5330 ..... B•1178
§ IVO Industries, Inc., Eatontown, NJ 07724, 201-542-5151;800-932-0489 ..... B•1089, D•1148
† Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1167
§ Marktech International Corp., Menands, NY 12204, 518-436-5865 ... B•1172-1173
§† NES, Inc. (Nationwide Electronic Systems), Carpentersville, IL 60110, 312-426-5900 ..... B•1098, D•1153,1406-1407
§ Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914 ..... D•1412
Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794 ..... B•1827
Seiko Instruments U.S.A., Inc., Components Div., Torrance, CA 90505, 213-517-7770 ..... B•1109
Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA ..... B•1991-1992
§ Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1183
Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ... B•1188-1191,1193-1195
VL Electronics, Inc., Varitronix LTD., Los Angeles, CA 90039, 213-661-8883 ..... B•1123
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1125
§ A.C. Interface Inc., Irvine, CA 92718 714-472-9524
§ A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
Artisan Controls Corp., Parsippany, NJ 07054 201-428-1770
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Chrono-log Corp., Havertown, PA 19083 215-853-1130
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
Communication Devices, Inc., Scarborough, Ont., CAN M1H3A4 416-439-6320
§ Corman Technologies Inc., Waterloo, Ontario, CANADA N2V 1N2 519-884-4430
Digitec, Marion, OH 43302 614-387-3444
† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590 516-334-0870
§ Electrol Co., York, PA 17405 717-848-1722
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
§ Extech Instruments Corp., Waltham, MA 02154 617-890-7440
† Fema Elctrns. Corp., E. Brunswick, NJ 08816 201-238-1223
† Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Hughes Aircraft Co., Microelctrns. Sys. Div., Irvine, CA 92715 714-752-3800
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 415-347-8217
Keltron Corp., Miniprinters Div., Waltham, MA 02154 617-894-8700
† Korry Electronics Co., Criton Technologies, Seattle, WA 98109 206-281-1300
Ledco Div., St. Paul, MN 55107 612-222-2791
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Lumex Opto/Comps., Inc., Palatine, IL 60067 312-359-2790
Matrix Corp., Raleigh, NC 27610 919-833-2000
MicroDimensions, Inc., Mentor, OH 44060 216-974-8070
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459 203-283-8261
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ Paccom, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
† Pho-Tronics Div., E. R. Wagner Mfg. Co., Milwaukee, WI 53224 414-355-6704
§† Quality Technologies, Palo Alto, CA 93404 415-493-0400
§ Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
§ Rohm Corporation, Irvine, CA 92718 714-855-2131
Schroff Incorporated, Schroff GMBH, Warwick, RI 02886 401-732-3770
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
§ Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§ Texas Instrs., Inc., Dallas, TX 75380 ..... 800-232-3200 (ext 700)
§ Texas Instruments, Data/Image Sensing (Opto), Dallas, TX 75265 214-995-6611
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
Texmate, Inc., Solana Beach, CA 92075 619-481-7177
§ Thor Electronics, Linden, NJ 07036 201-486-3300
§ Three-Five Sys., Inc., Phoenix, AZ 85201 602-496-0035
§† VCH Incorporated, Chicago Miniature, Buffalo Grove, IL 60089 312-459-3400
§ Wamco, Inc., Fountain Valley, CA 92708 714-545-5560
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Displays, Lighted Segment-2450

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1043
§ AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1129
Canyon Elctrns., Phoenix, AZ 85021, 602-944-4421 ..... B•1051
Crouzet Controls, Inc., Schaumburg, IL 60173-5419, 312-843-2200 ..... B•1711
§ Dialight Corp., A Cambridge Elctrns. Inds. Co., Manasquan, NJ 08736, 201-223-9400 ..... B•1065
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 .. B•1066-1068,1073
† Electronics Research Associates Inc., Winsted, CT 06098, 203-379-2731 ..... B•1075
Everlight - USA, Glendora, CA 91740, 213-697-5067 ..... B•1143
Hamlin LCD, A Div. of Standish Inds., Lake Mills, WI 53551, 414-648-2315 ..... B•1081
Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1166
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1087
Inter-Market, Glenview, IL 60025, 312-729-5330 ..... B•1178
IVO Industries, Inc., Eatontown, NJ 07724, 201-542-5151;800-932-0489 .. B•1089
§† NES, Inc. (Nationwide Electronic Systems), Carpentersville, IL 60110, 312-426-5900 ..... B•1098

§ **Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757** ..... **B•1110-1111,1113,1345**
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... **B•1122**
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... **B•1118-1119**
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... **B•1125**
§ A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
American Control Technology, Inc., West Dundee, IL 60118 312-426-6780
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5121
Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 312-360-3500
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-564-3131
Densitron Corporation, Densitron International, Torrance, CA 90505 213-530-3530
§† Digital Electronics, Hayward, CA 94544-7831 415-471-4700
§† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
† EEV Inc., Elmsford, NY 10523 914-592-6050
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
† Fema Elctrns. Corp., E. Brunswick, NJ 08816 201-238-1223
Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 312-884-1444
Ghielmetti, Inc., Los Angeles, CA 90028-8770 213-463-5111
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
Hamlin, Lake Mills, WI 53551 414-648-2361
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 415-347-8217
§ JKL Components Corporation, Pacoima, CA 91331 818-896-0019
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459 203-283-8261
NEI Ferranti-Packard Electronics, Mississauga, Ont., CANADA L4W 2P1 416-624-3020
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
Shapiro Scientific Inst., Corona del Mar, CA 92625 714-675-1024
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Three-Five Sys., Inc., Phoenix, AZ 85201 602-496-0035
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
§† VCH Incorporated, Chicago Miniature, Buffalo Grove, IL 60089 312-459-3400
§† Wamco, Inc., Fountain Valley, CA 92708 714-545-5560

Displays, Liquid Crystal (LCD)-2450

§ **Amperex Electronic Company, A Div. of North American Philips Corporation, Slatersville, RI 02876, 401-762-3800** ..... **B•1046-1047**
§ **AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916** ..... **B•1048-1049**
Bonar Kard-O-Lite, Inc., King of Prussia, PA 19406, 215-277-2910 ..... **B•1132**
CBM America Corp., Santa Monica, CA 90404, 213-828-8245 ..... **D•1083**
C-Tek Inc., Wakefield, MA 01880, 617-246-1720 ..... **D•1142**
Data Ray Corp., Broomfield, CO 80020, 303-469-5173 ..... **B•1058-1060**
† **DCI Inc., Olathe, KS 66061, 913-782-5672** ..... **B•1061**
§† **Electronics Research Associates Inc., Winsted, CT 06098, 203-379-2731** ..... **B•1075**
§† **Excel Technology Intl. Corp., Belle Mead, NJ 08502, 201-874-4747** ..... **B•1078-1079**
§ **Hamlin LCD, A Div. of Standish Inds., Lake Mills, WI 53551, 414-648-2315** ..... **B•1081**
§ **Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173, 312-517-1144** ..... **B•1082-1084**
† **IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311** ..... **B•1087**
§† **NES, Inc. (Nationwide Electronic Systems), Carpentersville, IL 60110, 312-426-5900** ..... **B•1098, D•1153**
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914** ..... **D•1412**
† **Ocular Inc., Richardson, TX 75080, 214-437-2561** ..... **B•1099-1101**
§ **Optrex/Satori, Torrance, CA 90505, 213-378-9478** ..... **B•1102-1104**
§ **Seiko Instruments U.S.A., Inc., Components Div., Torrance, CA 90505, 213-517-7770** ..... **B•1109**
Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA ..... **B•1991-1992**
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... **B•1110-1111,1113-1116,1345**
§ **Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850** ..... **B•1122**
VL Electronics, Inc., Varitronix LTD., Los Angeles, CA 90039, 213-661-8883 ..... **B•1123**
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... **B•1125**
§ A.C. Interface Inc., Irvine, CA 92718 714-472-9524
§ Action Instruments, San Diego, CA 92123 619-279-5726
A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Communication Devices, Inc., Scarborough, Ont., CAN M1H3A4 416-439-6320
Computerwise, Olathe, KS 66062 913-829-0600
Crystaloid Electronics, Hudson, OH 44236 216-655-2429
§† Densitron Corporation, Densitron International, Torrance, CA 90505 213-530-3530
Displaytech, Inc., Boulder, CO 80301 303-449-8933
† EEV Inc., Elmsford, NY 10523 914-592-6050
Elform, Inc., Reno, NV 89510 702-356-1734
Endicott Research Group, Endicott, NY 13760 607-754-9187
§ Epson America, Inc./OEM Div., Torrance, CA 90505 213-534-4500
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
§ Extech Instruments Corp., Waltham, MA 02154 617-890-7440
† Fema Elctrns. Corp., E. Brunswick, NJ 08816 201-238-1223
Hamlin, Lake Mills, WI 53551 414-648-2361
Hitachi America, Ltd., San Jose, CA 95131 408-435-8300
† Hughes Aircraft Co., Microelctrns. Sys. Div., Irvine, CA 92715 714-752-3800
International Instrumentation, Inc., Westlake Vlg., CA 91361 805-495-7673
Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
§ LXD, Inc., Beachwood, OH 44122 216-292-3300
Melfess Five, Inc., Los Angeles, CA 90025 ..... 213-826-8133;800-533-2297
MFI, Los Angeles, CA 90025 ..... 213-826-8133;800-533-2297
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Philips Electronics Ltd, Philips Comps., Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Sam Sung Elctrn. Dvcs., America, Inc., La Mirada, CA 90638 213-802-8425
Shapiro Scientific Inst., Corona del Mar, CA 92625 714-675-1024
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
Supertek Electronics, Inc., Arlington Heights, IL 60005 312-981-5655
Taliq Corp., Sunnyvale, CA 94089 408-745-0750
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Texmate, Inc., Solana Beach, CA 92075 619-481-7177
§ Thor Electronics, Linden, NJ 07036 201-486-3300
§ Three-Five Sys., Inc., Phoenix, AZ 85201 602-496-0035
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
† UCE, Inc., Norwalk, CT 06854 203-838-7509

Displays, LCD, Sheets-2450

AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... **B•1049**
Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173, 312-517-1144 ..... **B•1082-1084**
Ocular Inc., Richardson, TX 75080, 214-437-2561 ..... **B•1099-1101**
VL Electronics, Inc., Varitronix LTD., Los Angeles, CA 90039, 213-661-8883 ..... **B•1123**
† Fema Elctrns. Corp., E. Brunswick, NJ 08816 201-238-1223
§ Optrex/Satori, Torrance, CA 90505 213-378-9478
Supertek Electronics, Inc., Arlington Heights, IL 60005 312-981-5655

Displays, Message-2450

AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... **B•1129**
Crosspoint, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... **B•1709**
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... **B•1070,1072-1073**
Fujitsu of America, Santa Clara, CA 95054, 408-562-1000 ..... **B•1080**
Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173, 312-517-1144 ..... **B•1082-1084**
Idea, Inc., Brea, CA 92621, 213-697-4332 ..... **B•1166**
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... **B•1869**
MicroDimensions, Inc., Mentor, OH 44060, 216-974-8070 ..... **B•1091**
§† **NES, Inc. (Nationwide Electronic Systems), Carpentersville, IL 60110, 312-426-5900** ..... **D•1153,1406-1410**
Ocular Inc., Richardson, TX 75080, 214-437-2561 ..... **B•1099-1101**
Optrex/Satori, Torrance, CA 90505, 213-378-9478 ..... **B•1102-1104**
Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... **B•1122**
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... **B•1120-1121**
American Control Technology, Inc., West Dundee, IL 60118 312-426-6780
† Aydin Corp., Horsham, PA 19044 215-657-7510
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5121
Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 312-360-3500
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
Colt Electronics Co., Inc., Lenexa, KS 66219 913-888-1673
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-564-3131
† DCI Inc., Olathe, KS 66061 913-782-5672
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 312-884-1444
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
NEI Ferranti-Packard Electronics, Mississauga, Ont., CANADA L4W 2P1 416-624-3020
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
† Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
§ Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430 201-529-8757
Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Telegenix, Inc., Div. of Inductotherm Industries, Cherry Hill, NJ 08034 609-424-5220
† UCE, Inc., Norwalk, CT 06854 203-838-7509
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Displays, Multifunction-2450

C-Tek Inc., Wakefield, MA 01880, 617-246-1720 ..... **D•1142-1143**
Fujitsu of America, Santa Clara, CA 95054, 408-562-1000 ..... **B•1080**
Hitachi America, Ltd., Electron Tube Division, Schaumburg, IL 60173, 312-517-1144 ..... **B•1082-1084**
Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... **B•1167**
Ocular Inc., Richardson, TX 75080, 214-437-2561 ..... **B•1099-1101**
Optrex/Satori, Torrance, CA 90505, 213-378-9478 ..... **B•1102-1104**
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... **B•1125**
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Altech Corp., Somerville, NJ 08876 201-359-4454
American Control Technology, Inc., West Dundee, IL 60118 312-426-6780
Capitol Switch Inc., Danbury, CT 06810 203-744-3300
Colt Electronics Co., Inc., Lenexa, KS 66219 913-888-1673
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-564-3131
† Kaiser Electronics, Kaiser Aerospace & Elctrns., San Jose, CA 95134 408-432-3000
Taliq Corp., Sunnyvale, CA 94089 408-745-0750

Displays, Planar Gas Discharge-2450

Canyon Elctrns., Phoenix, AZ 85021, 602-944-4421 ..... B•1051
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5121
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-564-3131
§ Densitron Corporation, Densitron International, Torrance, CA 90505 213-530-3530
† Displays, Inc., Lewistown, PA 17044 717-242-2541
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
§† Interstate Electronics Corp., Anaheim, CA 92803 714-758-0500
† Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132

Displays, Plasma-2450

§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1052
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-564-3131 ..... B•1055-1057
§† Densitron Corporation, Densitron International, Torrance, CA 90505, 213-530-3530 ..... B•1063
Endicott Research Group, Endicott, NY 13760, 607-754-9187 ..... B•1076
§ Fujitsu of America, Santa Clara, CA 95054, 408-562-1000 ..... B•1080
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1087
World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1125
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5121
Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 312-884-1444
† Librascope Corporation, A Subsidiary of the Singer Co., Glendale, CA 91201 818-244-6541
† Miltope Corp., Melville, NY 11747 516-420-0200
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
† Orbit Instrument of Cal., Cypress, CA 90630 714-527-0561
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
Telegenix, Inc., Div. of Inductotherm Industries, Cherry Hill, NJ 08034 ... 609-424-5220

Displays, Programmable-2450

AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1048
§ Chrono-log Corp., Havertown, PA 19083, 215-853-1130 ..... D•1084
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... B•1066-1067,1072-1073
MicroDimensions, Inc., Mentor, OH 44060, 216-974-8070 ..... B•1091
NES, Inc. (Nationwide Electronic Systems), Carpentersville, IL 60110, 312-426-5900 ..... B•1098
Seiko Instruments U.S.A., Inc., Components Div., Torrance, CA 90505, 213-517-7770 ..... B•1109
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Somerville, NJ 08876 201-359-4454
American Control Technology, Inc., West Dundee, IL 60118 312-426-6780
† Aydin Corp., Horsham, PA 19044 215-657-7510
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5121
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 312-360-3500
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
Colt Electronics Co., Inc., Lenexa, KS 66219 913-888-1673
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-564-3131
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 312-884-1444
§ ITT Gilfillan, ITT Corp., Van Nuys, CA 91409 818-988-2600
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
Matrox Electronic Systems, Ltd., Dorval, QU, CANADA H9P 2T4 514-685-2630
Omega Engineering, Stamford, CT 06907 800-826-6342
§† Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
§ Three-Five Sys., Inc., Phoenix, AZ 85201 602-496-0035

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§ Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1110-1111,1113
Aydin Corp., Horsham, PA 19044 215-657-7510
† Devco Engineering, Fairfield, NJ 07006 ..... 201-CA8-0321
Dotronix, New Brighton, MN 55112 612-633-1742
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009 ... 619-931-3000
Hughes Aircraft Co., Microelctrns. Sys. Div., Irvine, CA 92715 714-752-3800
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
† Librascope Corporation, A Subsidiary of the Singer Co., Glendale, CA 91201 818-244-6541
Mitsubishi Electronics, Torrance, CA 90502 213-217-5732
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
† Orbit Instrument of Cal., Cypress, CA 90630 714-527-0561
Shapiro Scientific Inst., Corona del Mar, CA 92625 714-675-1024
§† Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
† Terminal Data Corp., Rockville, MD 20855 301-921-8282
† UCE, Inc., Norwalk, CT 06854 203-838-7509

Displays, Remote-2450

Applied Data Systems, Baltimore, MD 21202, 800-541-2003;301-576-0335 ..... B•1050
† DCI Inc., Olathe, KS 66061, 913-782-5672 ..... D•1380
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... B•1072
§ Electro-Numerics, Inc., Irvine, CA 92714, 714-250-1501 ..... D•1391
§ IVO Industries, Inc., Eatontown, NJ 07724, 201-542-5151;800-932-0489 ..... B•1089, D•1148
§† NES, Inc. (Nationwide Electronic Systems), Carpentersville, IL 60110, 312-426-5900 ..... B•1098, D•1153,1406-1411
Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914 .... D•1412-1413
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... B•1117-1121
§ Action Instruments, San Diego, CA 92123 619-279-5726
Adams-Russell, Inc., Hunt Valley, MD 21030 301-771-0077
§ Altech Corp., Somerville, NJ 08876 201-359-4454
Austron, Inc., Austin, TX 78761-4766 512-251-2341
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5121
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Chrono-log Corp., Havertown, PA 19083 215-853-1130
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
§ Colorgraphic Communications Corp., Atlanta, GA 30366 404-455-3921
Colt Electronics Co., Inc., Lenexa, KS 66219 913-888-1673
C-Tek Inc., Wakefield, MA 01880 617-246-1720
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-564-3131
Datachron Inc., Anaheim, CA 92805 714-385-1705
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
§† Excel Technology Intl. Corp., Belle Mead, NJ 08502 201-874-4747
† Infodex, Inc., Wolcott, CT 06716 203-879-4944
Inter-Market, Glenview, IL 60025 312-729-5330
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
KMC Systems, Inc., Midland Pk, NJ 07432 201-447-0007
§ LFE, Instruments Div., Clinton, MA 01510-3099 508-835-1000
Systems Data, Inc., Akron, OH 44321 216-666-0085
† UCE, Inc., Norwalk, CT 06854 203-838-7509
§ Vidco, Inc., Beaverton, OR 97005 503-641-1804

Displays, Status-2450

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1042
§ Amperex Electronic Company, A Div. of North American Philips Corporation, Slatersville, RI 02876, 401-762-3800 ..... B•1047
C-Tek Inc., Wakefield, MA 01880, 617-246-1720 ..... D•1142-1143
§ Dialight Corp., A Cambridge Elctrns. Inds. Co., Manasquan, NJ 08736, 201-223-9400 ..... B•1065
† Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... B•1073
Electro-Numerics, Inc., Irvine, CA 92714, 714-250-1501 ..... D•1391
§ IVO Industries, Inc., Eatontown, NJ 07724, 201-542-5151;800-932-0489 .. B•1089
MicroDimensions, Inc., Mentor, OH 44060, 216-974-8070 ..... B•1091
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261 .. B•1175
§† NES, Inc. (Nationwide Electronic Systems), Carpentersville, IL 60110, 312-426-5900 ..... D•1153,1406-1411
Sam Sung Elctrn. Dvcs., America, Inc., La Mirada, CA 90638, 213-802-8425 ..... B•1106-1108
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1345
§† Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... B•1117-1121
§ A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
§ Altech Corp., Somerville, NJ 08876 201-359-4454
ASC Systems, St. Clair Shores, MI 48081 313-779-8700
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5121
Canyon Elctrns., Phoenix, AZ 85021 602-944-4421
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
Colt Electronics Co., Inc., Lenexa, KS 66219 913-888-1673
Datum Inc., Timing/Aacom Divisions, Anaheim, CA 92806-5790 714-533-6333
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
† DCI Inc., Olathe, KS 66061 913-782-5672
Display Devices, Inc., Encinitas, CA 92024 619-753-0113
Hughes Aircraft Co., Microelctrns. Sys. Div., Irvine, CA 92715 714-752-3800
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
† Infodex, Inc., Wolcott, CT 06716 203-879-4944
† ISC Cardion Electronics, Inc., Woodbury, NY 11797 516-921-7300
§ JKL Components Corporation, Pacoima, CA 91331 818-896-0019
Keltron Corp., Miniprinters Div., Waltham, MA 02154 617-894-8700
KMC Systems, Inc., Midland Pk, NJ 07432 201-447-0007
§ Mitsubishi Electronics, Torrance, CA 90502 213-217-5732
NEI Ferranti-Packard Electronics, Mississauga, Ont., CANADA L4W 2P1 416-624-3020
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
† Quantum Electronics, Inc., Lewistown, PA 17044 717-242-1132
Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000
§† Sorenson Lighted Controls, Hartford, CT 06114 ..... 203-527-3092;1-800-243-0240
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§ Three-Five Sys., Inc., Phoenix, AZ 85201 602-496-0035
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
† UCE, Inc., Norwalk, CT 06854 203-838-7509
§ Vidco, Inc., Beaverton, OR 97005 503-641-1804

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Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1166
§† NES, Inc. (Nationwide Electronic Systems), Carpentersville, IL 60110, 312-426-5900 ..... B•1098
† Barrington Plastics, Mt. Laurel, NJ 08054 609-235-5151
† Data Check Corporation, San Diego, CA 92126 619-578-0101
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022 201-941-4455

§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 312-884-1444
† Metron Optics Inc., Solana Beach, CA 92075-0690 619-755-4477
NEI Ferranti-Packard Electronics, Mississauga, Ont., CANADA L4W 2P1 416-624-3020

Displays, Touch Sensitive (Infrared & Mechanical) — See Touch Monitors (Vol. D), Touch Panels (Vol. D), Touch Terminals (Vol. D)

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Displays, Vacuum Fluorescent-2450

§† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405, 818-787-0311 ..... B•1087
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 .... B•1092-1093
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5121
Comark Corp., Medfield, MA 02052 508-359-8161
Densitron Corporation, Densitron International, Torrance, CA 90505 213-530-3530
§† Digital Electronics, Hayward, CA 94544-7831 415-471-4700
§† Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 312-884-1444
§ Noritake Co., Inc., Noritake Co., Limited (Japan), Torrance, CA 90505 213-373-6704
Varo Electron Devices:An Imo Inds. Co., Garland, TX 75046 214-487-4129

Display Sets (MIL), Computer-2440

Intronics, Inc., Newton, MA 02158, 617-964-4000 ..... B•1018
Control Displays, Inc., Colmar, PA 18915 215-822-3383
C-Tek Inc., Wakefield, MA 01880 617-246-1720
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
† Librascope Corporation, A Subsidiary of the Singer Co., Glendale, CA 91201 818-244-6541
† Miltope Corp., Melville, NY 11747 516-420-0200
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
† Plessey Electronic Systems Corp., Wayne, NJ 07470 201-633-6000

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Distortion Correction, CRT-2450

Intronics, Inc., Newton, MA 02158 617-964-4000

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Dividers, Frequency-3450 — *See Vol. A*

Dividers, Power (LF, HF, VHF, UHF)-3450 — *See Vol. A*

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Drawers, Sliding-1400 — *See Vol. C*

Drills & Accessories, Manual & Power-5400 — *See Vol. C*

Drivers & Decoders For Readouts-2450

§ Dialight Corp., A Cambridge Elctrns. Inds. Co., Manasquan, NJ 08736, 201-223-9400 ..... B•1065
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 .. B•1068-1071,1073
§† Electronics Research Associates Inc., Winsted, CT 06098, 203-379-2731 ..... B•1075
Orbit Instrument of Cal., Cypress, CA 90630, 714-527-0561 ..... D•1155
Philips ECG, American Philips Co., Waltham, MA 02254, 617-890-6107 .. A•2197
§ ALTEK Corporation, Silver Springs, MD 20904-7802 301-572-2555
AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5121
§ C-Tek Inc., Wakefield, MA 01880 617-246-1720
CTS Corporation, Microelectronics Div., W. Lafayette, IN 47906 317-463-2565
† Dionics, Westbury, NY 11590 516-997-7474
† Exar Corp., San Jose, CA 95161-9007 408-732-7970
§† General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
§ LSI Computer Systems, Inc., Melville, NY 11747 516-271-0400
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
NEI Ferranti-Packard Electronics, Mississauga, Ont., CANADA L4W 2P1 416-624-3020
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
§† Teledyne Semiconductor, Mountain View, CA 94039-7267 415-968-9241
† UCE, Inc., Norwalk, CT 06854 203-838-7509
§ Wilson, H. F., Engineering Co., Glen Ellyn, IL 60137 312-469-8473

Drivers, Chopper-1100 — *See Vol. D*

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Drivers, Solenoid-4550

† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... B•1615
§† Antex Electronics Corp., Gardena, CA 90248 213-532-3092
† Circuit Technology Inc., Farmingdale, NY 11735 516-293-8686
† Dionics, Westbury, NY 11590 516-997-7474
† Linear Motions Co., Valinda, CA 91744 818-918-7806
§ MKC Electronics Corp., Overland Park, KS 66215 913-894-9711
§ Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
§† Silicon General, Garden Grove, CA 92641 714-898-8121
Teledyne Semiconductor, Mountain View, CA 94039-7267 415-968-9241
Voltex, Amityville, NY 11701 516-842-2772

Drivers, Speaker-1300 — *See Vol. D*

Drivers, Surface Mount-1100 — *See Vol. D*

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Drives/Subsystems, Magnetic Tape, Reel-to-Reel-2000 — *See Vol. D*

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Dummy Loads, Power-2900 — *See Vol. D*

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Dummy Loads, Resistive-2900 — *See Vol. D*

Dummy Loads (MIL), RF-2440

† Alan Industries Inc., Columbus, IN 47201 812-372-8869
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
† Antenna Specialists, The Allen Group, Cleveland, OH 44139 216-349-8400
§† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† Compac, Holbrook, NY 11741 516-585-3400
† Electro Impulse, Red Bank, NJ 07701-0870 201-741-0404
Electronic Systems Div., Servo Corp. of America, Hicksville, NY 11802 .. 516-938-9700
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§† M/A-COM Omni Spectra, Inc., Merrimack, NH 03054 603-424-4111
† NH Research, Incorporated, Instrumentation Products Division, Irvine, CA 92714 714-474-3900
Pasternack Enterprises, Irvine, CA 92713 714-261-1920
† Trompter Electronics, Inc., Sterling Holding, Westlake Village, CA 91359-5069 818-707-2020
Varian, Continental Electronics Division, Dallas, TX 75227 214-381-7161

Duplexers, Microwave-3400 — *See Vol. D*

Duplexers, Nonmicrowave-1900 — *See Vol. D*

Duplicators, Magnetic Tape-1300 — *See Vol. D*

Dust Covers — See Covers, Protective (Vol. C)

DVMs — See Meters, Volt, Digital (Vol. D)

Earphones — See Headphones (Vol. D)

Earth Stations, TV, Receive Only-1900 — *See Vol. D*

Earth Stations; TV, Receive/Transmit-1900 — *See Vol. D*

Edge Clips, Surface Mount-2500 — *See Vol. C*

Edge Connectors, Surface Mount-2100 — *See Vol. C*

Editing Equipment, Tape-1300 — *See Vol. D*

Ejectors & Extractors, PC Boards — See Pullers, Circuit Board (Vol. C)

Elastomers, Conductive — See Conductive Elastomers (Vol. C)

Elastomers, Heat Shrinkable — See Caps, Forms & Tapes, Heat Shrinkable (Vol. C)

Electret — See Microphones, Condenser (Vol. D)

Electrical Measurement & Test Services — See Services, Electrical Measurement & Test (Vol. D)

Electrodes, Electroplating — See Electroplating Equipment & Supplies (Vol. D)

Electrodes, High Voltage-2900 — *See Vol. D*

Electromagnets-1850 — *See Vol. A*

Electronic Counter Countermeasures (ECCM) Fixes (MIL)-2440

† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
† Cincinnati Elctrns., Cincinnati, OH 45241 513-733-6100
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
New Wave Instruments, Provo, UT 84604 801-373-4909
† Optical & Conductive Coatings, Meridian Inds., Inc., Pacheco, CA 94553 415-798-6066
† Signatron, A Unit of Sundstrand Corp., Lexington, MA 02173 617-861-1500
ST Research Corporation, Newington, VA 22122 703-550-7000

Electronic Countermeasures (ECM) (MIL), Cruise Missiles-2440

† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951

ECM Sets (MIL)-2440

† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
American Electronic Laboratories, Inc., Lansdale, PA 19446 215-822-2929
§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Signatron, A Unit of Sundstrand Corp., Lexington, MA 02173 617-861-1500
ST Research Corporation, Newington, VA 22122 703-550-7000
† Systems Research Laboratories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
† Tracor Flight Systems, Inc., Tracor, Inc., A Westmark Co., Santa Ana, CA 92705 714-662-0333

ECM Systems (MIL)-2440

† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
† American Electronic Laboratories, Inc., Lansdale, PA 19446 215-822-2929
§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† E-Systems, Greenville Div., Greenville, TX 75401 214-455-3450
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
† Systems Research Laboratories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
† Tracor Flight Systems, Inc., Tracor, Inc., A Westmark Co., Santa Ana, CA 92705 714-662-0333
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

ECM Systems (MIL), Deceptive-2440

† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
American Electronic Laboratories, Inc., Lansdale, PA 19446 215-822-2929
† Aydin Corp., Horsham, PA 19044 215-657-7510
§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
† Systems Research Laboratories, Arvin/Calspan, Dayton, OH 45440 513-426-6000

Electronic Intelligence (Elint) (MIL)-2440

Adams-Russell, Inc., Hunt Valley, MD 21030 301-771-0077
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
† American Electronic Laboratories, Inc., Lansdale, PA 19446 215-822-2929
§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
† Condor Systems, Inc., San Jose, CA 95124 408-371-9580
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ..... 214-470-2106/2107
† E-Systems, Greenville Div., Greenville, TX 75401 214-455-3450
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
New Wave Instruments, Provo, UT 84604 801-373-4909
† Sanders/A Lockheed Co. Div. Microwave Technlg. Ctr., Manchester, NH 03108 ..... 603-645-6000 X 5548
† SCOPE Incorporated, Reston, VA 22090 703-471-5600
ST Research Corporation, Newington, VA 22122 703-550-7000
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Electronic Loads — See Dummy Loads (Vol. D)

Electronic Support Measures (ESM) Sets (MIL)-2440

† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
American Electronic Laboratories, Inc., Lansdale, PA 19446 215-822-2929
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† E-Systems, Melpar Div., Falls Church, VA 22046 703-560-5000
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
GTE Government Systems Corp., Mountain View, CA 94039 415-966-2000
† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
ST Research Corporation, Newington, VA 22122 703-550-7000
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Electronic Warfare (EW) Sets (MIL)-2440

† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
† American Electronic Laboratories, Inc., Lansdale, PA 19446 215-822-2929
§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Lockheed Electronics Co., Inc., Lockheed Corporation, Plainfield, NJ 07061 201-757-1600
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
† Plessey Electronic Systems Corp., Wayne, NJ 07470 201-633-6000
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
Republic Electronics Co., Hauppauge, NY 11788 516-273-9800
† SCOPE Incorporated, Reston, VA 22090 703-471-5600
† Signatron, A Unit of Sundstrand Corp., Lexington, MA 02173 617-861-1500
ST Research Corporation, Newington, VA 22122 703-550-7000
† Systems Research Laboratories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
† Tracor Flight Systems, Inc., Tracor, Inc., A Westmark Co., Santa Ana, CA 92705 714-662-0333

Electroplating Equipment & Supplies-4100 — *See Vol. D*

Electrostatic Discharge Guns - Also See Generators, ESD-2900 — *See Vol. D*

Electrostatic Discharge (MIL)-2440

§† NRD Inc., Subsidiary of Mark IV Inds., Inc., Grand Island, NY 14072, 716-773-7634 ..... D•2244
Schaffner EMC, Inc., Instr. Div., Union, NJ 07083, 201-851-0644;800-367-5566 ..... D•1343
§† ACL Inc., Elk Grove, IL 60007 ..... 312-981-9212;800-STATIC-0
§† Electro-Metrics, Penril Corp., Amsterdam, NY 12010 518-843-2600
Greenwich Instruments USA, Charlotte, NC 28205 704-376-7805
† KeyTek Instrument Corp., Wilmington, MA 01887 508-658-0880
Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
§ Semtronics Corp., Peachtree City, GA 30269 404-487-6681
Simco Co., Hatfield, PA 19440 215-822-2171
§† Stackbin Corp., Lincoln, RI 02865 ..... 401-333-1600;800-333-1603

Elements, Sensing — See Transducers (Vol. B)

Eliminators, Battery — See Power Supplies, AC to DC Adapter (Vol. D)

Emitter Location & Identification System (MIL), Automatic Ground Transportable-2440

† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000
† Signatron, A Unit of Sundstrand Corp., Lexington, MA 02173 617-861-1500
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Emitters/Detectors, Infrared-3700

Amperex Electronic Company, A Div. of North American Philips Corporation, Slatersville, RI 02876, 401-762-3800 ..... B•1317-1318
Philips ECG, American Philips Co., Waltham, MA 02254, 617-890-6107 .. A•2197
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1882
§ Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1345-1346
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
† Analog Modules, Inc., Longwood, FL 32750 407-339-4355
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164

† DBA Systems, Inc., Melbourne, FL 32902-0550 305-727-0660
§ Everlight - USA, Glendora, CA 91740 213-697-5067
§ General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ Idea, Inc., Brea, CA 92621 213-697-4332
† Ledco Div., St. Paul, MN 55107 612-222-2791
† Ledtronics, Inc., Torrance, CA 90505 213-549-9995
§ MERET, Inc., Santa Monica, CA 90404-4998 213-828-7496
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§† Motorola Semiconductor Prods. Sector, Phoenix, AZ 85018-6606 602-244-6900
§ Optek Technology Inc., McKinney, TX 75069 214-542-9461
§ Opto Technology, Inc., Wheeling, IL 60090 312-537-4277
Ortel Corp., Alhambra, CA 91803 818-281-3636
Philips Electronics Ltd, Philips Comps., Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§ Rohm Corporation, Irvine, CA 92718 714-855-2131
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
Zexco, Van Nuys, CA 91401 818-997-7895

Emitters, Fiber Optic-Also See Diodes, Laser-2475

§† MERET, Inc., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1215
§ A.C. Interface Inc., Irvine, CA 92718 714-472-9524
A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
Fibronics International Inc., Communications Way, Hyannis, MA 02601-1892 508-778-0700
General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Hitachi America, Ltd., San Jose, CA 95131 408-435-8300
§ Honeywell Optoelectronics, Richardson, TX 75081 214-470-4271
† Math Assocs., Westbury, NY 11590 516-334-6800
§† Motorola Semiconductor Prods. Sector, Phoenix, AZ 85018-6606 602-244-6900
§† Optek Technology Inc., McKinney, TX 75069 214-542-9461
Opto Technology, Inc., Wheeling, IL 60090 312-537-4277
Ortel Corp., Alhambra, CA 91803 818-281-3636
Rehlander Assocs., Beverly, MA 01915 617-922-5961
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
Thomson Electron Tubes & Devices Corp., Special Products Div., Dover, NJ 07801 201-328-1400
Zexco, Van Nuys, CA 91401 818-997-7895

Emulators, In-circuit-2900 — ***See Vol. D***

Emulators, RTS-2900 — ***See Vol. D***

Emulators, Terminal-2900 — ***See Vol. D***

Encapsulating Materials — See Compounds, Encapsulating, Molding, Potting (Vol. C)

Encapsulation Services — See Services, Encapsulation (Vol. D)

Enclosures, Circuit Board, Module, & Relay Mounting-1400 — ***See Vol. C***

Enclosures, CRT — See Mounts CRT (Vol. C)

Enclosures, Equipment & Panel Mounting-1400 — ***See Vol. C***

Enclosures, Instrument, With Integral Connectors-1400 — ***See Vol. C***

Enclosures, Keyboard-1400 — ***See Vol. C***

Enclosures, Nonmetallic-1400 — ***See Vol. C***

Enclosures, Portable, Metallic & Nonmetallic-1400 — ***See Vol. C***

Enclosures, Power Distribution-1400 — ***See Vol. C***

Enclosures, Shielded-1400 — ***See Vol. C***

Enclosures, Shipping, Metallic & Nonmetallic-1400 — ***See Vol. C***

Enclosures, (MIL)-2440

Amco Engineering, Schiller Pk., IL 60176, 312-671-6670;800-833-3156 ..... C•1008-1009
Cabtron Systems, Inc., Northbrook, IL 60062, 312-498-6090 ..... C•1014
Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820, 603-742-1120,800-872-0042 ..... B•1940
† Compac, Holbrook, NY 11741, 516-585-3400 ..... C•1016-1017
ECS Composites, Grants Pass, OR 97526, 503-476-8871 ..... C•1022-1023
EG & G Birtcher, EG & G, Inc., El Monte, CA 91734-1268, 818-442-2572 ..... C•1024-1025
† Electronic Enclosures, Div. Wyle Labs, El Segundo, CA 90245, 213-643-8181 ..... C•1027
† Equipto Electronics Corp., Aurora, IL 60506, 312-897-4691 ..... C•1040
† Gemini, Cannon Falls, MN 55009, 507-263-3957;800-533-3631 ..... C•1055
† Optima Enclosures, Tucker, GA 30084-5088, 404-496-4000 ..... C•1062
Par Metal Products, Inc., Brooklyn, NY 11216, 718-774-5900 ..... C•1076
Rantec Division, Emerson Electric Co., Los Osos, CA 93402, 805-528-5858 ..... D•2034,2036
† Skydyne Div. of AAR, Brooks & Perkins, Port Jervis, NY 12771, 914-856-6655;800-428-CASE ..... C•1095-1096
TDJ Co., Inc., San Diego, CA 92110, 619-276-5920 ..... C•1102-1103
Zero Corp., Burbank, CA 90503, 818-846-4191 ..... C•1122
ADE, Inc., Chicago, IL 60633 312-646-3400
A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
Anvil Cases, Inc., Rosemead, CA 91770 ..... 818-575-8614;800-242-4466; 800-423-4279(outside CA)
† Ark Elctrns. Corp., Southampton, PA 18966 215-322-6510
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
Emcor Products, Crenlo, Inc., Rochester, MN 55901 507-289-3371
† General Devices Co., Inc., Indianapolis, IN 46239-9632 317-897-7000
† Hoffman Engineering, Anoka, MN 55303 612-421-2240
† Hudson Industries, Hudson, NH 03051 603-880-7712
† Instrument Enclosures, Sun Valley, CA 91352 818-768-4622
† Langley:Fleet Aerospace, Inc., San Diego, CA 92112 619-264-3181
Mini-Systems, Inc., Electronic Package Div., Plainville, MA 02762 508-695-2000
Rose Enclosures Sys., Inc., Frederick, MD 21701 301-696-9800
† STRONGBOX, Culver City, CA 90231-2726 213-305-8288
† Trilobyte Computer Corporation, San Leandro, CA 94577 415-895-1100

Encoders, Digital — See Encoders, Shaft Angle (Vol. B)

Encoders, Displacement, Linear-5500

Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042, 516-488-6700 ..... B•1938
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910, 818-882-0424 ..... B•1942
Eltrol Corporation, Canoga Park, CA 91304, 818-709-0131 ..... B•1241
Enprotech Corp., Kalamazoo, MI 49007, 616-381-0665 ..... B•1953
† Itek Encoder, Newton, MA 02161-1953, 617-969-7300 ..... B•1960-1961
Orbit Instrument of Cal., Cypress, CA 90630, 714-527-0561 ..... D•1155
† Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ..... D•1203-1205
U. S. Digital Corp., Los Alamitos, CA 90720, 213-594-0094 ..... B•1997
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... B•1037
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
Astrosystems, Lake Success, NY 11042 516-328-1600
Burleigh Instruments, Fishers, NY 14453 716-924-9355
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
C-Tek Inc., Wakefield, MA 01880 617-246-1720
Dynamics Research Corp., Encoder Division, Wilmington, MA 01887-2193 508-658-6100
† Farrand Controls, Div. of Farrand Industries, Inc., Valhalla, NY 10595 914-761-2600
† Force, Inc., Christiansburg, VA 24073 703-382-0462
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
§ Honeywell Optoelectronics, Richardson, TX 75081 214-470-4271
§ JMR Electronics, Bronx, NY 10461 212-597-6050
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
Perfect Gear & Instrument, Designatronics, Inc., New Hyde Park, NY 11040 516-328-3300
§ Photoswitch Div., Allen Bradley Co., Waltham, MA 02154 617-466-8000
† Teledyne Gurley, Troy, NY 12181 518-272-6300
§ Temposonics, MTS Sys. Corp., Plainview, NY 11803 516-349-1950
Transducer Systems, Inc., Kulpsville, PA 19443 215-256-4611
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778 508-358-2777

Encoders, Fiber Optic-2475

† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910, 818-882-0424 ..... B•1942
Eltrol Corporation, Canoga Park, CA 91304, 818-709-0131 ..... B•1241
Fiberoptic Systems, Inc., Simi Valley, CA 93063, 805-583-2088 ..... B•1205
† Hathaway Corporation:Motion Control Div., Tulsa, OK 74116, 918-438-7800 ..... B•1253
† Litton Encoder Div., Chatsworth, CA 91311, 818-341-6161 ..... B•1963
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601 ..... B•1295-1296
Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507, 312-844-4300 ..... B•1842-1843
§† APEC Fiber Optics Corp., College Station, TX 77840 409-693-5397
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
§ JMR Electronics, Bronx, NY 10461 212-597-6050
§ 3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
Silicon Detector Corp., Camarillo, CA 93010 805-484-2884
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400

Encoders, Magnetic Strip-5500

Litton Encoder Div., Chatsworth, CA 91311, 818-341-6161 ..... B•1963
§ Xico, Inc., Chatsworth, CA 91311, 818-709-4403 ..... D•1117
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018 215-622-1000
Elcom Industries, Inc., St. Louis, MO 63132 314-429-3100
§ Identatronics, Inc., Elk Grove, IL 60007 ..... 312-437-2654;1-800-323-5403
§ Mag-Tek, Carson, CA 90746 213-631-8602
Micro Mo Electronics, Inc., St. Petersburg, FL 33701 813-822-2529
Vertex Industries, Inc., Clifton, NJ 07014 201-472-1331

Encoders, Proof-2000 — *See Vol. D*

Encoders, Shaft Angle, Contacting-5500

Airflyte Elctrns. Co., Bayonne, NJ 07002, 201-436-2230 ..... B•1233
BEI Motion Systems Co., Computer Products Div., San Marcos, CA 92069, 619-471-2600 ..... B•1934
BEI Motion Systems Co., Industrial Encoder Div., Goleta, CA 93117, 805-968-0782 ..... B•1934
BEI Motion Systems Co., Position Controls Div., Carlsbad, CA 92008, 619-931-0200 ..... B•1934
§ **Bourns, Inc., Resistive Components Group, Riverside, CA 92507, 714-781-5050** ..... A•2085
§ **Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820, 603-742-1120,800-872-0042** ..... B•1940-1941
† **Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300** .... D•1158
Data Technology, Inc., Woburn, MA 01811, 617-935-8820 ..... B•1945-1947
† **ILC Data Device Corp., Bohemia, NY 11716, 516-567-5600** ..... D•1182
† **Litton Encoder Div., Chatsworth, CA 91311, 818-341-6161** ..... B•1963
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1988-1989
U. S. Digital Corp., Los Alamitos, CA 90720, 213-594-0094 ..... B•1997
† **Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100** ..... B•1037,1998
§† Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
BEI Motion Systems Co., Corporate Off., Carlsbad, CA 92009 619-931-1500
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018 215-622-1000
Industrial Drives, A Kollmorgen Div., Radford, VA 24141 703-639-2495
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
Motor-Tronics, Inc., Vista, CA 92083 619-727-7430
§ Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
Noble U.S.A., Inc., Rolling Meadows, IL 60008 312-364-6038
Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
Piher International Corp., Mt. Prospect, IL 60056 ..... 312-390-6680;800-323-6693
Texas Instrs., Inc., Dallas, TX 75380 ..... 800-232-3200 (ext 700)
Trans-Tek, Ellington, CT 06029 203-872-8351
§ Veeder-Root, Hartford, CT 06102 203-527-7201

Encoders, Shaft Angle, Magnetic-5500

Hathaway Corporation:Motion Control Div., Tulsa, OK 74116, 918-438-7800 ..... B•1253
† **ILC Data Device Corp., Bohemia, NY 11716, 516-567-5600** ..... D•1182
Litton Encoder Div., Chatsworth, CA 91311, 818-341-6161 ..... B•1963
† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529** ..... B•1966
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1995
† **Transmagnetics, Farmingdale, NY 11735, 516-293-3100** ..... D•1203-1205
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
Astrosystems, Lake Success, NY 11042 516-328-1600
B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018 215-622-1000
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
† Farrand Controls, Div. of Farrand Industries, Inc., Valhalla, NY 10595 914-761-2600
§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
IVO Industries, Inc., Eatontown, NJ 07724 ..... 201-542-5151;800-932-0489
Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
† Librascope Corporation, A Subsidiary of the Singer Co., Glendale, CA 91201 818-244-6541
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
† Performance Controls, Inc., Horsham, PA 19044 215-675-6500
§ Temposonics, MTS Sys. Corp., Plainview, NY 11803 516-349-1950
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300
† Vernitech:Vernitron Corp., Deer Pk, NY 11729 516-586-5100

Encoders, Shaft Angle, Optical-5500

Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040, 815-397-7400 ..... B•1235
BEI Motion Systems Co., Computer Products Div., San Marcos, CA 92069, 619-471-2600 ..... B•1934
BEI Motion Systems Co., Digital Products Div., Little Rock, AR 72203, 501-851-4000 ..... B•1934
BEI Motion Systems Co., Industrial Encoder Div., Goleta, CA 93117, 805-968-0782 ..... B•1934
BEI Motion Systems Co., Position Controls Div., Carlsbad, CA 92008, 619-931-0200 ..... B•1934
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042, 516-488-6700 ..... B•1237,1937-1938
§ **Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820, 603-742-1120,800-872-0042** ..... B•1940-1941
† **Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018, 215-622-1000** ..... B•1238
† **Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910, 818-882-0424** ..... B•1942
§ **Data Technology, Inc., Woburn, MA 01811, 617-935-8820** ..... B•1945-1947
Disc Instruments, Honeywell, Costa Mesa, CA 92626, 714-433-0343 ..... B•1949-1951
Enprotech Corp., Kalamazoo, MI 49007, 616-381-0665 ..... B•1953
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116, 918-438-7800 ..... B•1253
† **Itek Encoder, Newton, MA 02161-1953, 617-969-7300** ..... B•1960-1961
§ **IVO Industries, Inc., Eatontown, NJ 07724, 201-542-5151;800-932-0489** .. B•1962
† **Litton Encoder Div., Chatsworth, CA 91311, 818-341-6161** ..... B•1963
† **Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621** ..... B•1964-1965
† **Measurement Systems, Inc., Norwalk, CT 06854, 203-838-5561** ..... D•1152
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1281, 1966
Servo-Tek Products Co., Hawthorne, NJ 07506, 201-427-3100 ..... B•1302
§ **Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757** ..... B•1995
† **Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300** ..... B•1305
U. S. Digital Corp., Los Alamitos, CA 90720, 213-594-0094 ..... B•1997
† **Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100** ..... B•1037,1998
§† Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§ ALTEK Corporation, Silver Springs, MD 20904-7802 301-572-2555
§ Automatic Timing & Controls Co., King of Prussia, PA 19406 ..... 215-337-5500; 800-441-8245
§ B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
§ C-Tek Inc., Wakefield, MA 01880 617-246-1720
Dynamics Research Corp., Encoder Division, Wilmington, MA 01887-2193 508-658-6100
§ Dynapar, Gurnee, IL 60031 312-662-2666
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 408-738-4266
Elm Systems, Wauconda, IL 60084 312-526-5003
§ Encoder Products, Sandpoint, ID 83864 208-263-8541
Epson America, Inc./OEM Div., Torrance, CA 90505 213-534-4500
Escap Products, Hauppauge, NY 11788 516-234-3900
Fiberoptic Systems, Inc., Simi Valley, CA 93063 805-583-2088
FSI/Fork Standards, Inc., Lombard, IL 60148 ..... 312-231-3511;312-932-9380
§ Gordos, A Flint Industries Company, Rogers, AR. 72757, AR 72757 501-636-5000
† HH Controls Co., Inc., Arlington, MA 02174 617-646-2626
§† Honeywell Optoelectronics, Richardson, TX 75081 214-470-4271
IMC Magnetics Corp., IMC/Hansen, Princeton, IN 47670-0023 812-385-3415
Industrial Drives, A Kollmorgen Div., Radford, VA 24141 703-639-2495
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
Marktech International Corp., Menands, NY 12204 518-436-5865
† Maxon Precision Motors, Inc., Burlingame, CA 94010 415-697-9614
§ Motion Control Devices, An EG & G Torque Systems Co., Lowell, MA 01851 617-454-3407
§† Optek Technology Inc., McKinney, TX 75069 214-542-9461
Opto Technology, Inc., Wheeling, IL 60090 312-537-4277
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
§ Photoswitch Div., Allen Bradley Co., Waltham, MA 02154 617-466-8000
PMI Motion Technologies, Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
§† Renco, Robbins & Myers, Goleta, CA 93117-3094 805-968-1525
SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
† Teledyne Gurley, Troy, NY 12181 518-272-6300
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
Toko America, Inc., Mt. Prospect, IL 60056 312-297-0070
§ Veeder-Root, Hartford, CT 06102 203-527-7201
§† Wide Range Elctrns. Corp., St. Louis, MO 63026 314-343-9191
ZI-TECH Instrument Corp., Mountain View, CA 94039-1567 415-966-8484

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BEI Motion Systems Co., Digital Products Div., Little Rock, AR 72203, 501-851-4000 ..... B•1934
BEI Motion Systems Co., Position Controls Div., Carlsbad, CA 92008, 619-931-0200 ..... B•1934
Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820, 603-742-1120,800-872-0042 ..... B•1941
Emcor Products, Crenlo, Inc., Rochester, MN 55901, 507-289-3371 ..... C•1039
† **Hathaway Corporation:Motion Control Div., Tulsa, OK 74116, 918-438-7800** ..... B•1253
Itek Encoder, Newton, MA 02161-1953, 617-969-7300 ..... B•1960-1961
† **Litton Encoder Div., Chatsworth, CA 91311, 818-341-6161** ..... B•1963
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400

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Ethernet Extenders-2475

§† Canoga-Perkins Corp., Chatsworth, CA 91311 818-718-6300
Siecor Electro-Optic Products, Siecor Corporation, Research Triangle Park, NC 27709 ..... 1-800-888-LAN1;919-481-5100

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Expanders, Data-2440

§ Data Translation, Inc., Marlboro, MA 01752 508-481-3700
DEI, Escondido, CA 92025 619-743-8344
Erbtec Engineering, Inc., Boulder, CO 80301 303-447-8750

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Fans, Propeller-2600 — ***See Vol. C***

Fans, Tubeaxial-2600 — ***See Vol. C***

Fans, Vaneaxial-2600 — ***See Vol. C***

Fans/Blowers (MIL)-2440

McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550, 609-799-0100 ..... C•1675
§ Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1305
† Ashland Elec. Prods., Inc., Rochester, NH 03867 603-335-1100
Bosch, Robert, Corp., Broadview, IL 60153 312-865-5200
† Hi-Tech, Inc., Zion, IL 60099 312-746-2447
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
§ Interfan, William J. Purdy Co., Burlingame, CA 94010 415-347-1203
† Kooltronic, Inc., Hopewell, NJ 08525 609-466-3400
† Kooltronic, Inc., Ventura, CA 93003 805-642-8521
† Merrill, Inc., Gwynedd Valley, PA 19437 215-643-2116
† MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779 516-467-5151
§ NIDEC Corporation, Torrington, CT 06790 203-482-4422
§ Oriental Motor U.S.A. Corporation, Torrance, CA 90503 213-515-2264
§ Precision Fabrication Technologies, Inc., Monon, IN 47959 ..... 1-800-558-7297; 219-253-6666

Fasteners, Cable & Wire — See Wire & Cable Ties (Vol. C)

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Fiber Optic Data Links — See Data Links, Fiber Optic (Vol. B)

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Fiber Optic Splices & Splicing Equipment-2475

AMP, Harrisburg, PA 17105, 717-564-0100 ..... C•1157
† Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727 ..... B•1214
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1212
MOLEX, Inc., Lisle, IL 60532, 312-969-4550 ..... C•1881
GTE Fiberoptic Products, Williamsport, PA 17701 ... 717-326-6591;1-800-FBR-OPTICS
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
† INTELCO, Acton, MA 01720 508-264-4485
§† Light Control Systems Inc., Tyngsboro, MA 01879 617-649-9870
§ 3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Optelecom, Inc., Gaithersburg, MD 20877 301-840-2121
† Power Technology, Inc., Little Rock, AR 72219 501-568-1995
Teleterminal Corp., Greenland, NH 03840 603-431-1200
§ Thomas & Betts Corporation, Bridgewater, NJ 08807 201-685-1600
† York Technology, Inc., Burbank, CA 91502 818-955-8927

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Jan Hardware Mfg. Co., Long Island City, NY 11101, 718-361-0800 ..... C•1586
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1208-1210,1212-1213
§† MERET, Inc., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1215
§† A.C. Interface Inc., Irvine, CA 92718 714-472-9524
Ametek Controls Div., Ametek Fiber Optic Products, Feasterville, PA 19047 215-355-6900
§† AMP, Harrisburg, PA 17105 717-564-0100
AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§ Berk-Tek Inc., New Holland, PA 17557 717-354-6200
† Circuit Technology Inc., Farmingdale, NY 11735 516-293-8686
§† Codenoll Technology Corp., Yonkers. NY 10701 914-965-6300
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
Corning Glass Works, Telecommunications Products Division, Corning, NY 14831 607-974-7732
Dowty RFL Inds. Inc./Communications Div., The Dowty Grp. PLC, Boonton, NJ 07005-0239 201-334-3100
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
Fiberoptic Systems, Inc., Simi Valley, CA 93063 805-583-2088
† Fibronics International Inc., Communications Way, Hyannis, MA 02601-1892 508-778-0700
† Force, Inc., Christiansburg, VA 24073 703-382-0462
† Foundation Instruments Inc., Nepean, ON, CANADA K2E 7J6 613-226-4000
FSI/Fork Standards, Inc., Lombard, IL 60148 ..... 312-231-3511;312-932-9380
† Galileo Electro-Optics Corp., Sturbridge, MA 01566 508-347-9191
† Giannini Institute, Indio, CA 92201 619-347-2833
GTE Fiberoptic Products, Williamsport, PA 17701 ... 717-326-6591;1-800-FBR-OPTICS
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§† ITT Cannon:Military/Aerospace Div., Santa Ana, CA 92705-5684 714-557-4700
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
§† Mikron Instr., Wyckoff, NJ 07481 201-891-7330
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
Omega Engineering, Stamford, CT 06907 800-826-6342
† Optelecom, Inc., Gaithersburg, MD 20877 301-840-2121
Pasternack Enterprises, Irvine, CA 92713 714-261-1920
Raychem Corp., Elctrns. Grp., Menlo Park, CA 94025 415-361-3860
Rehlander Assocs., Beverly, MA 01915 617-922-5961
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621
SpecTran Corp., Sturbridge, MA 01566 508-347-2751
§† Standard Wire & Cable Co., Rancho Dominguez, CA 90220 ..... 213-609-1811; 800-447-0006/821-527
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
§ Thomas & Betts Corporation, Bridgewater, NJ 08807 201-685-1600
U.S. Instr. Rentals, San Mateo, CA 94403 800-824-2873
Welch Allyn, Inc., Industrial Products Division, Skaneateles Falls, NY 13153-0187 315-685-8945

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† **AME Corporation, Towaco, NJ 07082-0195, 201-263-1700** ..... **B•1678**
AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ... **B•1049,1129**
Everlight - USA, Glendora, CA 91740, 213-697-5067 ..... **B•1143**
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... **B•1146,1149**
† **Homalite, Inc., Wilmington, DE 19804, 302-652-3686** ..... **B•1085**
Idea, Inc., Brea, CA 92621, 213-697-4332 ..... **B•1166**
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119, 206-284-5475 ..... **B•1866**
† **JMJ Technical Prods., Newark, NJ 07105, 201-589-4257** ..... **C•1612**
Lamb Industries, Inc., Portland, OR 97225, 503-297-8878 ..... **B•1164**
Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... **B•1167**
§ **RMF Products, Inc., Batavia, IL 60510, 312-879-0020** ..... **C•1613**
§ **Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123** ..... **B•1195**
APM-Hexseal, Englewood, NJ 07631 201-569-5700
† Dontech, Inc., Doylestown, PA 18901 215-348-5010
§ Electro-Mech Components, Inc., South El Monte, CA 91733-3689 818-442-7180
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
Jan Hardware Mfg. Co., Long Island City, NY 11101 718-361-0800
† Libbey-Owens-Ford Co., Liberty Mirror Products, Brackenridge, PA 15014 412-224-1800
Polaroid Corporation, Polarizer Div., Norwood, MA 02062 800-225-2770
RFI Corporation, Bay Shore, NY 11706 516-231-6400
Rolyn Optics Co., Covina, CA 91722-2199 ..... 818-915-5707/5717
Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-327-1282
Schott Glass Technologies, Inc., Duryea, PA 18642 717-457-7485
† Wamco, Inc., Fountain Valley, CA 92708 714-545-5560

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Everlight - USA, Glendora, CA 91740, 213-697-5067 ..... **B•1143**
† **Homalite, Inc., Wilmington, DE 19804, 302-652-3686** ..... **B•1085**
Idea, Inc., Brea, CA 92621, 213-697-4332 ..... **B•1166**
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 201-679-3366 ..... **A•1707**
† Balzers Optical Corporation, Marlboro, MA 01752 617-481-9860
Crosspoint, Div. of Info-Lite, Fairview, NJ 07022 201-941-4455
† Dontech, Inc., Doylestown, PA 18901 215-348-5010
International Polarizer, Inc., Marlborough, MA 01752 508-481-7495
Polaroid Corporation, Polarizer Div., Norwood, MA 02062 800-225-2770
§ Screen Data Corp., Dover, NJ 07801 ..... 201-887-7713;800-248-1212
§ Sun-Flex Co., Inc., Novato, CA 94947 415-883-1221
† Wamco, Inc., Fountain Valley, CA 92708 714-545-5560

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Jan Hardware Mfg. Co., Long Island City, NY 11101, 718-361-0800 ..... **C•1586**
§ Alan Gordon Entprs., Inc., N. Hollywood, CA 91601 818-985-5500
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., Anaheim, CA 92805 714-491-5121
† Balzers Optical Corporation, Marlboro, MA 01752 617-481-9860
Burleigh Instruments, Fishers, NY 14453 716-924-9355
† Dontech, Inc., Doylestown, PA 18901 215-348-5010
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
† Evaporated Coatings, Inc., Willow Grove, PA 19090 215-659-3080
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
† Homalite, Inc., Wilmington, DE 19804 302-652-3686
International Polarizer, Inc., Marlborough, MA 01752 508-481-7495
† JMJ Technical Prods., Newark, NJ 07105 201-589-4257
† Libbey-Owens-Ford Co., Liberty Mirror Products, Brackenridge, PA 15014 412-224-1800
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
† Optical & Conductive Coatings, Meridian Inds., Inc., Pacheco, CA 94553 415-798-6066
§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
† Optima Precision, Inc., Rancho Palos Verdes, CA 90274 .. 800-544-4418;213-377-4118
† Oxley, Inc., Branford, CT 06405 203-488-1033
† Plumer Precision Optics, Pennsburg, PA 18073 215-679-6272
† Pomfret Research Optics, Orange, VA 22960 703-854-4350
Rolyn Optics Co., Covina, CA 91722-2199 ..... 818-915-5707/5717
Schott Glass Technologies, Inc., Duryea, PA 18642 717-457-7485
Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§ Sun-Flex Co., Inc., Novato, CA 94947 415-883-1221

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Chesterfield Products, Elmwood Park, NJ 07407, 201-797-9655 ..... **A•1690**
Comstron Corp., Melville, NY 11747, 516-756-1100 ..... **A•1691**
† **Eagle, Fallbrook, CA 92028, 619-728-6000** ..... **A•1700,1702**
† **Electronic Precision Components Corporation, Mt. Vernon, NY 10550, 914-664-2333** ..... **A•1692**
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400** ..... **A•1693**
Filter Concepts Inc., Santa Ana, CA 92707, 714-545-7003 ..... **A•1660-1661**
† **Filtron Co., Inc., Sub. of ARX Inc., Old Bethpage, NY 11804, 516-752-1144** ..... **A•1694**
Hisonic, Inc., Olathe, KS 66061, 913-782-0012 ..... **A•2307**
JMK, Inc., Amherst, NH 03031, ;;;603-886-4115 ..... **A•1663**
† **KR Electronics, Inc., Avenel, NJ 07001, 201-636-1900** ..... **A•1704-1705**
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 201-679-3366 ... **A•1706-1707**
Microsonics Inc., Weymouth, MA 02188, 617-337-4200 ..... **A•1442**
§† **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** .. **A•1440,1708**
† **Oxley, Inc., Branford, CT 06405, 203-488-1033** ..... **A•1715, B•1025**
RFI Corporation, Bay Shore, NY 11706, 516-231-6400 ..... **A•1667**
§† **Tusonix, Inc., Tucson, AZ 85740-7144, 602-744-0400** ..... **A•1681**
Alpha Components, Mechanicsburg, PA 17055 717-697-8595
AMP, Harrisburg, PA 17105 717-564-0100
† Ark Elctrns. Corp., Southampton, PA 18966 215-322-6510
Cir-Q-Tel, Inc., Beltsville, MD 20805 301-946-1800
† Cirtech, EG & G, Shawnee Mission, KS 66223 913-681-2801
Control Concepts Corp., Binghamton, NY 13902-1380 607-724-2484
† Cornell-Dubilier Elctrns., Wayne, NJ 07470 201-694-8600
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† Elmag Division, Lindgren RF Enclosures, Riviera Bch., FL 33404 407-881-9292
Elpac Components, Elpac Electronics, Inc., Santa Ana, CA 92705 714-979-4440
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† Ferretec Inc., Milpitas, CA 95035-6315 408-263-1216
Fil-Coil Company, Inc., Garden City, NY 11530 516-228-9445
Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Hertz Filter, Syosset, NY 11791 516-822-4770
§† Hi-Q Crystals, Hybrids International Ltd., Olathe, KS 66062 913-764-4544
Hughes Aircraft Co., Microelctrns. Sys. Div., Irvine, CA 92715 714-752-3800
Hycomp, Inc., Marlborough, MA 01752 508-485-6300
† Integrated Microwave, San Diego, CA 92121 619-259-2600
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
† Magnetic Component Engineering, Inc., Culver City, CA 90230 213-398-4761
Marway Prods. Inc., Santa Ana, CA 92703 714-973-1800
North Hills Electronics, Glen Cove, NY 11542 516-671-5700
† OPT Industries Inc., Phillipsburg, NJ 08865 201-454-2600
† Pico Electronics, Inc., Mt. Vernon, NY 10552 ..... 914-699-5514;800-431-1064
Piconics, Tyngsboro, MA 01879 508-649-7501
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013 717-243-5929
† SFE Technologies, San Fernando, CA 91340 818-365-9411
Sokol Crystal Products, Inc., Mineral Point, WI 53565 608-987-3363
Spectrum Control, Inc., Erie, PA 16505 814-455-0966
† Stanford Applied Engrg. Inc., Santa Clara, CA 95054 408-988-0700
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291

† Transco Products, Inc., Camarillo, CA 93011-6003 805-987-8007
† TTE, Incorporated, Los Angeles, CA 90064 213-478-8224
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9 403-259-3200
§† United Transformer Co.:Div. of Opt Industries Inc., Phillipsburg, NJ 08865 201-454-2600
Vernitron Piezoelectric Div., Bedford, OH 44146-5478 216-232-8600

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† International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
MACOM, Inc., Burlington, MA 01803 617-272-3000
§ Micro-Coax Components, Inc., a UTI Company, Collegeville, PA 19426 .. 215-489-3700
Microwave Development Laboratories, Natick, MA 01760 617-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666

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† Logitek, Inc., Ronkonkoma, NY 11779 516-467-4200
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
† Modular Devices, Shirley, NY 11967 516-345-3100
† Scientific Technologies, Optical Sensor Div. Inc., Hayward, CA 94544 ... 415-471-9717

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Fuse Elements-4300

§ Bussmann:Cooper Industries, St. Louis, MO 63178, 314-394-2877 ..... C•1295
§ FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1367
Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016, 312-824-1188 ..... B•1381
§ Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... A•1670-1671, B•1408
Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
§† Ercona, Patchogue, NY 11772 516-758-0700
Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
Panel Components Corp., Santa Rosa, CA 95406 707-523-0600
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308

Fuseholders — See Clips & Holders, Fuse (Vol. B)

Fuses-4300

§ Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... B•1355-1358
§† Bussmann:Cooper Industries, St. Louis, MO 63178, 314-394-2877 ..... C•1295
Elcom Systems, Inc., Boca Raton, FL 33487, 305-994-1774 ..... A•1779
§† Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016, 312-824-1188 ..... B•1376-1385
Matsuo Electronics, Huntington Beach, CA 92648, 714-969-2491 ..... A•1117
Panel Components Corp., Santa Rosa, CA 95406, 707-523-0600 ..... B•1403
§† RCD Components, Inc., Manchester, NH 03103, 603-669-0054 ..... A•2043
§ Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... B•1408
Alden Products Co., Brockton, MA 02403 508-583-0160
§ Altech Corp., Somerville, NJ 08876 201-359-4454
§† Beswick:Cooper U.K. Ltd., Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§† Brush Fuses Inc., Des Plaines, IL 60018 312-299-2211
§ Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
§ Ercona, Patchogue, NY 11772 516-758-0700
§† Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
§ FIC Corp., Rockville, MD 20852 ..... 301-881-8124;800-638-6594
† Fuses Unlimited, D.E.I., Chatsworth, CA 91311 818-882-1515
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Gould Shawmut, Newburyport, MA 01950 ..... 508-462-6662/3131
§ International Components Corp., Melville, NY 11747 516-293-1500
† KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
K-Tronics, K. T. Elctrns. Inc., Sunnyvale, CA 94086 ..... 1-800-888-ELCO
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
Mepcopal Company, San Diego, CA 92121 619-453-0332
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
Raychem Corp., Elctrns. Grp., Menlo Park, CA 94025 415-361-3860
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
§ San-O Industrial Corp., Bohemia, NY 11716 516-567-5556
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487

Fuses, Failure Indicating-4300

Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... B•1355-1358
§† Bussmann:Cooper Industries, St. Louis, MO 63178, 314-394-2877 ..... C•1295
§ FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1367
§ Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016, 312-824-1188 ..... B•1381
Panel Components Corp., Santa Rosa, CA 95406, 707-523-0600 ..... B•1403
§ Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... B•1408
Alden Products Co., Brockton, MA 02403 508-583-0160
§ Altech Corp., Somerville, NJ 08876 201-359-4454
§† Beswick:Cooper U.K. Ltd., Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§ Brush Fuses Inc., Des Plaines, IL 60018 312-299-2211
Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
§† Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
† Fuses Unlimited, D.E.I., Chatsworth, CA 91311 818-882-1515
§ Gould Shawmut, Newburyport, MA 01950 ..... 508-462-6662/3131
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
§ San-O Industrial Corp., Bohemia, NY 11716 516-567-5556

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§ Bussmann:Cooper Industries, St. Louis, MO 63178, 314-394-2877 ..... C•1295
Connector Corp., Chicago, IL 60646, 312-539-3108 ..... C•1315
§ Daburn Electronics & Cable Corp., Northvale, NJ 07647, 201-768-5400 .. C•1848
§† FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1367
§† Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016, 312-824-1188 ..... B•1376-1385
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ..... D•2214
† Alan Industries Inc., Columbus, IN 47201 812-372-8869
§† Beswick:Cooper U.K. Ltd., Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
Doran Manufacturing Co., Cincinnati, OH 45225 513-681-5424
§ Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
§ Globtek, Inc., N. Bergen, NJ 07047 201-861-0246
§ International Components Corp., Melville, NY 11747 516-293-1500
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§† Keystone Electronics Corp., Astoria, NY 11105-2017 718-956-8900
§ National Tel-Tronics, Meadville, PA 16335 814-724-6440
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
§ San-O Industrial Corp., Bohemia, NY 11716 516-567-5556
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487

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§ Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... B•1356-1357
§† Bussmann:Cooper Industries, St. Louis, MO 63178, 314-394-2877 ..... C•1295
Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016, 312-824-1188 ..... B•1376-1380,1382-1385
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§ Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722 ..... C•1916
§ Altech Corp., Somerville, NJ 08876 201-359-4454
§† Beswick:Cooper U.K. Ltd., Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§ Brush Fuses Inc., Des Plaines, IL 60018 312-299-2211
Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
§† Ercona, Patchogue, NY 11772 516-758-0700
§ Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
§ FIC Corp., Rockville, MD 20852 ..... 301-881-8124;800-638-6594
Fuses Unlimited, D.E.I., Chatsworth, CA 91311 818-882-1515
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700

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Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1871
§† Bussmann:Cooper Industries, St. Louis, MO 63178, 314-394-2877 ..... C•1295
§ FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1367
Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... B•1899-1900

Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ..... **B•1902-1903**
Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016, 312-824-1188 ..... **B•1376-1380,1382-1385**
Matsuo Electronics, Huntington Beach, CA 92648, 714-969-2491 ..... **A•1117**
Micro Devices Product Group, Therm-O-Disc, Inc., Mansfield, OH 44907, 419-525-8500 ..... **B•1402**
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Accurate Electronics, Elyria, OH 44036 216-366-6330
Bel Fuse, Jersey City, NJ 07302 201-432-0463
§ Beswick:Cooper U.K. Ltd., Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§ Chatham Controls, Chatham, NJ 07928 201-635-8892
Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
Elmwood Sensors, Pawtucket, RI 02861 401-727-1300
Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
§ Midwest Components, Inc., Muskegon, MI 49443 616-777-2602
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Optrex/Satori, Torrance, CA 90505 213-378-9478
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
Raychem Corp., Elctrns. Grp., Menlo Park, CA 94025 415-361-3660
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
§ San-O Industrial Corp., Bohemia, NY 11716 516-567-5556
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
Western Elctrn. Comps. Corp., Camarillo, CA 93010 805-482-8002

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HBM, Inc., Marlboro, MA 01752, 508-624-4500 ..... **B•1958-1959**
§† **NES, Inc. (Nationwide Electronic Systems), Carpentersville, IL 60110, 312-426-5900** ..... **D•1408**
§ **Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914** ..... **D•1412**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... **B•1912-1913,1988-1989, C•1907, D•1331,1414-1415**
BLH Electronics, Inc., Canton, MA 02021-9111 617-821-2000
CDS - Colorado Data Sys., Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
Entran Devices, Fairfield, NJ 07006 ..... 201-227-1002;800-635-0650
Flotek Corporation, Tucson, AZ 85714 602-294-9222
§ Helm Instrument Co., Inc., Maumee, OH 43537 419-893-4356
§† Kistler-Morse, Redmond, WA 98073 206-881-8000
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
Measurements Group, Inc., Raleigh, NC 27611 919-365-3800
† Piezo Electric Products, Inc., Metuchen, NJ 08840 201-548-2800
Sensotec, Inc., Columbus, OH 43212 614-486-7723

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Gearheads & Speed Reducers - Also see gears and gear mechanisms-3500

Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330 ..... **B•1240**
§ **Jan Hardware Mfg. Co., Long Island City, NY 11101, 718-361-0800** ..... **C•1586**
† **Maxon Precision Motors, Inc., Burlingame, CA 94010, 415-697-9514** ..... **B•1278**
§† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529** ..... **B•1282-1283,1966**
SAIA Inc., Elkhart, IN 46515-3030, 219-262-4418 ..... **B•1300-1301**
† **Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300** ..... **B•1305**
§† Berg, W. M., Inc., East Rockaway, NY 11518 516-599-5010
§† Berger-Lahr Corp., Jaffrey, NH 03452 603-532-7701
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042 516-488-6700
§ Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
§ Electrol Co., York, PA 17405 717-848-1722
Escap Products, Hauppauge, NY 11788 516-234-3900
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
§† Globe Motors, Dayton, OH 45404 513-228-3171
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
† PIC Design, Remington Technologies, Inc., Middlebury, CT 06762 203-758-8272
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
† Precision Mechanisms, Westbury, NY 11590 ..... 516-ED3-5955
Robbins & Myers/Electro-Craft, Eden Prairie, MN 55344 612-942-3600
§ SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
† Sterling Instruments, New Hyde Pk., NY 11040 516-328-3300
† Techno, A DSG Company, New Hyde Park, NY 11040 516-328-3970
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
† Valley Electromagnetics, Spring Valley, IL 61362 815-664-2348
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

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† Rohde & Schwarz, Inc., Lanham, MD 20706 301-459-8800

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Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 ..... **B•1935, D•1138-1139**
† Aeroflex Laboratories Inc, ARK, Inc., Plainview, NY 11803 516-694-6700
† American Aerospace Controls, Farmingdale, NY 11735 516-694-5100
Cryomagnetics, Inc., Oak Ridge, TN 37830 615-482-9551
Dowty RFL Inds. Inc./Instrumentation Div., The Dowty Grp. PLC, Boonton, NJ 07005-0239 201-334-3100
Lake Shore Cryotronics, Inc., Westerville, OH 43081 614-891-2243
LDJ Incorporated, Troy, MI 48099-0219 313-528-2202
Magnetic Instrumentation, Indianapolis, IN 46226 317-545-2102
Ohio Semitronics, Inc., Columbus, OH 43212 614-486-9561
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Walker Scientific, Worcester, MA 01606 ..... 508-852-3674;508-853-3232

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Generators, Sweep-2900 – ***See Vol. D***

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Hall Effect Devices – See Generators, Hall (Vol. B), Magnetoresistors, Hall (Vol. A), Multipliers, Hall (Vol. A), Probes, Hall (Vol. A), Switches, Hall Effect (Vol. B)

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Handles For Cabinets, Circuit Boards, Racks, etc.-1400 – ***See Vol. C***

Handsets, Chestsets, Headsets, etc.-1300 – ***See Vol. D***

Hardware – See Fasteners (Vol. C), Clamps (Vol. C), Terminals (Vol. C), etc.

Hardware (MIL), Connector-2440

Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492, 203-265-8910 ..... **C•1266-1267**
† Jettron Products Inc., E. Hanover, NJ 07936, 201-887-0571 ..... **C•1392-1393**
U.S. Terminals, Cincinnati, OH 45243, 513-561-8145 ..... **C•1557**
† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
Autosplice, Inc., Woodside, NY 11377 718-429-0500
Autoswage Products, Shelton, CT 06484 203-929-1401
§† Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007 312-981-6000
§† ITT Cannon:Military/Aerospace Div., Santa Ana, CA 92705-5684 714-557-4700
§† Lyn-Tron, Inc., Burbank, CA 91505 ..... 213-849-6211;800-423-2734
† Micro Plastics Inc., Flippin, AR 72634 501-453-2261
§ National Tel-Tronics, Meadville, PA 16335 814-724-6440

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Headers, Relay & Transformer-2100 – ***See Vol. C***

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Headers, Transistor & Diode-2500 – ***See Vol. C***

Headphones-1300 – ***See Vol. D***

Heads, Magnetic Recording-1300 – ***See Vol. D***

Headsets (MIL)-2440

RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-2828
§† Rye Industries, Inc., Mamaroneck, NY 10543 914-698-0080
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911

Heat Dissipators – See Heat Sinks, Semiconductor (Vol. C), Heat Sinks, Soldering (Vol. C)

Heaters, Immersion-4100 – ***See Vol. D***

Heaters & Heating Elements (For Components & Equipment)-Also See Ovens-5300

Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... **B•1900**
§ Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 .. **B•1903**
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... **A•1999**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... **B•1988, D•1414**
Acme Elec. Heating Corp., Hialeah, FL 33013 305-685-8326
Ajax Magnethermic Corp., Warren, OH 44482 216-372-8511
† Armstrong World Inds., Lancaster, PA 17604 717-397-0611
† Blue M, A Unit of General Signal, Blue Island, IL 60406 312-385-9000
† The Carborundum Company, Electronic Ceramics, Niagara Falls, NY 14302 716-278-2000
§† Casso-Solar, Pomona, NY 10970 914-354-2500
† DELTA M Corporation, Oak Ridge, TN 37830 615-483-1569
§† Despatch Industries, Minneapolis, MN 55440-1320 612-331-1873
† Electrofilm, Valencia, CA 91355 805-257-2240
Eraser Co., Syracuse, NY 13221 315-454-3237
§ GTE Corp., Sylvania Emissive Prods./Process Heat, Exeter, NH 03833 .. 603-772-4331
§ Hoffman Engineering, Anoka, MN 55303 612-421-2240
§ Law, R. E. Instrument, Inc., Palos Hills, IL 60465 312-974-4000
§ Midwest Components, Inc., Muskegon, MI 49443 616-777-2602
† Minco Products, Minneapolis, MN 55432 612-571-3121
† Molecu-Wire, Farmingdale, NJ 07727 201-938-9473
Multi-Amp Corp., TBG, Dallas, TX 75237 214-333-3201
† OAL Associates, Inc., Escondido, CA 92025 619-743-7143
† Ocean State Thermotics, Inc., Smithfield, RI 02917 401-231-4640
§ Pamran Inc., Racine, WI 53404 414-637-7999
§† Philips Elmet, Lewiston, ME 04240 207-784-3591
Raychem Corp., Elctrns. Grp., Menlo Park, CA 94025 415-361-3860
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
† Thermolab, N. Hollywood, CA 91605 818-787-4084
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 312-364-7277
† Trent, Inc., Philadelphia, PA 19127 215-482-5000

Heat Exchangers & Systems-2600 – ***See Vol. C***

Heat Guns, Production-5400 – ***See Vol. C***

Heating Elements, Infrared-5300

§† Remtek Corporation, Fremont, CA 94538, 415-490-3999 ..... **C•1701**
Acme Elec. Heating Corp., Hialeah, FL 33013 305-685-8326
§† Casso-Solar, Pomona, NY 10970 914-354-2500
† Glenro, Inc., Paterson, NJ 07501 ..... 201-279-5900;800-922-0106
† Ocean State Thermotics, Inc., Smithfield, RI 02917 401-231-4640
Omega Engineering, Stamford, CT 06907 800-826-6342
§ S. F. Products Corporation, Southport, CT 06490 203-929-6180

Heat Pumps – See Cooling/Heating Modules, Thermoelectric (Vol. B)

Heat Shrinkable Elastomers, Plastics – See Caps, Forms & Tapes, Heat Shrinkable (Vol. C), Tubing, Heat Shrinkable (Vol. C)

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Heat Sinks, Soldering-4600 – ***See Vol. C***

Heat Sinks, Surface Mount-2600 – ***See Vol. C***

Heat Sinks (MIL)-2440

§† AAVID Engineering, Inc., Laconia, NH 03247-0400, 603-528-3400 ... **C•1634-1638**
Bergquist, Minneapolis, MN 55435, 800-328-3882 ..... **C•1696**
§† IERC, Burbank, CA 91502, 213-849-2481 ..... **C•1663**
§† Thermalloy, Inc., Dallas, TX 75381-0839, 214-243-4321 ..... **C•1689**
§† Calmark Corp., San Gabriel, CA 91776 818-287-0451
Delbert Blinn Co., Pomona, CA 91769 714-629-3900
Dow Corning Corp., Midland, MI 48686-0994 517-496-4000
† IMC Magnetics Corp., Thermal Products Group, Jericho, NY 11753 516-938-0800
§ Mann, Henry, Inc., Huntingdon Valley, PA 19006 215-355-7200
† M P C, Santa Ana, CA 92704 714-775-0211
† Noren Products Inc., Menlo Pk., CA 94025 415-322-9500
Precision Extrusions, Inc., Bensenville, IL 60106 312-766-0340

† Products Engrg. Corp., Azusa, CA 91702 818-969-5879
† Staver Co., Inc., Bay Shore, NY 11706 516-666-8000
† Thermacore Inc., Lancaster, PA 17601 717-569-6551
Unitrack Industries, Inc., West Chester, PA 19380 215-692-0800

Hermetic Sealing – See Machines, Hermetic Sealing (Vol. D), Seals, Hermetic (Vol. C), Services, Hermetic Sealing (Vol. D)

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Hybrid Circuits – See Circuits, Hybrid (Vol. A)

Hybrid Voltage Regulators – See Regulators & Stabilizers (Vol. D)

Identification, Friend or Foe (IFF) ESM (MIL)-2440

† Collins Avionics Divisions, Rockwell Intl., Cedar Rapids, IA 52498 319-395-1000
† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000
† ISC Cardion Electronics, Inc., Woodbury, NY 11797 516-921-7300
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Republic Electronics Co., Hauppauge, NY 11788 516-273-9800
† Signatron, A Unit of Sundstrand Corp., Lexington, MA 02173 617-861-1500

Igniters, Piezo-2300 – *See Vol. A*

Image Processing Systems – See Processors, Image (Vol. D)

Imagers, Thermal-2900 – *See Vol. D*

Imagers, Charge-Coupled Devices-3700

EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 408-738-4266
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§ Texas Instruments, Data/Image Sensing (Opto), Dallas, TX 75265 214-995-6611
Thomson Electron Tubes & Devices Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000
§† Vicon Industries, Inc., Melville, NY 11747 516-293-2200

IEEE 488 (GPIB) Bus – See Controllers, IEEE 488 (GPIB) (Vol. C), Cable, IEEE (Vol. D)

Impedance Comparators – See Bridges, Impedance (Vol. D)

Impedance Converters, Microwave-3400 – *See Vol. D*

Inclinometers-2900 – *See Vol. D*

Incremental Magnetic Recorders – See Recorders, Computer Data (Vol. D)

Indexers (Stepping Motor)-3500

§ Superior Electric, Bristol, CT 06010, 203-582-9561 ..... B•1306-1307
Design Components, Inc., Franklin, MA 02038 ..... 508-528-7300;800-341-4811
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
§ Super Vexta, Torrance, CA 90503-7395 213-515-2264

Indexing Mechanism, Electromechanical-2400 – *See Vol. C*

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Indicator Lights – See Lights, Indicator (Vol. B)

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BEI Motion Systems Co., Computer Products Div., San Marcos, CA 92069, 619-471-2600 ..... B•1934
† BEI Motion Systems Co., Digital Products Div., Little Rock, AR 72203, 501-651-4000 ..... B•1934
BEI Motion Systems Co., Industrial Encoder Div., Goleta, CA 93117, 805-968-0782 ..... B•1934
BEI Motion Systems Co., Position Controls Div., Carlsbad, CA 92008, 619-931-0200 ..... B•1934
† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 ..... D•1158-1159
† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 ..... D•1163,1165
† Control Technology Co., Inc., Long Island City, NY 11101, 718-361-2133 ..... D•2247
Disc Instruments, Honeywell, Costa Mesa, CA 92626, 714-433-0343 ..... B•1949-1950
† Interface Engineering Inc., Holbrook, MA 02343, 617-986-2600 ..... D•1190-1191
Itek Encoder, Newton, MA 02161-1953, 617-969-7300 ..... B•1960-1961
Litton Encoder Div., Chatsworth, CA 91311, 818-341-6161 ..... B•1963
† North Atlantic Industries, Hauppauge, NY 11788, 516-582-6500 ..... D•1328
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... B•1996
† Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ..... D•1202,1205
U. S. Digital Corp., Los Alamitos, CA 90720, 213-594-0094 ..... B•1997
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... B•1037
Airflyte Elctrns. Co., Bayonne, NJ 07002 201-436-2230
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Astrosystems, Lake Success, NY 11042 516-328-1600
BEI Motion Systems Co., Corporate Off., Carlsbad, CA 92009 619-931-1500
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018 215-622-1000
C-Tek Inc., Wakefield, MA 01880 617-246-1720
† Electric Tachometer, Philadelphia, PA 19142 215-726-7723
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
† HH Controls Co., Inc., Arlington, MA 02174 617-646-2626
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
† ILC Data Device Corp., Bohemia, NY 11716 516-567-5600
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
§† Meco Industries, Mechanical Engraving Co., Inc., Bronx, NY 10470 212-324-4455
† Metric Systems, Ft. Walton Beach, FL 32548-9990 904-244-9600
† Natel Engineering Co., Inc., Simi Valley, CA 93063 805-581-3950
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000
† Teledyne Gurley, Troy, NY 12181 518-272-6300
Trans-Tek, Ellington, CT 06029 203-872-8351
§† Veeder-Root, Hartford, CT 06102 203-527-7201
† Vernitron Controls, Vernitron Corporation, San Diego, CA 92073 619-428-5581
† Warren-Knight Instrument Co., Warren Industries, Inc., Philadelphia, PA 19116 215-464-9300
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778 508-358-2777

Indicators, Azimuth-5500

† Control Technology Co., Inc., Long Island City, NY 11101, 718-361-2133 ..... D•2247
† Interface Engineering Inc., Holbrook, MA 02343, 617-986-2600 ..... D•1190-1191
North Atlantic Industries, Hauppauge, NY 11788, 516-582-6500 ..... D•1328
† Argent Electronics, Troy, OH 45373 513-335-0031
Astrosystems, Lake Success, NY 11042 516-328-1600
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018 215-622-1000
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
C-Tek Inc., Wakefield, MA 01880 617-246-1720
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
† GAP Instrument Corp., Hauppauga, NY 11788 516-273-0909
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
Jewell Electrical Instruments, Manchester, NH 03108-4038 603-669-6400
§† Meco Industries, Mechanical Engraving Co., Inc., Bronx, NY 10470 212-324-4455
† Metric Systems, Ft. Walton Beach, FL 32548-9990 904-244-9600
† Natel Engineering Co., Inc., Simi Valley, CA 93063 805-581-3950
Precision Specialties, Inc., Northridge, CA 91324 818-349-9774
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
† Transmagnetics, Farmingdale, NY 11735 516-293-3100
§† Veeder-Root, Hartford, CT 06102 203-527-7201
† Vernitech:Vernitron Corp., Deer Pk, NY 11729 516-586-5100
† Vernitron Controls, Vernitron Corporation, San Diego, CA 92073 619-428-5581
† Warren-Knight Instrument Co., Warren Industries, Inc., Philadelphia, PA 19116 215-464-9300

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Airpax Co., Cheshire Div., Cheshire, CT 06410, 203-271-6000 ..... D•1137
Dialight Corp., A Cambridge Elctrns. Inds. Co., Manasquan, NJ 08736, 201-223-9400 ..... B•1133-1135,1137-1141
§† Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 ..... B•1728
§† FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1367
§ Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1158,1160-1162
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ..... D•2214

† **Mineico Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261** .. **B•1175**
§ **Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229** ..... **D•2231**
§ **Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850** ..... **B•1122**
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... **B•1117-1118**
† **Vernitron Controls, Vernitron Corporation, San Diego, CA 92073, 619-428-5581** ..... **B•1313**
Applied Controls Co., Inc., Fairfield, NJ 07006-2828 201-227-5454
§† C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
Components Unlimited, Inc., Portland, OR 97223 503-620-3522
Computer Doctors, College Park, MD 20740 ..... 1-800-RAM-STAR;301-474-3095
§ Current Ring Co. Inc., Ballwin, MO 63011 800-325-8653
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
§ Dreefs Switch, Inc., Waukegan, IL 60087 ..... 312-662-7667;800-323-9605
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
EMICO Inc., Dublin, PA 18917 215-249-9330
§ Ericson Manufacturing Co., Willoughby, OH 44094 216-951-8000
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
Korry Electronics Co., Criton Technologies, Seattle, WA 98109 206-281-1300
Landis & Gyr, Inc., Pleasantville, NY 10570 914-747-3540
Lark Electronics, Inc., New York, NY 10040 212-569-0430
Ledtronics, Inc., Torrance, CA 90505 213-549-9995
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Lumex Opto/Comps., Inc., Palatine, IL 60067 312-359-2790
Micro Pneumatic Logic, inc., Fort Lauderdale, FL 33309-1786 305-973-6166
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§† Modutec, Manchester, NH 03103 603-669-5121
NEI Ferranti-Packard Electronics, Mississauga, Ont, CANADA L4W 2P1 416-624-3020
† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
Oshino Electric Lamp Works, Ltd., Shinagawa-Ku, Tokyo, JAPAN 03-471-8548
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430 201-529-8757
Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§ Square D Co., Palatine, IL 60067 312-397-2600
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200
Star Micronics, Inc., OEM Division, Piscataway, NJ 08854 201-572-9512
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630 312-792-2700
§ Sylvania Miniature Lighting, GTE Corporation, Hillsboro, NH 03244 603-464-5533
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
§ Time Mark Corp., Tulsa, OK 74116 918-438-1220
§† VCH Incorporated, Chicago Miniature, Buffalo Grove, IL 60089 312-459-3400

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Indicators, Distortion — See Analyzers, AF (Vol. D)

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Airpax Co., Cheshire Div., Cheshire, CT 06410, 203-271-6000 ..... **D•1137**
FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... **B•1367**
International Instruments:APrime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... **D•1402**
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ..... **D•2214**
† **Mineico Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261** .. **B•1175**
Oxley, Inc., Branford, CT 06405, 203-488-1033 ..... **B•1025**
Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... **B•1198**
Staver Co., Inc., Bay Shore, NY 11706, 516-666-8000 ..... **B•1117-1118**
Advanced Techn. Research Labs., Alexandria, VA 22312 703-750-2920
Airpax Co., Sensor Div., A Division of North American Philips Corp., Cheshire, CT 06410 203-272-0301
Beede Electrical Instrument Co., Inc., Penacook, NH 03303 603-753-6362
§ Chessell Corp., Newtown, PA 18940 215-968-0660
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018 215-622-1000
Components Unlimited, Inc., Portland, OR 97223 503-620-3522
Crompton Instruments, Inc., Glendale Heights, IL 60139 312-351-9888
Crompton Instrs., Hawker Siddley, Elk Grove Village, IL 60007 312-593-1107
Dixson, Inc., Grand Junction, CO 81503 ..... 303-242-8863 (ext 223)
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
EMICO Inc., Dublin, PA 18917 215-249-9330
§ FENWAL INC., Ashland, MA 01721 508-881-2000
Hickok Electric Instrument, Cleveland, OH 44108 216-541-8060
† Ideal Precision Meter, Brooklyn, NY 11222 212-383-6904
Jewell Electrical Instruments, Manchester, NH 03108-4038 603-669-6400
Ledtronics, Inc., Torrance, CA 90505 213-549-9995
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Love Controls Corp., Wheeling, IL 60090 312-541-3232
§ Lumex Opto/Comps., Inc., Palatine, IL 60067 312-359-2790
§ Modutec, Manchester, NH 03103 603-669-5121
NEI Ferranti-Packard Electronics, Mississauga, Ont, CANADA L4W 2P1 416-624-3020
† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
§ Ragen Data Systems, Inc., Central Islip, NY 11722 516-234-3800
Sensitive Research Instruments, Mt. Vernon, NY 10550 914-699-9717
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430 201-529-8757
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200
§ Sunshine Scientific Instruments, Philadelphia, PA 19115 215-673-5600
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

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Control Technology Co., Inc., Long Island City, NY 11101, 718-361-2133 ..... **D•2247**
Disc Instruments, Honeywell, Costa Mesa, CA 92626, 714-433-0343 ..... **B•1949-1950**
Dixson, Inc., Grand Junction, CO 81503, 303-242-8863 (ext 223) ... **D•1381,1383**
Servo-Tek Products Co., Hawthorne, NJ 07506, 201-427-3100 ..... **B•1302**
§ Action Instruments, San Diego, CA 92123 619-279-5726
† AEMC Corporation, Boston, MA 02111 ..... 617-451-0227;800-343-1391
Airpax Co., Sensor Div., A Division of North American Philips Corp., Cheshire, CT 06410 203-272-0301
† Ametek, Inc., Mansfield & Green Div., Largo, FL 34643 813-536-7831
§ Analogic Corp., Peabody, MA 01961 508-977-3000
† Atec, Inc., Houston, TX 77055 713-468-7971
Beede Electrical Instrument Co., Inc., Penacook, NH 03303 603-753-6362
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
§ Biddle Instruments, Blue Bell, PA 19422 215-646-9200
§ Bindicator, Port Huron, MI 48061-0009 313-987-2700
§ Chessell Corp., Newtown, PA 18940 215-968-0660
Controlex, Inc., New Boston, NH 03070 603-487-5512
Crompton Instruments, Inc., Glendale Heights, IL 60139 312-351-9888
Crompton Instrs., Hawker Siddley, Elk Grove Village, IL 60007 312-593-1107
§ C-Tek Inc., Wakefield, MA 01880 617-246-1720
Digitec, Marion, OH 43302 614-387-3444
§ Dynapar, Gurnee, IL 60031 312-662-2666
Eldec Corp., Monitor & Control Div., Lynnwood, WA 98046-0100 206-743-1313
† Electric Tachometer, Philadelphia, PA 19142 215-726-7723
Esterline Angus Instrument Corp., Indianapolis, IN 46224 317-244-7611
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
† Faria, Thomas G., Corp., Uncasville, CT 06382-0983 203-848-9271
Harrel, Inc., E. Norwalk, CT 06855 203-866-2573
† Howell Instruments, Ft. Worth, TX 76107 817-336-7411
§ IVO Industries, Inc., Eatontown, NJ 07724 ..... 201-542-5151;800-932-0489
Jewell Electrical Instruments, Manchester, NH 03108-4038 603-669-6400
§ Jumo Process Control, Inc., Bergenfield, NJ 07621 201-501-0060
Mag-Con, St. Paul, MN 55113 612-633-8820
Metrix Instrument Co., Houston, TX 77043 713-461-2131
§† NES, Inc. (Nationwide Electronic Systems), Carpentersville, IL 60110 312-426-5900
PPM, Inc., Cleveland, OH 44139 216-349-2300
§ Ragen Data Systems, Inc., Central Islip, NY 11722 516-234-3800
Richard-Lee Co., Cranford, NJ 07016 201-276-0710
SGS-THOMSON Microelectronics, Phoenix, AZ 85022 602-867-6100
† Stemco Instruments, Colt Industries, Longview, TX 75607 214-643-3236
§ Sunshine Scientific Instruments, Philadelphia, PA 19115 215-673-5600
† Teledyne Gurley, Troy, NY 12181 518-272-6300
§ Torq Corp., Bedford, OH 44146 216-232-4100
§ Westberg Manufacturing Inc. (WESTACH), Sonoma, CA 95476 707-938-2121
Westronics Inc. of Texas, Ft. Worth, TX 76161 817-625-2311

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Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... **D•1015,1331**
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Acurex Corp./Autodata Div., Mountain View, CA 94039 415-967-9100
Advanced Techn. Research Labs., Alexandria, VA 22312 703-750-2920
Analogic Corp., Peabody, MA 01961 508-977-3000

§† Anritsu Meter Co. of America, Franklin Lakes, NJ 07417 201-848-0033
† Atec, Inc., Houston, TX 77055 713-468-7971
§ Athena Controls, Inc., Plymouth Meeting, PA 19462 215-828-2490
§† Bailey Controls Co., Div. of Babcox & Wilcox, Wickliffe, OH 44092 216-585-8500
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
Biddle Instruments, Blue Bell, PA 19422 215-646-9200
§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
C.G. Instruments, Dayton, OH 45459 513-434-7643
§ Chessell Corp., Newtown, PA 18940 215-968-0660
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§ EDL, Inc., Hauppauge, NY 11788 ..... 516-435-2808;1-800-DIAL EDL
Eldec Corp., Monitor & Control Div., Lynnwood, WA 98046-0100 206-743-1313
§ Everest Interscience, Inc., Fullerton, CA 92634-3640 714-992-4461
§ Extech Instruments Corp., Waltham, MA 02154 617-890-7440
§ FENWAL INC., Ashland, MA 01721 508-881-2000
§† Fenwal Electronics/APD, Kidde, Inc., Milford, MA 01757 508-478-6000
Fuji Electric Corp. of America, Los Angeles, CA 90017 213-622-4490
§† Gordon Co.:Watlow, Richmond, IL 60071 815-678-2211
Gould Inc., Recording Systems Division, Cleveland, OH 44114 216-361-3315
† Harrel, Inc., E. Norwalk, CT 06855 203-866-2573
† Howell Instruments, Ft. Worth, TX 76107 817-336-7411
§ IR Scientific, Carlisle, MA 01741 508-667-7110
§ Jumo Process Control, Inc., Bergenfield, NJ 07621 201-501-0060
Keystone Carbon, Thermistor Div., St. Marys, PA 15857 814-781-1591
† Lake Shore Cryotronics, Inc., Westerville, OH 43081 614-891-2243
Leeds & Northrup, General Signal, North Wales, PA 19454 215-699-2000
§ Love Controls Corp., Wheeling, IL 60090 312-541-3232
3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
Metrix Instrument Co., Houston, TX 77043 713-461-2131
§ National Controls Corp., W. Chicago, IL 60185 312-231-5900
§ Pacific Transducer Corp., Los Angeles, CA 90064 213-478-1134
PPM, Inc., Cleveland, OH 44139 216-349-2300
Princo Instruments, Inc., Southampton, PA 18966
Richards, Arklay S., Co., Inc., Newton Highlands, MA 02161-1793 617-527-4385
† Rustrak Instruments, Mark IV Company, E. Greenwich, RI 02818 ..... 401-884-6800; 800-332-3202
§ Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108 800-628-8862
§ Sunshine Scientific Instruments, Philadelphia, PA 19115 215-673-5600
§ Tempil Div., Big Three Inds., S. Plainfield, NJ 07080 201-757-8300
† Transicoil Inc., Penn Airborne Products, Southampton, PA 18966 215-355-3400
§ United Electric Controls, Watertown, MA 02172 617-926-1000
§ West Instrument, A Mark IV Company, Schiller Park, IL 60176 312-678-6400

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† **Airpax Co., Cheshire Div., Cheshire, CT 06410, 203-271-6000** ..... **D•1137**
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FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... **B•1367**
† **Mineico Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261** .. **B•1175**
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Biddle Instruments, Blue Bell, PA 19422 215-646-9200
Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Current Ring Co. Inc., Ballwin, MO 63011 800-325-8653
Ledtronics, Inc., Torrance, CA 90505 213-549-9995
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
§† VCH Incorporated, Chicago Miniature, Buffalo Grove, IL 60089 312-459-3400

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§ American Laser Systems, Inc., Goleta, CA 93117 805-967-0423
Burleigh Instruments, Fishers, NY 14453 716-924-9355
§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
§† Casso-Solar, Pomona, NY 10970 914-354-2500
† Cincinnati Elctrns., Cincinnati, OH 45241 513-733-6100
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
† Diversified Optical Products, Inc., Diversified Optical Corp., Salem, NH 03079 603-898-1880
§ EDL, Inc., Hauppauge, NY 11788 ..... 516-435-2808;1-800-DIAL EDL
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
ElectroPhysics Corp., Nutley, NJ 07110 201-667-2262
ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549 914-241-1008
§ Everest Interscience, Inc., Fullerton, CA 92634-3640 714-992-4461
† Glenro, Inc., Paterson, NJ 07501 ..... 201-279-5900;800-922-0106
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
† IR Scientific, Carlisle, MA 01741 508-667-7110
§† Mikron Instr., Wyckoff, NJ 07481 201-891-7330
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192 818-341-5151
† Radiometrics, Inc., Huntsville, AL 35803 205-881-1272
† Scientific Technologies, Optical Sensor Div. Inc., Hayward, CA 94544 ... 415-471-9717
§ S. F. Products Corporation, Southport, CT 06490 203-929-6180
§† UTI Instruments Co., Milpitas, CA 95035-2008 408-945-1955
§† Xedar Corp., Boulder, CO 80301 303-443-6441

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Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... **B•1218-1219**
Dubbeldee Harris Diamond Corp.:D. Drukker & Zn. N.V., Mt. Arlington, NJ 07856 201-770-1420
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
† Foundation Instruments Inc., Nepean, ON, CANADA K2E 7J6 613-226-4000
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
† INTELCO, Acton, MA 01720 508-264-4485
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ Paladin Corp., Newbury Park, CA 91320 805-499-0318

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Dymec Silicon Transistor Corp., Winchester, MA 01890, 617-729-7870 ..... **B•1206-1207**
† **Ross Engineering Corp., Campbell, CA 95008, 408-377-4621** ..... **B•1615**
Biddle Instruments, Blue Bell, PA 19422 215-646-9200
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
† Fibronics International Inc., Communications Way, Hyannis, MA 02601-1892 508-778-0700
† Galileo Electro-Optics Corp., Sturbridge, MA 01566 508-347-9191
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† INTELCO, Acton, MA 01720 508-264-4485
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
Rehlander Assocs., Beverly, MA 01915 617-922-5961
§ SC Technology, Inc., Livermore, CA 94550 415-373-9230
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
U.S. Instr. Rentals, San Mateo, CA 94403 800-824-2873
Volpi-MFG-USA, Auburn, NY 13021 315-255-1737
Welch Allyn, Inc., Industrial Products Division, Skaneateles Falls, NY 13153-0187 315-685-8945

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A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
† Colorado Video, Inc., Boulder, CO 80306 303-530-9580
§ Data Translation, Inc., Marlboro, MA 01752 508-481-3700
† EEV Inc., Elmsford, NY 10523 914-592-6050
ElectroPhysics Corp., Nutley, NJ 07110 201-667-2262
General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
Interelectronics Corp., Congers, NY 10920 ..... 914-EL8-8000
† Litton Electron Devices, San Carlos, CA 94070 415-591-8411
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§† Varo Electron Devices:An Imo Inds. Co., Garland, TX 75046 214-487-4129

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K-Tronics, K. T. Elctrns. Inc., Sunnyvale, CA 94086, 1-800-888-ELCO ... B•1375
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§ Ericson Manufacturing Co., Willoughby, OH 44094 216-951-8000
† Square D Co., Palatine, IL 60067 312-397-2600
§ Syracuse Electronics, Pass & Seymour, Inc., Syracuse, NY 13221 315-468-6211

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§ Clairex Electronics, Clairex Corporation, Mt. Vernon, NY 10550, 914-664-6602 ..... B•1320
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§ Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1340-1343
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
§ General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
§† Optek Technology Inc., McKinney, TX 75069 214-542-9461
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
Texas Instruments, Data/Image Sensing (Opto), Dallas, TX 75265 214-995-6611

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NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1325-1326,1330-1332
§ Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1340-1343
† Atlantic Solar Products, Baltimore, MD 21237 ..... 301-686-2500;800-237-6527
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707

Interrupters, Power-4300

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§ Electronic Specialists, Natick, MA 01760 ..... 617-655-1532;800-225-4876
† LSI Jennings, San Jose, CA 95122-2696 408-292-4025
Marway Prods. Inc., Santa Ana, CA 92703 714-973-1800
Mechanical Products Inc., Jackson, MI 49204 517-782-0391
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621
Schaffner EMC, Inc., Instr. Div., Union, NJ 07083 ..... 201-851-0644;800-367-5566

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§ Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1335
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
§ A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
§ APEC Fiber Optics Corp., College Station, TX 77840 409-693-5397
AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
† Atlantic Solar Products, Baltimore, MD 21237 ..... 301-686-2500;800-237-6527
† Dionics, Westbury, NY 11590 516-997-7474
§ FDK America, Inc., Fuji Electrochemical Co., Ltd., Cerritos, CA 90701 213-404-1770
§ General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ Lumex Opto/Comps., Inc., Palatine, IL 60067 312-359-2790
§† MERET, Inc., Santa Monica, CA 90404-4998 213-828-7496
§† Motorola Semiconductor Prods. Sector, Phoenix, AZ 85018-6606 602-244-6900
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Optek Technology Inc., McKinney, TX 75069 214-542-9461
§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
Opto 22, Huntington Bch., CA 92649 714-891-5861
§† Quality Technologies, Palo Alto, CA 93404 415-493-0400
§† Raytheon Co., Quincy, MA 02169 617-479-5300
Rehlander Assocs., Beverly, MA 01915 617-922-5961
† Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
† Silonex Inc., Plattsburgh, NY 12901 518-561-3160
SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
§† Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077
§† Texas Instrs., Inc., Dallas, TX 75380 ..... 800-232-3200 (ext 700)
§ Texas Instruments, Data/Image Sensing (Opto), Dallas, TX 75265 214-995-6611

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§ **Concord Electronics Corporation, New York, NY 10012, 1-212-777-6571** ..... **C•1313**
† **Daburn Electronics & Cable Corp., Northvale, NJ 07647, 201-768-5400** .. **C•1848**
Jolo Industries, Inc., Garden Grove, CA 92643, 714-554-6840 ..... **C•1395**
§ **Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700** ..... **C•1535-1536**
Texas Instruments, Connector System, Attleboro, MA 02703, 508-699-5269;508-699-3450 ..... **C•1543**
U.S. Terminals, Cincinnati, OH 45243, 513-561-8145 ..... **C•1557**
† Accurate Electronics, Elyria, OH 44036 216-366-6330
† ADC Telecommunications, Inc., Minneapolis, MN 55435 612-835-6800
Autoswage Products, Shelton, CT 06484 203-929-1401
† DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011 212-691-9050
§† M/A-COM Omni Spectra, Inc., Merrimack, NH 03054 603-424-4111
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
† Trompter Electronics, Inc., Sterling Holding, Westlake Village, CA 91359-5069 818-707-2020

Jammers (MIL)-2440

† American Electronic Laboratories, Inc., Lansdale, PA 19446 215-822-2929
† Cincinnati Elctrns., Cincinnati, OH 45241 513-733-6100
† Litton Electron Devices, San Carlos, CA 94070 415-591-8411
† Lockheed Electronics Co., Inc., Lockheed Corporation, Plainfield, NJ 07061 201-757-1600
† Signatron, A Unit of Sundstrand Corp., Lexington, MA 02173 617-861-1500
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Jamming Systems (MIL)-2440

† American Electronic Laboratories, Inc., Lansdale, PA 19446 215-822-2929
§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
† E-Systems, Greenville Div., Greenville, TX 75401 214-455-3450
† Signatron, A Unit of Sundstrand Corp., Lexington, MA 02173 617-861-1500
† Tracor Flight Systems, Inc., Tracor, Inc., A Westmark Co., Santa Ana, CA 92705 714-662-0333
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Jigs And Fixtures, Chassis & Circuit Board-4100 — *See Vol. D*

Joint Compounds, Semiconductor — See Coatings, Compounds, Lubricants, etc., Heat Conductive (Vol. C)

Joints, Rotary, Fiber Optic-2475

Adams Rite Products, Inc., Glendale, CA 91204 818-241-5121
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 703-953-4751
§ 3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683

Joints, Rotary, Microwave-3450 — *See Vol. A*

Joysticks — See Controls, Computer Input (Vol. D)

Joysticks, Inductive-2200 — *See Vol. D*

Joysticks, Potentiometer-2200 — *See Vol. D*

Joystick, Toggle Switch-2200 — *See Vol. D*

Jumpers, Bonding-2100 — *See Vol. C*

Jumpers, Circuit Board-2100 — *See Vol. C*

Jumpers, Wire, Terminated — See Cords, Patch (Vol. C)

Junctions, Hybrid, Microwave-3450 — *See Vol. A*

Keyboard Legends and Symbols-5150

Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... **B•1860**
Flex-Key Corp., Sub. of Astronics Corp., Gloucester, MA 01930, 508-281-2040 ..... **B•1863**
Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... **B•1864-1865**
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010, 415-347-8217 .... **B•1867**
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... **B•1868-1869**
Lucas Duralith Corporation, Millville, NJ 08332, 609-825-6900 ..... **B•1873**
§ **Mechanical Enterprises, Herndon, VA 22070, 703-435-9496** ..... **B•1801,1877**
MOLEX, Inc., Lisle, IL 60532, 312-969-4550 ..... **B•1815**
† **Orbit Instrument of Cal., Cypress, CA 90630, 714-527-0561** ..... **B•1881**
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 312-438-4000 ..... **B•1882**
† **Risk, George, Inds., Kimball, NE 69145, 308-235-4645** ..... **B•1883**
Veetronix, Inc., Lexington, NE 68850, 308-324-4600 ..... **B•1853**
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Arkay Engravers, Inc., Ronkonkoma, NY 11779 516-467-7795
† Barrington Plastics, Mt. Laurel, NJ 08054 609-235-5151
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
Conductive Rubber Technology, Santa Barbara, CA 93103 805-965-6511
Control Displays, Inc., Colmar, PA 18915 215-822-3383
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403 ..... 612-375-9639;800-826-8719
§ Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
ITW Cortron, Illinois Tool Works, Elmhurst, IL 60126 312-279-9110
Mantex Corp., Oxford, MI 48051 313-628-8200
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
Plasticorp, Harbor City, CA 90710 213-539-9530

Keyboards, Address Encoded-5150

§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500** ..... **B•1859**
† **Flex-Key Corp., Sub. of Astronics Corp., Gloucester, MA 01930, 508-281-2040** ..... **B•1863**
Mechanical Enterprises, Herndon, VA 22070, 703-435-9496 ..... **B•1801,1876**
Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... **B•1880**
† **Orbit Instrument of Cal., Cypress, CA 90630, 714-527-0561** ..... **B•1881**
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 312-438-4000 ..... **B•1882**
† **Risk, George, Inds., Kimball, NE 69145, 308-235-4645** ..... **B•1883**
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 214-851-4005
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
ITW Cortron, Illinois Tool Works, Elmhurst, IL 60126 312-279-9110
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491
Mantex Corp., Oxford, MI 48051 313-628-8200
Maxi-Switch Co., Sub. of EECO, Minneapolis, MN 55433 612-755-7660
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
† SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960

Keyboards, Capacitive-5150

† **Amkey, Methuen, MA 01844, 508-975-5445** ..... **B•1856-1857**
Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... **B•1860**
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
§ Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683

Keyboards, Conductive Rubber-5150

Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119, 206-284-5475 ..... **B•1866**
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... **B•1868**
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
† AME Corporation, Towaco, NJ 07082-0195 201-263-1700
§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 214-851-4005
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
† Flex-Key Corp., Sub. of Astronics Corp., Gloucester, MA 01930 508-281-2040
Ghielmetti, Inc., Los Angeles, CA 90028-8770 213-463-5111
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
§ IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
§ Maxi-Switch Co., Sub. of EECO, Minneapolis, MN 55433 612-755-7660
OMNI Switch USA, Inc., Phoenix, AZ 85027 602-582-0629
Shin-Etsu Polymer America, Inc., Union City, CA 94587 415-475-9000
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960

Keyboards, Ferrite Core-5150

ITW Cortron, Illinois Tool Works, Elmhurst, IL 60126 312-279-9110
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491

Keyboards, Full Travel-5150

† **Amkey, Methuen, MA 01844, 508-975-5445** ..... **B•1856-1857**
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500** ..... **B•1859**
CTI Electronics, Stratford, CT 06497, 203-386-9779 ..... **D•1087**
§† **Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600** ..... **B•1860**
§ **Grayhill Inc., La Grange, IL 60525, 708-354-1040** ..... **B•1865**
§ **Mechanical Enterprises, Herndon, VA 22070, 703-435-9496** .. **B•1801,1876-1877**
§ **Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000** ..... **B•1880**
§ **Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 312-438-4000** ..... **B•1882**
Texas Instruments, Connector System, Attleboro, MA 02703, 508-699-5269;508-699-3450 ..... **B•1885**
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300

§ Alps Electric (USA), Inc., San Jose, CA 95134 ... 408-432-6000
§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 ... 214-851-4005
Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 ... 219-747-3121
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 ... 813-573-2525
† Capitol Switch Inc., Danbury, CT 06810 ... 203-744-3300
§ Cincinnati Electrosystems, Loveland, OH 45140 ... 513-831-6800
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
Conductive Rubber Technology, Santa Barbara, CA 93103 ... 805-965-6511
† Control Displays, Inc., Colmar, PA 18915 ... 215-822-3383
DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011 ... 212-691-9050
§ EECO Incorporated, Santa Ana, CA 92702-0659 ... 714-835-6000
Electronics Research Associates Inc., Winsted, CT 06098 ... 203-379-2731
† Flex-Key Corp., Sub. of Astronics Corp., Gloucester, MA 01930 ... 508-281-2040
§ Fujitsu of America, Santa Clara, CA 95054 ... 408-562-1000
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 ... 818-787-0311
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119 ... 206-284-5475
ITW Cortron, Illinois Tool Works, Elmhurst, IL 60126 ... 312-279-9110
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 ... 416-727-9491
§ Maxi-Switch Co., Sub. of EECO, Minneapolis, MN 55433 ... 612-755-7660
Noble U.S.A., Inc., Rolling Meadows, IL 60008 ... 312-364-6038
Shin-Etsu Polymer America, Inc., Union City, CA 94587 ... 415-475-9000
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 ... 714-996-0960
Spectra Lux Corp., Kirkland, WA 98034 ... 206-747-0560

Keyboards, Hard Contact-5150

† Amkey, Methuen, MA 01844, 508-975-5445 ... B•1856-1857
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ... B•1859
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ... B•1865
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ... B•1868
§ Mechanical Enterprises, Herndon, VA 22070, 703-435-9496 ... B•1801,1876
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 312-438-4000 ... B•1882
† Risk, George, Inds., Kimball, NE 69145, 308-235-4645 ... B•1883
Texas Instruments, Connector System, Attleboro, MA 02703, 508-699-5269;508-699-3450 ... B•1885
Advanced Input Devices, Coeur d'Alene, ID 83814 ... 208-765-8000
§ Alps Electric (USA), Inc., San Jose, CA 95134 ... 408-432-6000
§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 ... 214-851-4005
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 ... 219-747-3121
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 ... 813-573-2525
Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 ... 414-355-8300
† Capitol Switch Inc., Danbury, CT 06810 ... 203-744-3300
Eaton Corp./MSC Products, Costa Mesa, CA 92627 ... 714-642-2427
EECO Incorporated, Santa Ana, CA 92702-0659 ... 714-835-6000
† Flex-Key Corp., Sub. of Astronics Corp., Gloucester, MA 01930 ... 508-281-2040
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 ... 818-787-0311
ITW Cortron, Illinois Tool Works, Elmhurst, IL 60126 ... 312-279-9110
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 ... 416-727-9491
Marquardt Switches Inc., Cazenovia, NY 13035 ... 315-655-8050
§ Maxi-Switch Co., Sub. of EECO, Minneapolis, MN 55433 ... 612-755-7660
Oak Switch Systems, Crystal Lake, IL 60014 ... 815-459-5000
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 ... 714-996-0960
Spectra Lux Corp., Kirkland, WA 98034 ... 206-747-0560

Keyboards, Lighted-5150

† Flex-Key Corp., Sub. of Astronics Corp., Gloucester, MA 01930, 508-281-2040 ... B•1863
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ... B•1864-1865
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448 ... B•1870-1872
† Orbit Instrument of Cal., Cypress, CA 90630, 714-527-0561 ... B•1881
† Risk, George, Inds., Kimball, NE 69145, 308-235-4645 ... B•1883
Advanced Input Devices, Coeur d'Alene, ID 83814 ... 208-765-8000
§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 ... 214-851-4005
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 ... 813-573-2525
Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 ... 414-355-8300
† Capitol Switch Inc., Danbury, CT 06810 ... 203-744-3300
† Control Displays, Inc., Colmar, PA 18915 ... 215-822-3383
Ghielmetti, Inc., Los Angeles, CA 90028-8770 ... 213-463-5111
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119 ... 206-284-5475
† Interface Products, Inc., Oceanside, CA 92056 ... 619-945-0230
ITW Cortron, Illinois Tool Works, Elmhurst, IL 60126 ... 312-279-9110
Memtron Technologies, Inc., Frankenmuth, MI 48734 ... 517-652-2656;800-234-7525
OMNI Switch USA, Inc., Phoenix, AZ 85027 ... 602-582-0629
Shin-Etsu Polymer America, Inc., Union City, CA 94587 ... 415-475-9000
Spectra Lux Corp., Kirkland, WA 98034 ... 206-747-0560
† Stacoswitch, Costa Mesa, CA 92626 ... 714-549-3041
§ Topflight, York, PA 17404 ... 717-843-9901;800-233-9386

Keyboards, Low Profile-5150

§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ... B•1859
§† Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ... B•1860
† Flex-Key Corp., Sub. of Astronics Corp., Gloucester, MA 01930, 508-281-2040 ... B•1863
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ... B•1864-1865
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448 ... B•1871-1872
Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ... B•1880
† Orbit Instrument of Cal., Cypress, CA 90630, 714-527-0561 ... B•1881
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 312-438-4000 ... B•1882
§† Risk, George, Inds., Kimball, NE 69145, 308-235-4645 ... B•1883
Advanced Input Devices, Coeur d'Alene, ID 83814 ... 208-765-8000
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 ... 201-231-8300
§ Alps Electric (USA), Inc., San Jose, CA 95134 ... 408-432-6000
§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 ... 214-851-4005
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 ... 219-747-3121
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 ... 813-573-2525
Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 ... 414-355-8300
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011 ... 212-691-9050
† Eaton Corp./MSC Products, Costa Mesa, CA 92627 ... 714-642-2427
§ EECO Incorporated, Santa Ana, CA 92702-0659 ... 714-835-6000
§ Electronics Research Associates Inc., Winsted, CT 06098 ... 203-379-2731
§ Fujitsu of America, Santa Clara, CA 95054 ... 408-562-1000
Ghielmetti, Inc., Los Angeles, CA 90028-8770 ... 213-463-5111
† GM Nameplate, Inc., Seattle, WA 98119 ... 206-284-2200
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 ... 818-787-0311
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119 ... 206-284-5475
ITW Cortron, Illinois Tool Works, Elmhurst, IL 60126 ... 312-279-9110
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 ... 416-727-9491
§ Maxi-Switch Co., Sub. of EECO, Minneapolis, MN 55433 ... 612-755-7660
Memtron Technologies, Inc., Frankenmuth, MI 48734 ... 517-652-2656;800-234-7525
Moxness Products, Inc., Versa Technologies, Racine, WI 53405 ... 414-554-5050; 800-558-5706
NMB Technologies, Chatsworth, CA 91311 ... 818-341-3355
Noble U.S.A., Inc., Rolling Meadows, IL 60008 ... 312-364-6038
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 ... 714-996-0960
† Stacoswitch, Costa Mesa, CA 92626 ... 714-549-3041
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 ... 408-737-7683
§ Texas Instruments, Connector System, Attleboro, MA 02703 ... 508-699-5269; 508-699-3450
§ Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 ... 617-699-3800
† Transicoil, Inc., Worcester, PA 19490-9990 ... 215-277-1300

Keyboards, Membrane-5150

Bergquist, Minneapolis, MN 55435, 800-328-3882 ... B•1858
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ... B•1859
Electronics Research Associates Inc., Winsted, CT 06098, 203-379-2731 ... B•1861
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ... B•1868
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448 ... B•1870,1872
Lucas Duralith Corporation, Millville, NJ 08332, 609-825-6900 ... B•1873
Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 ... B•1878
MOLEX, Inc., Lisle, IL 60532, 312-969-4550 ... B•1815, C•1451
NMB Technologies, Chatsworth, CA 91311, 818-341-3355 ... B•1879
§ Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ... B•1880
PacTec, LaFrance Corp., Philadelphia, PA 19153, 215-365-8400 ... C•1068
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 312-438-4000 ... B•1882
Advanced Input Devices, Coeur d'Alene, ID 83814 ... 208-765-8000
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 ... 201-231-8300
§ Alps Electric (USA), Inc., San Jose, CA 95134 ... 408-432-6000
§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 ... 214-851-4005
† Barrington Plastics, Mt. Laurel, NJ 08054 ... 609-235-5151
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 ... 813-573-2525
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 ... 414-355-8300
† C.A.M. Graphics Co., Inc., Amityville, NY 11701 ... 516-842-3400
§ Cincinnati Electrosystems, Loveland, OH 45140 ... 513-831-6800
Conductive Rubber Technology, Santa Barbara, CA 93103 ... 805-965-6511
DOW SWITCH, Wilmington, MA 01887 ... 617-935-6395
§ EECO Incorporated, Santa Ana, CA 92702-0659 ... 714-835-6000
Endicott Research Group, Endicott, NY 13760 ... 607-754-9187
† Flex-Key Corp., Sub. of Astronics Corp., Gloucester, MA 01930 ... 508-281-2040
§ Fujitsu of America, Santa Clara, CA 95054 ... 408-562-1000
Ghielmetti, Inc., Los Angeles, CA 90028-8770 ... 213-463-5111
† GM Nameplate, Inc., Seattle, WA 98119 ... 206-284-2200
GTI/Circuits Div., Leesburg, IN 46538 ... 219-453-3261
The Hall Company, Urbana, OH 43078 ... 513-652-1376
† Hallmark Nameplate, Inc., Farmingdale, NY 11735 ... 800-645-9502
HMW Enterprises, Inc., Etters, PA 17319 ... 717-938-4691
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 ... 818-787-0311
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119 ... 206-284-5475
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ... 201-291-0500;800-631-2165
Mantex Corp., Oxford, MI 48051 ... 313-628-8200
Maxi-Switch Co., Sub. of EECO, Minneapolis, MN 55433 ... 612-755-7660
Methode Electronics, Inc., Chicago, IL 60656 ... 312-867-9600
§† Miller Dial Corp., El Monte, CA 91731 ... 818-444-4555
Moxness Products, Inc., Versa Technologies, Racine, WI 53405 ... 414-554-5050; 800-558-5706
OMNI Switch USA, Inc., Phoenix, AZ 85027 ... 602-582-0629
§ Schurter, Inc., Petaluma, CA 94952 ... 707-778-6311
† Sheldahl, Inc., Northfield, MN 55057 ... 507-663-8000
Shin-Etsu Polymer America, Inc., Union City, CA 94587 ... 415-475-9000
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 ... 714-996-0960
Texas Instruments, Connector System, Attleboro, MA 02703 ... 508-699-5269; 508-699-3450

Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800
§ Topflight, York, PA 17404 ..... 717-843-9901;800-233-9386

Keyboards, Modular-5150

§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1859
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1865
MOLEX, Inc., Lisle, IL 60532, 312-969-4550 ..... B•1815
Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1880
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1882
§† Risk, George, Inds., Kimball, NE 69145, 308-235-4645 ..... B•1883
Texas Instruments, Connector System, Attleboro, MA 02703, 508-699-5269;508-699-3450 ..... B•1885
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 214-851-4005
Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403 ..... 612-375-9639;800-826-8719
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
† Flex-Key Corp., Sub. of Astronics Corp., Gloucester, MA 01930 508-281-2040
Ghielmetti, Inc., Los Angeles, CA 90028-8770 213-463-5111
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
ITW Cortron, Illinois Tool Works, Elmhurst, IL 60126 312-279-9110
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366

Keyboards, Pad-5150

† Amkey, Methuen, MA 01844, 508-975-5445 ..... B•1856-1857
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1859
§ Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... B•1860
§ Electronics Research Associates Inc., Winsted, CT 06098, 203-379-2731 ..... B•1861
† Flex-Key Corp., Sub. of Astronics Corp., Gloucester, MA 01930, 508-281-2040 ..... B•1863
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1864-1865
§ Mechanical Enterprises, Herndon, VA 22070, 703-435-9496 ..... B•1801,1876
NMB Technologies, Chatsworth, CA 91311, 818-341-3355 ..... B•1879
§ Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1880
† Orbit Instrument of Cal., Cypress, CA 90630, 714-527-0561 ..... B•1881
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1882
§† Risk, George, Inds., Kimball, NE 69145, 308-235-4645 ..... B•1883
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 214-851-4005
† Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
Conductive Rubber Technology, Santa Barbara, CA 93103 805-965-6511
† Control Displays, Inc., Colmar, PA 18915 215-822-3383
Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
Ghielmetti, Inc., Los Angeles, CA 90028-8770 213-463-5111
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491
Mantex Corp., Oxford, MI 48051 313-628-8200
Maxi-Switch Co., Sub. of EECO, Minneapolis, MN 55433 612-755-7660
Memtron Technologies, Inc., Frankenmuth, MI 48734 ..... 517-652-2656;800-234-7525
MOLEX, Inc., Lisle, IL 60532 312-969-4550
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
Shin-Etsu Polymer America, Inc., Union City, CA 94587 415-475-9000
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960

Keyboards, Photo-optical-5150

§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525

Keyboards, Programmable-5150

† Amkey, Methuen, MA 01844, 508-975-5445 ..... B•1856-1857
Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1880
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
† Aydin Corp., Horsham, PA 19044 215-657-7510
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 312-360-3500
† Da-Tech Corp., Ivyland, PA 18974 215-322-9410
HMW Enterprises, Inc., Etters, PA 17319 717-938-4691
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491
Mors Technologies Inc., Mors Group-France, St. Laurent, Quebec, CANADA H4T 1A7 514-735-4411

Keyboards, Reed-5150

† Risk, George, Inds., Kimball, NE 69145, 308-235-4645 ..... B•1883
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
† Da-Tech Corp., Ivyland, PA 18974 215-322-9410
EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
Maxi-Switch Co., Sub. of EECO, Minneapolis, MN 55433 612-755-7660

Keyboards, Solid State-5150

† Amkey, Methuen, MA 01844, 508-975-5445 ..... B•1856-1857
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1859
ITW Cortron, Illinois Tool Works, Elmhurst, IL 60126 312-279-9110
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491

Keyboards, Wireless-5150

Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1859
Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... B•1860
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 214-851-4005
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600

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† Amkey, Methuen, MA 01844, 508-975-5445 ..... B•1856-1857
§† Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... B•1860
Electronics Research Associates Inc., Winsted, CT 06098, 203-379-2731 ..... B•1861
† Flex-Key Corp., Sub. of Astronics Corp., Gloucester, MA 01930, 508-281-2040 ..... B•1863
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119, 206-284-5475 ..... B•1866
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... B•1869
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448 ..... B•1870
† Orbit Instrument of Cal., Cypress, CA 90630, 714-527-0561 ..... B•1881
† Risk, George, Inds., Kimball, NE 69145, 308-235-4645 ..... B•1883
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
† Control Displays, Inc., Colmar, PA 18915 215-822-3383
§ Fujitsu of America, Santa Clara, CA 95054 408-562-1000
† GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
† Spectra Lux Corp., Kirkland, WA 98034 206-747-0560
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300

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Keypads-5150

§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... B•1692
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1859
§ Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... B•1860
† Flex-Key Corp., Sub. of Astronics Corp., Gloucester, MA 01930, 508-281-2040 ..... B•1863
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1864-1865
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010, 415-347-8217 .... B•1867
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... B•1868
§ Mechanical Enterprises, Herndon, VA 22070, 703-435-9496 .. B•1801,1876-1877
Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 ..... B•1878
MOLEX, Inc., Lisle, IL 60532, 312-969-4550 ..... B•1815
§ Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1880
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1882
† Risk, George, Inds., Kimball, NE 69145, 308-235-4645 ..... B•1883
§ Texas Instruments, Connector System, Attleboro, MA 02703, 508-699-5269;508-699-3450 ..... B•1885
Veetronix, Inc., Lexington, NE 68850, 308-324-4600 ..... B•1853
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
AME Corporation, Towaco, NJ 07082-0195 201-263-1700
Bowmar Instrument Corp., Aerospace Div., Ft. Wayne, IN 46809 219-747-3121
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
Conductive Rubber Technology, Santa Barbara, CA 93103 805-965-6511
† Control Displays, Inc., Colmar, PA 18915 215-822-3383
§ EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403 ..... 612-375-9639;800-826-8719
Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
Endicott Research Group, Endicott, NY 13760 607-754-9187
Grimes Company, Brea, CA 92621 714-671-3931
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
§ Keytek Keyboards Canada Inc., Aurora, Ontario, CANADA L4G 3W8 416-727-9491
Mantex Corp., Oxford, MI 48051 313-628-8200
Moxness Products, Inc., Versa Technologies, Racine, WI 53405 ..... 414-554-5050; 800-558-5706
OMNI Switch USA, Inc., Phoenix, AZ 85027 602-582-0629
Plasticorp, Harbor City, CA 90710 213-539-9530
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
Shin-Etsu Polymer America, Inc., Union City, CA 94587 415-475-9000
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800

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Kits, Fiber Optic-2475

§ **AMP, Harrisburg, PA 17105, 717-564-0100 ..... C•1157**
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
Contact East, N. Andover, MA 01845 508-682-2000
† Daniels Manufacturing Corp., Orlando, FL 32809 407-855-6161
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
† Foundation Instruments Inc., Nepean, ON, CANADA K2E 7J6 613-226-4000
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
† INTELCO, Acton, MA 01720 508-264-4485
§ 3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Optelecom, Inc., Gaithersburg, MD 20877 301-840-2121
Rehlander Assocs., Beverly, MA 01915 617-922-5961
§ Thomas & Betts Corporation, Bridgewater, NJ 08807 201-685-1600

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Kits, Shielding-4525 — *See Vol. C*

Kits, Terminal-2100 — *See Vol. C*

Kits, Training Aid-4200 — *See Vol. C*

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Knobs, Collet-2400 — *See Vol. C*

Knobs, Limit Stop-2400 — *See Vol. C*

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Labels, Coatings, Crayons, Pellets, etc., Temperature Indicating-5300

§ EDL, Inc., Hauppauge, NY 11788 ..... 516-435-2808;1-800-DIAL EDL
§ Everest Interscience, Inc., Fullerton, CA 92634-3640 714-992-4461
Omega Engineering, Stamford, CT 06907 800-826-6342
§† Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108 800-628-8862
§ Tempil Div., Big Three Inds., S. Plainfield, NJ 07080 201-757-8300

Labels, Pressure Sensitive, Adhesive-2400 — *See Vol. C*

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Laminates, Metal Clad (Including Copper)-2500 — *See Vol. C*

Laminates, Plastic Impregnated (Unclad)-2500 — *See Vol. C*

Laminates, Plastic (With Integral Heating Elements)-5300

Flexible Technologies Division, Arlon, Inc., E. Providence, RI 02914 800-556-7683
Hughes Aircraft Co., Microelctrns. Sys. Div., Irvine, CA 92715 714-752-3800
§ Identatronics, Inc., Elk Grove, IL 60007 ..... 312-437-2654;1-800-323-5403

Lamp Adapters-2460

Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ... B•1145,1147-1149
Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1167
Display Devices, Inc., Encinitas, CA 92024 619-753-0113
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630 312-792-2700

Lamp Assembly Color Filters, Lens Mountable-2460

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1128
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... B•1068,1073
§ **Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1158,1162**
Lamb Industries, Inc., Portland, OR 97225, 503-297-8878 ..... B•1164
Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1167
Marktech International Corp., Menands, NY 12204, 518-436-5865 ... B•1172-1173
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1832
§† **Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1198**
† AME Corporation, Towaco, NJ 07082-0195 201-263-1700
† APM-Hexseal, Englewood, NJ 07631 201-569-5700
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§† Ercona, Patchogue, NY 11772 516-758-0700
Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
† Lamptronix Co., Ltd., Crystal Lake, IL 60014 815-455-0400
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Lumex Opto/Comps., Inc., Palatine, IL 60067 312-359-2790
Oak Switch Systems, Crystal Lake, IL 60014 815-459-5000
Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Visual Communications Co., Inc., San Diego, CA 92126 619-549-6900

Lamp Drivers-2460

Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 .. B•1066-1067,1073
Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1158,1162
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
† Circuit Technology Inc., Farmingdale, NY 11735 516-293-8686
§ Data Display Products, Los Angeles, CA 90009 213-640-0442
IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
SGS-THOMSON Microelectronics, Phoenix, AZ 85022 602-867-6100
§† Silicon General, Garden Grove, CA 92641 714-898-8121
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532 803-393-5421
§† Teledyne Crystalonics, Teledyne Industries, Inc., Cambridge, MA 02140 617-491-1670

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Lamps, Arc-2460

§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
§ Christie Electric Corp., Gardena, CA 90248 213-715-1402
§ Control Laser Corp., Orlando, FL 32809 407-438-2500
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
EG&G, Inc., Electro-Optics Div., Salem, MA 01970 508-745-3200
§ Ericson Manufacturing Co., Willoughby, OH 44094 216-951-8000
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
§ GTE Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923 ... 617-777-1900
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
ILC Technology, Inc., Sunnyvale, CA 94089 408-745-7900
Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
§† Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
§ Lumex Opto/Comps., Inc., Palatine, IL 60067 312-359-2790
UVP, Inc., San Gabriel, CA 91778 818-285-3123
Voltarc Tubes, Fairfield, CT 06430 203-255-2633
Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, Deutenium-2460

§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372

Lamps, Edge Lighting, Panel-2460

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1128
§† **Lamptronix Co., Ltd., Crystal Lake, IL 60014, 815-455-0400 ..... B•1165**
Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016, 312-824-1188 ..... B•1171
Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1198
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
EG&G, Inc., Electro-Optics Div., Salem, MA 01970 508-745-3200
† Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
§† JKL Components Corporation, Pacoima, CA 91331 818-896-0019
Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
† LocTite Luminescent Sys., Inc., LocTite Corp., Lebanon, NH 03766 603-448-3444
Oak Switch Systems, Crystal Lake, IL 60014 815-459-5000
Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
† Spectra Lux Corp., Kirkland, WA 98034 206-747-0560
Wamco, Inc., Fountain Valley, CA 92708 714-545-5560

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AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ... B•1048-1049
† **Bonar Kard-O-Lite, Inc., King of Prussia, PA 19406, 215-277-2910 ..... B•1132**
Lamptronix Co., Ltd., Crystal Lake, IL 60014, 815-455-0400 ..... B•1165
§ **Lucas Duralith Corporation, Millville, NJ 08332, 609-825-6900 ..... B•1873**
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1832
DOW SWITCH, Wilmington, MA 01887 617-935-6395
† Durel Corporation, Affiliate of 3M & Rogers Corp., Tempe, AZ 85282 602-731-6200
† E-L Products Corp., Sub.of Astronics Co., E. Aurora, NY 14052 716-655-0800
Endicott Research Group, Endicott, NY 13760 607-754-9187
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119 206-284-5475

† LocTite Luminescent Sys., Inc., LocTite Corp., Lebanon, NH 03766 603-448-3444
Optrex/Satori, Torrance, CA 90505 213-378-9478
† UCE, Inc., Norwalk, CT 06854 203-838-7509
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Lamps, Exciter, Photographic-2460

† Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1149
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
§ GTE Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923 ... 617-777-1900
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
§ North American Philips Lighting, Hightstown, NJ 08520 609-448-4000
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, Flashtube-2460

EG&G, Inc., Electro-Optics Div., Salem, MA 01970 508-745-3200
Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
ILC Technology, Inc., Sunnyvale, CA 94089 408-745-7900
† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
† Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-2828
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Voltarc Tubes, Fairfield, CT 06430 203-255-2633
§ Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, Fluorescent-2460

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1128
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1145
§ JKL Components Corporation, Pacoima, CA 91331, 818-896-0019 ..... B•1163
† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1186
§ Shokai Far East, Ltd., Hartsdale, NY 10530, 914-681-0700 ..... B•1187
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
Electra-Tec, Impert Industries, Inc., Otsego, MI 49078 .... 800-225-3532;616-694-2058
§† Ericson Manufacturing Co., Willoughby, OH 44094 216-951-8000
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§† Luxo Lamp Corp., Port Chester, NY 10573 914-937-4433
§ Mann, Henry, Inc., Huntingdon Valley, PA 19006 215-355-7200
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
Voltarc Tubes, Fairfield, CT 06430 203-255-2633

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Lamps, Hollow Cathode-2460

§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
§ Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372

Lamps, Incandescent-2460

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1044
§ Dialight Corp., A Cambridge Elctrns. Inds. Co., Manasquan, NJ 08736, 201-223-9400 ..... B•1140-1141
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 .. B•1066-1069,1073
§† Electronics Research Associates Inc., Winsted, CT 06098, 203-379-2731 .... B•1075
† Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1146-1148
§ Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1160-1161
§ Inter-Market, Glenview, IL 60025, 312-729-5330 ..... B•1178
§† JKL Components Corporation, Pacoima, CA 91331, 818-896-0019 ..... B•1163
† Lamptronix Co., Ltd., Crystal Lake, IL 60014, 815-455-0400 ..... B•1165
† Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1167
Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459, 203-283-8261 .. B•1175
Oshino Electric Lamp Works, Ltd., Shinagawa-Ku, Tokyo, JAPAN, 03-471-8548 ..... B•1176-1177
† Oxley, Inc., Branford, CT 06405, 203-488-1033 ..... B•1179
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 .. B•1832-1833
§† Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122
† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1186
§ Shokai Far East, Ltd., Hartsdale, NY 10530, 914-681-0700 ..... B•1187
§ Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1188,1190-1195
Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1198
§† Sylvania Miniature Lighting, GTE Corporation, Hillsboro, NH 03244, 603-464-5533 ..... B•1152-1157
Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900 ..... B•1200-1203
Arcolectric Corp., Canoga Park, CA 91304 818-700-1933
Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
Communication Devices, Inc., Scarborough, Ont., CAN M1H3A4 416-439-6320
Data Display Products, Los Angeles, CA 90009 213-640-0442
Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† Ericson Manufacturing Co., Willoughby, OH 44094 216-951-8000
§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
GTE Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923 ... 617-777-1900
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
§ IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
§ Jensen Tools, Inc., Axia, Inc., Phoenix, AZ 85044 602-968-6241
Lamb Industries, Inc., Portland, OR 97225 503-297-8878
§ Ledco Div., St. Paul, MN 55107 612-222-2791
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016 312-824-1188
§† Lumex Opto/Comps., Inc., Palatine, IL 60067 312-359-2790
† Lumitron, Summit, NJ 07902-0267 201-273-8998
§† Luxo Lamp Corp., Port Chester, NY 10573 914-937-4433
§ Mann, Henry, Inc., Huntingdon Valley, PA 19006 215-355-7200
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
Micro Lamps Inc., Batavia, IL 60510 312-879-0900
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
Oak Switch Systems, Crystal Lake, IL 60014 815-459-5000
§† Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-2828
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
§† VCH Incorporated, Chicago Miniature, Buffalo Grove, IL 60089 312-459-3400
§† Wamco, Inc., Fountain Valley, CA 92708 714-545-5560
Welch Allyn, Inc., Industrial Products Division, Skaneateles Falls, NY 13153-0187 315-685-8945
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

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Lamps, Infrared-2460

† Oxley, Inc., Branford, CT 06405, 203-488-1033 ..... B•1179
A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
§† Casso-Solar, Pomona, NY 10970 914-354-2500
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
EG&G, Inc., Electro-Optics Div., Salem, MA 01970 508-745-3200
ElectroPhysics Corp., Nutley, NJ 07110 201-667-2262
Eraser Co., Syracuse, NY 13221 315-454-3237
Gamma Scientific Inc., San Diego, CA 92123 619-279-8034
Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
GTE Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923 ... 617-777-1900
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
ILC Technology, Inc., Sunnyvale, CA 94089 408-745-7900
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
† Ledtronics, Inc., Torrance, CA 90505 213-549-9995
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Lumex Opto/Comps., Inc., Palatine, IL 60067 312-359-2790
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ North American Philips Lighting, Hightstown, NJ 08520 609-448-4000
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
† OAL Associates, Inc., Escondido, CA 92025 619-743-7143
§† Optek Technology Inc., McKinney, TX 75069 214-542-9461
§ Opto Technology, Inc., Wheeling, IL 60090 312-537-4277
Scanning Devices, Inc., Waltham, MA 02154 617-891-8991
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§ Three-Five Sys., Inc., Phoenix, AZ 85201 602-496-0035
§† Vicon Industries, Inc., Melville, NY 11747 516-293-2200

Lamps, Krypton-2460

JKL Components Corporation, Pacoima, CA 91331, 818-896-0019 ..... B•1163
§ Shokai Far East, Ltd., Hartsdale, NY 10530, 914-681-0700 ..... B•1187
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
§† Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
§ Xenon Corp., Woburn, MA 01801 617-938-3594

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Lamps, Magnifying, Inspection-4100 — *See Vol. D*

Lamps, Mercury Vapor-2460

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1128
§ American Ultraviolet, Murray Hill, NJ 07974 201-665-2211
Aristo Grid Lamp Prods., Roslyn, NY 11576 516-484-6141
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
§ GTE Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923 ... 617-777-1900
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
§ North American Philips Lighting, Hightstown, NJ 08520 609-448-4000
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§† Spectronics Corp., Westbury, NY 11590 516-333-4840
UVP, Inc., San Gabriel, CA 91778 818-285-3123
Voltarc Tubes, Fairfield, CT 06430 203-255-2633

Lamps, Nanopulse-2460

Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, Neon-2460

§ Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... B•1130-1131
§ Dialight Corp., A Cambridge Elctrns. Inds. Co., Manasquan, NJ 08736, 201-223-9400 ..... B•1140-1141
† Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1145
§ Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1161-1162
§ Inter-Market, Glenview, IL 60025, 312-729-5330 ..... B•1178
§† JKL Components Corporation, Pacoima, CA 91331, 818-896-0019 ..... B•1163
§† Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122
† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1186
§ Shokai Far East, Ltd., Hartsdale, NY 10530, 914-681-0700 ..... B•1187
§ Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ... B•1188,1192-1193,1195
§† Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1198
§ Sylvania Miniature Lighting, GTE Corporation, Hillsboro, NH 03244, 603-464-5533 ..... B•1153
Altair Exchange Corporation, Northridge, CA 91324 ..... 818-701-6977;800-824-5620
Aristo Grid Lamp Prods., Roslyn, NY 11576 516-484-6141
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
Communication Devices, Inc., Scarborough, Ont., CAN M1H3A4 416-439-6320
§ Data Display Products, Los Angeles, CA 90009 213-640-0442
Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electro-Mech Components, Inc., South El Monte, CA 91733-3689 818-442-7180
§† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
International Mircoelectronics, Arlington, TX 76003 817-561-2244
§† Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
† Lamptronix Co., Ltd., Crystal Lake, IL 60014 815-455-0400
§ Ledco Div., St. Paul, MN 55107 612-222-2791
† Ledtronics, Inc., Torrance, CA 90505 213-549-9995
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016 312-824-1188
§ Lumex Opto/Comps., Inc., Palatine, IL 60067 312-359-2790
Micro Lamps Inc., Batavia, IL 60510 312-879-0900
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Oak Switch Systems, Crystal Lake, IL 60014 815-459-5000
Oshino Electric Lamp Works, Ltd., Shinagawa-Ku, Tokyo, JAPAN 03-471-8548
Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-2828
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
UVP, Inc., San Gabriel, CA 91778 818-285-3123
§† VCH Incorporated, Chicago Miniature, Buffalo Grove, IL 60089 312-459-3400
Voltarc Tubes, Fairfield, CT 06430 203-255-2633
Wamco, Inc., Fountain Valley, CA 92708 714-545-5560
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Lamps, Oil Tight-2460

§ Dialight Corp., A Cambridge Elctrns. Inds. Co., Manasquan, NJ 08736, 201-223-9400 ..... B•1140-1141
§ Ericson Manufacturing Co., Willoughby, OH 44094 216-951-8000
† Ledtronics, Inc., Torrance, CA 90505 213-549-9995
§† Oak Switch Systems, Crystal Lake, IL 60014 815-459-5000
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Square D Co., Palatine, IL 60067 312-397-2600
§† VCH Incorporated, Chicago Miniature, Buffalo Grove, IL 60089 312-459-3400

Lamps, Press-to-Test-2460

§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
§† Oak Switch Systems, Crystal Lake, IL 60014 815-459-5000
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Square D Co., Palatine, IL 60067 312-397-2600

Lamps, Projection-2460

§ Alan Gordon Entprs., Inc., N. Hollywood, CA 91601 818-985-5500
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
§ Christie Electric Corp., Gardena, CA 90248 213-715-1402
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§ Ercona, Patchogue, NY 11772 516-758-0700
§ Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
§ GTE Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923 ... 617-777-1900
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
Lamb Industries, Inc., Portland, OR 97225 503-297-8878
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
† Lamptronix Co., Ltd., Crystal Lake, IL 60014 815-455-0400
§ North American Philips Lighting, Hightstown, NJ 08520 609-448-4000
§† Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
§ Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700

Lamps, Solid State — See Diodes, Light Emitting (Vol. B), Diodes, Liquid Crystal (Vol. B)

Lamps, Stroboscopic Source-2460

Alpha-M Corp., Dallas, TX 75229 214-406-0424
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
EG&G, Inc., Electro-Optics Div., Salem, MA 01970 508-745-3200
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229 503-641-4141
Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, Tritium (Hydrogen 3) Powered-2460

† NRD Inc., Subsidiary of Mark IV Inds., Inc., Grand Island, NY 14072, 716-773-7634 ..... D•2244

Lamps, Tungsten Halogen-2460

AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1049
† Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1148-1149
Altair Exchange Corporation, Northridge, CA 91324 ..... 818-701-6977;800-824-5620
American Ultraviolet, Murray Hill, NJ 07974 201-665-2211
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
Communication Devices, Inc., Scarborough, Ont., CAN M1H3A4 416-439-6320
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
Gamma Scientific Inc., San Diego, CA 92123 619-279-8034
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
§ GTE Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923 ... 617-777-1900
§ JKL Components Corporation, Pacoima, CA 91331 818-896-0019
§† Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
† Lamptronix Co., Ltd., Crystal Lake, IL 60014 815-455-0400
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ North American Philips Lighting, Hightstown, NJ 08520 609-448-4000
§† Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
§ Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
Welch Allyn, Inc., Industrial Products Division, Skaneateles Falls, NY 13153-0187 315-685-8945

Lamps, Ultraviolet-2460

JKL Components Corporation, Pacoima, CA 91331, 818-896-0019 ..... B•1163
§ American Ultraviolet, Murray Hill, NJ 07974 201-665-2211
Aristo Grid Lamp Prods., Roslyn, NY 11576 516-484-6141
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
† Clean Room Prods., Ronkonkoma, NY 11779-6528 516-588-7000
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
EG&G, Inc., Electro-Optics Div., Salem, MA 01970 508-745-3200
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
GTE Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923 ... 617-777-1900
Hamamatsu Corporation, Bridgewater, NJ 08807 201-231-0960
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
§ Luxo Lamp Corp., Port Chester, NY 10573 914-937-4433
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§† Spectronics Corp., Westbury, NY 11590 516-333-4840
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
§ UVP, Inc., San Gabriel, CA 91778 818-285-3123
Vactronic Lab. Equip. Inc., Bohemia, NY 11716 516-567-0520
Voltarc Tubes, Fairfield, CT 06430 203-255-2633
§ Xenon Corp., Woburn, MA 01801 617-938-3594

Lamps, Xenon-2460

§† JKL Components Corporation, Pacoima, CA 91331, 818-896-0019 ..... B•1163
§ Shokai Far East, Ltd., Hartsdale, NY 10530, 914-681-0700 ..... B•1187
§ Alan Gordon Entprs., Inc., N. Hollywood, CA 91601 818-985-5500
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
§ Christie Electric Corp., Gardena, CA 90248 213-715-1402
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
EG&G, Inc., Electro-Optics Div., Salem, MA 01970 508-745-3200
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229 503-641-4141
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
GTE Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923 ... 617-777-1900
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
ILC Technology, Inc., Sunnyvale, CA 94089 408-745-7900
† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
§ Lumex Opto/Comps., Inc., Palatine, IL 60067 312-359-2790
§ North American Philips Lighting, Hightstown, NJ 08520 609-448-4000
§† Precision Lamp, Inc., Cotati, CA 94931 707-792-0333
UVP, Inc., San Gabriel, CA 91778 818-285-3123
Xenon Corp., Woburn, MA 01801 617-938-3594

LANs — See Networks, Computer, Local Area (Vol. D)

Laser Systems-4100 — ***See Vol. D***

Laser Components & Laser Accessories-3700

† Analog Modules, Inc., Longwood, FL 32750, 407-339-4355 ..... D•1004
Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4, 613-226-5772 ..... D•1220
Advanced Kinetics, Costa Mesa, CA 92627 714-646-7165
§ Aerotech, Inc., Pittsburgh, PA 15238 412-963-7470
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
§ Apollo Lasers, Inc., Chatsworth, CA 91311 818-407-3000
AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§ Atomergic Chemetals Corp., Farmingdale, NY 11735-1527 516-694-9000
§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
Burleigh Instruments, Fishers, NY 14453 716-924-9355
Chicago Laser Systems, Inc., Chicago, IL 60634 312-282-2710

† Cleveland Crystals, Euclid, OH 44117 216-486-6100
† Coherent General, Inc., Sturbridge, MA 01566 508-347-2681
† Coherent, Inc., Palo Alto, CA 94303 415-493-2111
Computer Peripherals Inc., Newbury Pk, CA 91320 ..... 805-499-5751;800-854-7600
† Control Laser Corp., Orlando, FL 32809 407-438-2500
† Diversified Optical Products, Inc., Diversified Optical Corp., Salem, NH 03079 603-898-1880
† D. O. Industries, Rochester, NY 14623 716-359-4000
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
EG&G, Inc., Electronics Components Div., Salem, MA 01970 508-745-3200
† Electric Motor Engineering, Glendale, CA 91201 818-502-1866
ElectroPhysics Corp., Nutley, NJ 07110 201-667-2262
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229 503-641-4141
Eltec Instruments Inc., Daytona Bch., FL 32020 904-253-5328
GTE Government Systems Corp., Mountain View, CA 94039 415-966-2000
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Hitachi America, Ltd., San Jose, CA 95131 408-435-8300
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009 ... 619-931-3000
† KLC/Karl Lambrecht Corp., Chicago, IL 60618 312-472-5442
† Kontes, Kimble Div. of Owens/IL, Vineland, NJ 08360 609-692-8500
§† Laser Concepts, Omega Organization Intl., Seattle, WA 98133 206-364-7881
Lincoln Laser Co., Phoenix, AZ 85004 602-257-0407
§ Macrodyne, Schenectady, NY 12301 518-356-3500
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
§† MERET, Inc., Santa Monica, CA 90404-4998 213-828-7496
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
Noll, J. A. Co., Monroeville, PA 15146 412-733-1089
Photon, Inc., Los Gatos, CA 95030 408-354-5600
Power Technology, Inc., Little Rock, AR 72219 501-568-1995
Quantronix, Smithtown, NY 11788 516-273-6900
Raytheon Co., Laser Products, Quincy, MA 02169 617-479-5300
Recognition Technology, Inc., Westborough, MA 01581 617-366-4800
§ RMF Products, Inc., Batavia, IL 60510 312-879-0020
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430 201-529-8757
Spiricon, Inc., Logan, UT 84321 801-753-3729
Staffall Inc., Cranston, RI 02910 401-461-5554
§ Sun Research, Inc., New Durham, NH 03855 603-859-7110
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
† Union Carbide Corporation, Industrial Chemicals Div., Crystal Products Dept., San Diego, CA 92123 619-279-4500
† U. S. Laser Corp., Wyckoff, NJ 07481 201-848-9200
Xenon Corp., Woburn, MA 01801 617-938-3594

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Latches, Panels & Cabinets-2400 — *See Vol. C*

LCDs — See Diodes, Liquid Crystal (Vol. B)

Lead Assemblies, High Voltage-Also See Connectors; Cable Assemblies & Harnesses-6000 — *See Vol. C*

Lead Preparation Equipment, Surface Mount-4100 — *See Vol. D*

Leads, Test & Adapters-2900 — *See Vol. D*

LEDs — See Diodes, Light Emitting (LEDs) (Vol. B)

Light Emitting Diodes (LEDs), Surface/Mount-3700

Clairex Electronics, Clairex Corporation, Mt. Vernon, NY 10550, 914-664-6602 ..... B•1320
Dialight Corp., A Cambridge Elctrns. Inds. Co., Manasquan, NJ 08736, 201-223-9400 ..... B•1139
§ Everlight - USA, Glendora, CA 91740, 213-697-5067 ..... B•1143
§ Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1086,1166
IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1754
§ Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1158-1159
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
§ EPD Electronics, Inc., Gardena, CA 90247 213-515-4996
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
International Mircoelectronics, Arlington, TX 76003 817-561-2244
Ledtronics, Inc., Torrance, CA 90505 213-549-9995
§† Lumex Opto/Comps., Inc., Palatine, IL 60067 312-359-2790
Mouser Electronics, Mansfield, TX 76063 800-346-6873
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Rohm Corporation, Irvine, CA 92718 714-855-2131
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
§ Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430 201-529-8757
§ Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ Three-Five Sys., Inc., Phoenix, AZ 85201 602-496-0035
Topflight, York, PA 17404 ..... 717-843-9901;800-233-9386
§ Visual Communications Co., Inc., San Diego, CA 92126 619-549-6900

Lenses, Filters, Windows, Infrared - Also see Filters, Color, Panel light; Lenses, Readout & Display-3700

IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1754
Oxley, Inc., Branford, CT 06405, 203-488-1033 ..... B•1179
† Balzers Optical Corporation, Marlboro, MA 01752 617-481-9860
Burleigh Instruments, Fishers, NY 14453 716-924-9355
Ceramaseal, New Lebanon, NY 12125 518-794-7800
† Cleveland Crystals, Euclid, OH 44117 216-486-6100
† Coherent, Inc., Palo Alto, CA 94303 415-493-2111
† Diversified Optical Products, Inc., Diversified Optical Corp., Salem, NH 03079 603-898-1880
† D. O. Industries, Rochester, NY 14623 716-359-4000
† Dontech, Inc., Doylestown, PA 18901 215-348-5010
Dubbeldee Harris Diamond Corp.:D. Drukker & Zn. N.V., Mt. Arlington, NJ 07856 201-770-1420
† Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§† Ercona, Patchogue, NY 11772 516-758-0700
§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
§ IR Scientific, Carlisle, MA 01741 508-667-7110
† JMJ Technical Prods., Newark, NJ 07105 201-589-4257
† KLC/Karl Lambrecht Corp., Chicago, IL 60618 312-472-5442
† Ledtronics, Inc., Torrance, CA 90505 213-549-9995
§ Lumex Opto/Comps., Inc., Palatine, IL 60067 312-359-2790
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
† Optima Precision, Inc., Rancho Palos Verdes, CA 90274 .. 800-544-4418;213-377-4118
† Plumer Precision Optics, Pennsburg, PA 18073 215-679-6272
§ RMF Products, Inc., Batavia, IL 60510 312-879-0020
† Saphikon, Inc., Milford, NH 03055 603-673-5831
Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-327-1282
Schott Electronics, Seymour, CT 06483 203-881-0102
Schott Glass Technologies, Inc., Duryea, PA 18642 717-457-7485
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ Visual Communications Co., Inc., San Diego, CA 92126 619-549-6900
§ Carl Zeiss, Inc., Thornwood, NY 10594 914-747-1800

Lenses, Optical & Camera-3700

Savoy Electronics, Inc., Ft. Lauderdale, FL 33310, 305-563-1333;800-327-1282 ..... A•1482
§ Alan Gordon Entprs., Inc., N. Hollywood, CA 91601 818-985-5500
† Balzers Optical Corporation, Marlboro, MA 01752 617-481-9860
† Coherent, Inc., Palo Alto, CA 94303 415-493-2111
† Diversified Optical Products, Inc., Diversified Optical Corp., Salem, NH 03079 603-898-1880
† D. O. Industries, Rochester, NY 14623 716-359-4000
† Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§† Ercona, Patchogue, NY 11772 516-758-0700
§ General Hardware Mfg., New York, NY 10013 212-431-6100
Heitz, Karl, Inc., Woodside, NY 11377 718-565-0004
† KLC/Karl Lambrecht Corp., Chicago, IL 60618 312-472-5442
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
† Plumer Precision Optics, Pennsburg, PA 18073 215-679-6272
Rolyn Optics Co., Covina, CA 91722-2199 ..... 818-915-5707/5717
Schott Glass Technologies, Inc., Duryea, PA 18642 717-457-7485
§ Stenning Instrments, Inc., Pacific Palisades, CA 90272 213-459-2930
§† Vicon Industries, Inc., Melville, NY 11747 516-293-2200
§ Carl Zeiss, Inc., Thornwood, NY 10594 914-747-1800

Lenses, Readout & Display - Also see Filters, Color, Panel light; Lenses, filters, Windows, Infrared-2450

IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1754
§ Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1158,1162
Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1167
Oxley, Inc., Branford, CT 06405, 203-488-1033 ..... B•1179
§ Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1188,1191-1195
§† Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1198
§ Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900 ..... B•1199-1203
Atlantic Optical Moulding, Webster, MA 01570 617-943-1746
† Balzers Optical Corporation, Marlboro, MA 01752 617-481-9860
Display Devices, Inc., Encinitas, CA 92024 619-753-0113
† Dontech, Inc., Doylestown, PA 18901 215-348-5010
§ Electro-Mech Components, Inc., South El Monte, CA 91733-3689 818-442-7180
§† Ercona, Patchogue, NY 11772 516-758-0700
§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
† JMJ Technical Prods., Newark, NJ 07105 201-589-4257
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Lucas Duralith Corporation, Millville, NJ 08332 609-825-6900
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
† Moldtronics, Inc., Downers Grove, IL 60515 312-968-7000
§ NOBEX Div., Griffith Plastics Corp., Burlingame, CA 94010 415-342-8170
Noll, J. A. Co., Monroeville, PA 15146 412-733-1089
Oak Switch Systems, Crystal Lake, IL 60014 815-459-5000
§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Polaroid Corporation, Polarizer Div., Norwood, MA 02062 800-225-2770
§ RMF Products, Inc., Batavia, IL 60510 312-879-0020
Rolyn Optics Co., Covina, CA 91722-2199 ..... 818-915-5707/5717
§ Shelly Associates, Inc., Tustin, CA 92680 714-669-9850
§† VCH Incorporated, Chicago Miniature, Buffalo Grove, IL 60089 312-459-3400

Lids, Hybrid Package-3130 — *See Vol. A*

Light Choppers-3700

Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034

† Electro-Optical Industries, Santa Barbara, CA 93130 ..... 805-964-6701 (ext. 280)
† Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 607-272-7640
† Millivac Instruments, Inc., Schenectady, NY 12301 518-355-8300
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
† Philamon, Inc., Farmingdale, NY 11735 516-249-2700
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040

Light Pens-2000 — *See Vol. D*

Light Sources, Fiber Optic - Also see Generators, Light Pulse-2475

AMP, Harrisburg, PA 17105, 717-564-0100 ..... C•1157
Berkeley Nucleonics Corp., Richmond, CA 94804, 415-234-1100 ..... D•1230
Fiberoptic Systems, Inc., Simi Valley, CA 93063, 805-583-2088 ..... B•1205
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1324
† Advantest America, Inc., Lincolnshire, IL 60069 312-634-2552
Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
C.G. Instruments, Dayton, OH 45459 513-434-7643
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011 212-691-9050
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§ Efector, Inc., Exton, PA 19341 ..... 215-524-2000;800-441-8246
Fiberoptics Technology, Inc., Pomfret, CT 06258 ..... 203-928-0443, 800-433-5248
Fibronics International Inc., Communications Way, Hyannis, MA 02601-1892 508-778-0700
Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
† Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
† INTELCO, Acton, MA 01720 508-264-4485
§† Lamptronix Co., Ltd., Crystal Lake, IL 60014 815-455-0400
§† Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
§ Laser Precision Corp., Utica, NY 13502 315-797-4449
§ Lumex Opto/Comps., Inc., Palatine, IL 60067 312-359-2790
3 M Photodyne Inc., Camarillo, CA 93010 805-388-8378
Ortel Corp., Alhambra, CA 91803 818-281-3636
Rehlander Assocs., Beverly, MA 01915 617-922-5961
Schott Glass Technologies, Inc., Duryea, PA 18642 717-457-7485
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430 201-529-8757
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
U.S. Instr. Rentals, San Mateo, CA 94403 800-824-2873
Volpi-MFG-USA, Auburn, NY 13021 315-255-1737
Welch Allyn, Inc., Industrial Products Division, Skaneateles Falls, NY 13153-0187 315-685-8945
† Xenon Corp., Woburn, MA 01801 617-938-3594
† York Technology, Inc., Burbank, CA 91502 818-955-8927

Light Sources, Infrared - Also see Generators, Light Pulse-3700

Berkeley Nucleonics Corp., Richmond, CA 94804, 415-234-1100 ..... D•1230
§ Altech Corp., Somerville, NJ 08876 201-359-4454
† Analog Modules, Inc., Longwood, FL 32750 407-339-4355
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
C.G. Instruments, Dayton, OH 45459 513-434-7643
Data Instruments, Inc., Acton, MA 01720 508-264-9550
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
High Technology Sensors, Inc., Longwood, FL 32779 407-423-1755
§ IR Scientific, Carlisle, MA 01741 508-667-7110
§† Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
Ledtronics, Inc., Torrance, CA 90505 213-549-9995
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
Ortel Corp., Alhambra, CA 91803 818-281-3636
† Radiometrics, Inc., Huntsville, AL 35803 205-881-1272
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
Zexco, Van Nuys, CA 91401 818-997-7895

Light Sources, Photoelectric-3700

§ EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1321
§ Altech Corp., Somerville, NJ 08876 201-359-4454
† Ametek, Inc., Mansfield & Green Div., Largo, FL 34643 813-536-7831
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
§ Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§ Efector, Inc., Exton, PA 19341 ..... 215-524-2000;800-441-8246
FSI/Fork Standards, Inc., Lombard, IL 60148 ..... 312-231-3511;312-932-9380
§ Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192 818-341-5151
Rehlander Assocs., Beverly, MA 01915 617-922-5961
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Rodann Electronics Mfg. Co., Brea, CA 92621 714-529-1301
Scanning Devices, Inc., Waltham, MA 02154 617-891-8991
§ Scientific Technologies, Optical Sensor Div. Inc., Hayward, CA 94544 415-471-9717
§ Skan-A-Matic, Electro Corporation, Sarasota, FL 34230-3049 813-355-8411

Light Sources, Stroboscopic-3700

† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§ Sunshine Scientific Instruments, Philadelphia, PA 19115 215-673-5600
Vonco, Inc., Novi, MI 48050 313-344-0050
Xenon Corp., Woburn, MA 01801 617-938-3594

Light Sources, Ultraviolet-3700

Injectorall Electronics (Woman Owned), Bohemia, NY 11716, 516-563-3388 ..... C•1125
† American Ultraviolet, Murray Hill, NJ 07974 201-665-2211
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
Contact East, N. Andover, MA 01845 508-682-2000
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
§ Gates, Geo. W., & Co., Inc., Franklin Sq., NY 11010 516-352-2904
GTE Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923 617-777-1900
Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
§† Powertron Corp., Sparta, NJ 07871 201-579-5599
§† Spectronics Corp., Westbury, NY 11590 516-333-4840
† Stenning Instruments, Inc., Pacific Palisades, CA 90272 213-459-2930
§ UVP, Inc., San Gabriel, CA 91778 818-285-3123
Xenon Corp., Woburn, MA 01801 617-938-3594

Lights, Indicator-2460

Altair Exchange Corporation, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1042,1044
§ AND, William J. Purdy Co., Burlingame, CA 94010, 415-347-9916 ..... B•1129
§ Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... B•1130-1131
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492, 203-269-8701 ..... B•1694
§† Dialight Corp., A Cambridge Elctrns. Inds. Co., Manasquan, NJ 08736, 201-223-9400 ..... B•1133-1141
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... B•1073
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... B•1732
§† Electronics Research Associates Inc., Winsted, CT 06098, 203-379-2731 ..... B•1075
Everlight - USA, Glendora, CA 91740, 213-697-5067 ..... B•1143
§† FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1367
† Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1145-1148
Idea, Inc., Brea, CA 92621, 213-697-4332 ..... B•1166
§ Industrial Devices, Inc., Hackensack, NJ 07601, 201-489-8989 ..... B•1158-1162
§ Inter-Market, Glenview, IL 60025, 312-729-5330 ..... B•1178
ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
§† JKL Components Corporation, Pacoima, CA 91331, 818-896-0019 ..... B•1163
Lamb Industries, Inc., Portland, OR 97225, 503-297-8878 ..... B•1164
§† Lamptronix Co., Ltd., Crystal Lake, IL 60014, 815-455-0400 ..... B•1165
† Ledtronics, Inc., Torrance, CA 90505, 213-549-9995 ..... B•1167
Manufacturers Components, Inc., Hialeah, FL 33016, 305-556-4481;800-367-0377 ..... B•1788
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1817-1821
§ Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794 ..... B•1827
† Oxley, Inc., Branford, CT 06405, 203-488-1033 ..... B•1179
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 .. B•1832-1833
Sam Sung Elctrn. Dvcs., America, Inc., La Mirada, CA 90638, 213-802-8425 ..... B•1106-1108
§† Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122
§ Shokai Far East, Ltd., Hartsdale, NY 10530, 914-681-0700 ..... B•1187
§ Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1188-1190
§† Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1198
§ Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900 ..... B•1199-1203
Allied Control, Plantsville, CT 06479 203-621-6771
APM-Hexseal, Englewood, NJ 07631 201-569-5700
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
§† Audiosone, Inc., Stratford, CT 06497 203-377-4475
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
Communication Devices, Inc., Scarborough, Ont., CAN M1H3A4 416-439-6320
Crosspoint, Div. of Info-Lite, Fairview, NJ 07022 201-941-4455
§ Data Display Products, Los Angeles, CA 90009 213-640-0442
† Devco Engineering, Fairfield, NJ 07006 ..... 201-CA8-0321
Display Devices, Inc., Encinitas, CA 92024 619-753-0113
§ Dreefs Switch, Inc., Waukegan, IL 60087 ..... 312-662-7667;800-323-9605
† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† Electro-Mech Components, Inc., South El Monte, CA 91733-3689 818-442-7180
Entrelec, Alsthom International, Spring Valley, NY 10977 914-425-7460
† Flight Connector, TransTechnology Electronics, Peoria, IL 61615-1584 .. 309-693-3300
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
§† Glar-Ban, A Mark IV Company, Tonawanda, NY 14150 716-694-5076
GTE Sylvania Lighting, Sylvania Lighting Center, Danvers, MA 01923 617-777-1900
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
§ IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311

† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
§ Lamp Technology, Inc., Bohemia, NY 11716 516-567-1800
§† Ledco Div., St. Paul, MN 55107 612-222-2791
§† Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§† Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016 312-824-1188
§ Lumex Opto/Comps., Inc., Palatine, IL 60067 312-359-2790
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
§ Merix Chemical Co., Chicago, IL 60649 312-221-8242
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
Micro Lamps Inc., Batavia, IL 60510 312-879-0900
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§† Oak Switch Systems, Crystal Lake, IL 60014 815-459-5000
§ Oshino Electric Lamp Works, Ltd., Shinagawa-Ku, Tokyo, JAPAN 03-471-8548
Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
Pyle-National Division, BRIntec Corp., Chicago, IL 60651 312-342-6300
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430 201-529-8757
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630 312-792-2700
§† Sylvania Miniature Lighting, GTE Corporation, Hillsboro, NH 03244 603-464-5533
§† VCH Incorporated, Chicago Miniature, Buffalo Grove, IL 60089 312-459-3400
§ Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Lights, Panel — See Lights, Indicator (Vol. B)

Lights, Pilot — See Lights, Indicator (Vol. B)

Limit Stops — See Knobs, Limit Stop (Vol. C)

Limit Stops, Mechanical-2500 — *See Vol. C*

Limiters, Current-4300

§† Bussmann:Cooper Industries, St. Louis, MO 63178, 314-394-2877 ..... C•1295
§ FIC Corp., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1367
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ..... B•1901,1903
§ PolyPhaser Corporation, Gardnerville, NV 89410-1237, 702-782-2511;800-325-7170 ..... B•1405
Raychem Corp., Elctrns. Grp., Menlo Park, CA 94025, 415-361-3860 ..... B•1407
Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... B•1408
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907, 419-525-8500 ..... B•1921
§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
§ Bumdy Corporation, Norwalk, CT 06852 203-838-4444
Hitran Corporation, Flemington, NJ 08822-9943 201-782-5525
Mechanical Products Inc., Jackson, MI 49204 517-782-0391
Micro Devices Product Group, Therm-O-Disc, Inc., Mansfield, OH 44907 419-525-8500
§ Midwest Components, Inc., Muskegon, MI 49443 616-777-2602
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
§ Payne Engineering, Scott Depot, WV 25560 304-757-7353
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§† Silicon General, Garden Grove, CA 92641 714-898-8121
§ Square D Co., Palatine, IL 60067 312-397-2600
Techno, Inc., Van Nuys, CA 91405 818-781-1642
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800
Western Elctrn. Comps. Corp., Camarillo, CA 93010 805-482-8002
§ World Products Inc., Sonoma, CA 95476 707-996-5201

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Machines, Coil Winding-4100 — *See Vol. D*

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Magnets (MIL), Permanent-2440

† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
Jobmaster Corp., Randallstown, MD 21133-0207 ..... 301-655-1400;800-642-1400
† Magnet Sales & Mfg. Co. Inc., Culver City, CA 90230-6127 ..... 213-391-7213; 800-421-6692
† Ogallala Elctrns., Div. Arnold Engrg. Co., Ogallala, NE 69153 308-284-4093
† The Permanent Magnet Co., Inc., Indianapolis, IN 46226 317-547-1336
Steward, D. M., Mfg. Co., Chattanooga, TN 37401 615-867-4100

Magnifying Glasses, Inspection-4100 — *See Vol. D*

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Meters, Decibel Indicating-2900 — *See Vol. D*

Meters, Deviation-2900 — *See Vol. D*

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Meters, Digital RPM-2900 — *See Vol. D*

Meters, Digital, 2-wire, 4-20 mA Current Loop-2950 — *See Vol. D*

Meters, Dissolved Oxygen-2900 — *See Vol. D*

Meters, Distortion & Noise-2900 — *See Vol. D*

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Meters, VAR-2900 — *See Vol. D*

Meters, Vibration-2900 — *See Vol. D*

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Airpax Co., Cheshire Div., Cheshire, CT 06410, 203-271-6000 ..... B•1931
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... D•1170
I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714, 602-748-7900;1-800-433-3767 ..... D•1398,1400-1401
International Instruments:APrime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... D•1402-1403
Jobmaster Corp., Randallstown, MD 21133-0207, 301-655-1400;800-642-1400 ..... A•1329
Qualitec Technologies, Inc., Palo Alto, CA 94303-1706, 408-984-1763 ... D•1336
† Bowmar Telecommunications Div., Acton, MA 01720 508-263-8365
† Gralex Industries, Tarrytown, NY 10591 914-631-2978
† Ideal Precision Meter, Brooklyn, NY 11222 212-383-6904
Mercer Electronics, Simpson Electric Co, Elgin, IL 60120 312-697-2260
† Millivac Instruments, Inc., Schenectady, NY 12301 518-355-8300
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192 818-341-5151
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
Simpson Electric Co., Elgin, IL 60120 312-697-2260
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6102
§ Triplett Corporation, Bluffton, OH 45817-9987 419-358-5015

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† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... A•1737
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-564-3131 ..... A•1940-1942
§† Dale Electronics, Inc., El Paso Div., El Paso, TX 79926-6728, 915-592-3253 ..... A•1927-1928
Dale Electronics, Techno Division, Van Nuys, CA 91405-1139, 818-781-1642 ..... A•1924
Interpoint Corporation, Redmond, WA 98073-9705, 206-882-3100 ... A•1750-1751
† Mini-Systems, Inc., Electronic Package Div., Plainville, MA 02762, 508-695-2000 ..... A•1752
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† Allied-Signal Aerospace Co., Communications Div., Towson, MD 21204 301-583-4000
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
Beckman Industrial Corp., Subsidiary of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
CTS Corporation, Microelectronics Div., W. Lafayette, IN 47906 317-463-2565
† Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
§† General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
Hycomp, Inc., Marlborough, MA 01752 508-485-6300
Intepro Systems Inc., Lexington, MA 02173 617-863-9500
† Leach Control Products Div., Leach Corporation, Buena Pk, CA 90620 .. 714-739-0770
† NCR Microelectronics, NCR Corporation, Colorado Springs, CO 80916 ... 303-596-5795; 800-543-5618
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
§† Raytheon Semiconductor, Mountain View, CA 94043 415-968-9211
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Texas Instrs., Data Sys. Group, Dallas, TX 75380-9063 1-800-527-3500

Microcircuits (MIL), Linear-2440

† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 408-720-8737
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
† Aydin Corp., Horsham, PA 19044 215-657-7510
Beckman Industrial Corp., Subsidiary of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
§† General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
§† Raytheon Semiconductor, Mountain View, CA 94043 415-968-9211
§† Silicon General, Garden Grove, CA 92641 714-898-8121
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Teledyne Semiconductor, Mountain View, CA 94039-7267 415-968-9241
Texas Instrs., Data Sys. Group, Dallas, TX 75380-9063 1-800-527-3500
† Third Domain, Inc., Tucson, AZ 85731-7568 602-290-1820

Microcircuits (MIL), Low Power Schottky-2440

Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
Beckman Industrial Corp., Subsidiary of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Texas Instrs., Data Sys. Group, Dallas, TX 75380-9063 1-800-527-3500

Microcircuits (MIL), Memories, CMOS, Hybrids-2440

† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 ..... A•1748-1749
Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900 ..... A•1469
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
Beckman Industrial Corp., Subsidiary of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† Cincinnati Elctrns., Cincinnati, OH 45241 513-733-6100
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
§† General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
† Holt Inc., Irvine, CA 92718 714-859-8800
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
Memory X, San Diego, CA 92123 619-292-1151
M-Tron Industries, Yankton, SD 57078 605-665-9321
† Northwest Microcircuits, Inc., Corvallis, OR 97333 503-753-8242
Sunrise Electronics, Inc., Glendora, CA 91740 818-914-1926
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† VLSI Technology, Inc., San Jose, CA 95131 408-434-3100

Microcircuits (MIL), TTL, Schottky, Microprocessor-2440

† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 ..... A•1748-1749
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
Beckman Industrial Corp., Subsidiary of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Sunrise Electronics, Inc., Glendora, CA 91740 818-914-1926
Texas Instrs., Data Sys. Group, Dallas, TX 75380-9063 1-800-527-3500

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Microphones, Omnidirectional-1300 — *See Vol. D*

Microphones, Subminiature-1300 — *See Vol. D*

Microphones, Wireless-1300 — *See Vol. D*

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§† Audiosone, Inc., Stratford, CT 06497 203-377-4475
§† Shure Brothers Inc., Evanston, IL 60202-3696 312-866-2200
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683

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Microscopes-3700

† Assemtest, Haverhill, MA 01832 508-373-6800
§ Cambridge Instruments, Inc., Optical Systems Division, Buffalo, NY 14240 716-891-3000
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
ElectroPhysics Corp., Nutley, NJ 07110 201-667-2262
§† Excel Technology Intl. Corp., Belle Mead, NJ 08502 201-874-4747
§ Hacker Instruments, Fairfield, NJ 07007 201-226-8450
Jonard Industries Corp., Tuckahoe, NY 10707 914-793-0700
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
† Metron Optics Inc., Solana Beach, CA 92075-0690 619-755-4477
§ Pacific Transducer Corp., Los Angeles, CA 90064 213-478-1134
Research Devices, The American Optical Corp., Piscataway, NJ 08856 201-572-4800
§ Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108 800-628-8862
Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
§† Vision Engineering, Inc., New Milford, CT 06776 203-355-3776
§ Walker Scientific, Worcester, MA 01606 ..... 508-852-3674;508-853-3232
§ Carl Zeiss, Inc., Thornwood, NY 10594 914-747-1800

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Microwave Comb Generator — See Generators, Microwave (Vol. D)

Microwave Integrated Circuits (MICs)-3450 — *See Vol. A*

Microwave Receivers — See Receivers, Microwave (Vol. D)

Microwave Systems, Local Distribution-3400 — *See Vol. D*

Mirrors, Front Surface-3700

Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
† Evaporated Coatings, Inc., Willow Grove, PA 19090 215-659-3080
† Libbey-Owens-Ford Co., Liberty Mirror Products, Brackenridge, PA 15014 412-224-1800
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
Metron Optics Inc., Solana Beach, CA 92075-0690 619-755-4477
§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
† Optima Precision, Inc., Rancho Palos Verdes, CA 90274 .. 800-544-4418;213-377-4118
† Plumer Precision Optics, Pennsburg, PA 18073 215-679-6272
Rolyn Optics Co., Covina, CA 91722-2199 ..... 818-915-5707/5717
§ WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4 514-694-9136

Mirrors, Rear Surface-3700

Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
† Evaporated Coatings, Inc., Willow Grove, PA 19090 215-659-3080
† Libbey-Owens-Ford Co., Liberty Mirror Products, Brackenridge, PA 15014 412-224-1800
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
† Optima Precision, Inc., Rancho Palos Verdes, CA 90274 .. 800-544-4418;213-377-4118
Rolyn Optics Co., Covina, CA 91722-2199 ..... 818-915-5707/5717

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Modulator/Demodulators, Laser-3700

† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
§ Artel Communications Corp., Hudson, MA 01749 617-562-2100
† CATEL Telecommunications, Fremont, CA 94537 415-659-8988
† Coherent, Inc., Palo Alto, CA 94303 415-493-2111
§ Data-Design Labs., Cucamonga, CA 91730 714-987-2511
RE Instruments Corp., Westlake, OH 44145 216-871-7617

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Modulators, Light-3700

NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1326
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† Cleveland Crystals, Euclid, OH 44117 216-486-6100
§ Data-Design Labs., Cucamonga, CA 91730 714-987-2511
Displaytech, Inc., Boulder, CO 80301 303-449-8933
† Electro-Optical Industries, Santa Barbara, CA 93130 ..... 805-964-6701 (ext. 280)
FG Engineering, Fredonia, AZ 86022 602-643-7375
Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
† INTELCO, Acton, MA 01720 508-264-4485
§† Laser Concepts, Omega Organization Intl., Seattle, WA 98133 206-364-7881
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
RE Instruments Corp., Westlake, OH 44145 216-871-7617
Tektronix, Inc., Beaverton, OR 97077 800-835-9433

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Modules, Switching-5100

American Control Technology, Inc., West Dundee, IL 60118, 312-426-6780 ..... **B•1679**
Burgess Switch Co., American Electronic Components, Elkhart, IN 46515, 219-262-8608 ..... **B•1688**
Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... **A•2170-2171**
Crosspoint, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... **B•1709**
Crouzet Controls, Inc., Schaumburg, IL 60173-5419, 312-843-2200 ..... **B•1711**
CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117 ..... **D•1241**
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... **B•1733-1735**
§ **Gordos, A Flint Industries Company, Rogers, AR. 72757, AR 72757, 501-636-5000** ..... **B•1503-1506**
Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ..... **B•1785**
MarLee Switch Co., Upland, CA 91786, 714-982-8988 ..... **B•1789**
§ **Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697, 412-925-7272** ..... **A•2202**
T-Bar Incorporated, a Data Switch Co., Shelton, CT 06484, 203-926-1801 ..... **B•1850**
Advanced Systems Concepts, Altadena, CA 91001 818-791-0983
Capitol Switch Inc., Danbury, CT 06810 203-744-3300
Ghielmetti, Inc., Los Angeles, CA 90028-8770 213-463-5111
§ International Rectifier Corp., Semiconductor Div., El Segundo, CA 90245 213-772-2000
† Lorch Electronics:Div. of Vernitron Corp., Englewood, NJ 07631 201-569-8282
Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 407-848-4311
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
§† Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077
§ WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4 514-694-9136

Modules (MIL), Electronic-2440

† **ILC Data Device Corp., Bohemia, NY 11716, 516-567-5600** ..... **D•1183**
RTS Systems, Inc., Burbank, CA 91506, 818-566-6700 ..... **D•1052,1076-1077**
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
§ Ericson Manufacturing Co., Willoughby, OH 44094 216-951-8000
§ Integrity Technology, Milpitas, CA 95035 408-262-8640
† Lorch Electronics:Div. of Vernitron Corp., Englewood, NJ 07631 201-569-8282
† Modular Devices, Shirley, NY 11967 516-345-3100
† Natel Engineering Co., Inc., Simi Valley, CA 93063 805-581-3950
Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† Transmagnetics, Farmingdale, NY 11735 516-293-3100

Modules (MIL), Standard Electronic-2440

† **ILC Data Device Corp., Bohemia, NY 11716, 516-567-5600** ..... **D•1183**
† **Koep Precision Standards, Inc., South Plainfield, NJ 07080, 201-757-2220/2277** ..... **D•1310**
Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
§ Ericson Manufacturing Co., Willoughby, OH 44094 216-951-8000
GTE Products Corp., Williamsport, PA 17701 717-326-6591
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831

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Dymec Silicon Transistor Corp., Winchester, MA 01890, 617-729-7870 ..... **B•1206-1207**
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757 ..... 516-957-8700; 800-645-5516
§† Teltron, Inc., Birdsboro, PA 19508 215-582-2711
§† Vicon Industries, Inc., Melville, NY 11747 516-293-2200

Monitors, Temperature-Also See Controls, Temperature-5300

Action Instruments, San Diego, CA 92123, 619-279-5726 ..... **D•1157**
† **Chromalox Instrs. & Controls, La Vergne, TN 37086-3536, 615-793-3900** ..... **D•1141**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... **D•1169**
Frequency and Time Systems, Inc., DATUM, INC., Beverly, MA 01915, 508-927-8220 ..... **D•1271**
Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... **B•1898-1900**
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 .. **B•1903**
§† **NES, Inc. (Nationwide Electronic Systems), Carpentersville, IL 60110, 312-426-5900** ..... **D•1153**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... **D•1414-1415**
PPM, Inc., Cleveland, OH 44139, 216-349-2300 ..... **D•1334**
Sensor Scientific, Inc., Fairfield, NJ 07006, 201-227-7790;800-524-1610 ..... **B•1918-1919**
Western Elctrn. Comps. Corp., Camarillo, CA 93010, 805-482-8002 .. **B•1922-1925**
Active Control Instrumentation, Key Largo, FL 33037 305-451-1000
§ Acurex Corp./Autodata Div., Mountain View, CA 94039 415-967-9100
ADAC Corp., Woburn, MA 01801 617-935-6668
Advanced Techn. Research Labs., Alexandria, VA 22312 703-750-2920
§ Altech Corp., Somerville, NJ 08876 201-359-4454
§ Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563 516-593-5600
Analogic Corp., Peabody, MA 01961 508-977-3000
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
ASC Systems, St. Clair Shores, MI 48081 313-779-8700
§ Atkins Technical Inc., Gainesville, FL 32608 904-378-5555
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
§ Beckman Industrial Corp., Emerson Electric Co., San Diego, CA 92123 .. 619-495-3200
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303 603-753-6362
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
Burling Instruments, Chatham, NJ 07928 201-635-9481
§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
CDS - Colorado Data Sys., Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
† Climatronics, Bohemia, NY 11716 516-567-7300
† CML MACARR, A Marine Electric Systems Co., Clifton, NJ 07014-1135 201-471-6800
Controlex, Inc., New Boston, NH 03070 603-487-5512
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
Crompton Instrs., Hawker Siddley, Elk Grove Village, IL 60007 312-593-1107
Cybernetic Micro Sys., San Gregorio, CA 94074 415-726-3000
Data World Products, Francestown, NH 03043 603-588-3746
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
Digital Dynamics, Inc., Scotts Valley, CA 95066 408-438-4444
§ Digitec, Marion, OH 43302 614-387-3444
† Dranetz Technologies, Inc., Edison, NJ 08818-4019 201-287-3680
Electric Tachometer, Philadelphia, PA 19142 215-726-7723
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 312-882-5757
§ E-Squared Technology Corp., Ventura, CA 93003 805-644-9544
Esterline Angus Instrument Corp., Indianapolis, IN 46224 317-244-7611
§ FENWAL INC., Ashland, MA 01721 508-881-2000
Flotek Corporation, Tucson, AZ 85714 602-294-9222
§ John Fluke Mfg. Co., Inc., Everett, Wa 98206, WA 98206 206-356-5400
§† Gordon Co.:Watlow, Richmond, IL 60071 815-678-2211
Gordon Products, Brookfield, CT 06804 203-775-4501
§ Hafstrom Technical Products, Inc., San Diego, CA 92109 619-274-8822
† Hancock Electronics Corp., Hingham, MA 02043 617-740-4190
Harrel, Inc., E. Norwalk, CT 06855 203-866-2573
§ Helm Instrument Co., Inc., Maumee, OH 43537 419-893-4356
† Howell Instruments, Ft. Worth, TX 76107 817-336-7411
† Hy-Cal Engineering, El Monte, CA 91731 818-444-4000
International Instruments:APrime Technology Company, N. Branford, CT 06471 203-481-5721
§ Intra-computer, New York, NY 10001 212-947-5533
Kinetic Systems Corp., Lockport, IL 60441 815-838-0005
Lake Shore Cryotronics, Inc., Westerville, OH 43081 614-891-2243
Leeds & Northrup, General Signal, North Wales, PA 19454 215-699-2000
§ Love Controls Corp., Wheeling, IL 60090 312-541-3232
Mag-Con, St. Paul, MN 55113 612-633-8820
§ Metra Instruments, Inc., San Jose, CA 95131 408-432-1110
Metrix Instrument Co., Houston, TX 77043 713-461-2131
Metrosonics, Inc., Rochester, NY 14692-3075 716-334-7300
Midwest Components, Inc., Muskegon, MI 49443 616-777-2602
§† Mikron Instr., Wyckoff, NJ 07481 201-891-7330
Minco Products, Minneapolis, MN 55432 612-571-3121
† Narda Microwave Corp., Subsidiary of Loral Corp., Hauppauge, NY 11788 516-231-1700
§ Newport Electronics, Santa Ana, CA 92704-4426 714-540-4914
§ Non-Linear Systems/Div. of Kaypro Corp., Solana Bch, CA 92075 619-481-3953
§ Pacific Transducer Corp., Los Angeles, CA 90064 213-478-1134
Princo Instruments, Inc., Southampton, PA 18966
† Relco Products, Denver, CO 80237 303-756-1143
Richard-Lee Co., Cranford, NJ 07016 201-276-0710
Rochester Instrument Systems, Rochester, NY 14605 716-263-7700

† Rustrak Instruments, Mark IV Company, E. Greenwich, RI 02818 ..... 401-884-6800; 800-332-3202
Serial Lab Prods., Inc., Marlboro, MA 01752 617-481-1684
§ S. F. Products Corporation, Southport, CT 06490 203-929-6180
§ Sofrel, Inc., Eden Prairie, MN 55344 ..... 612-937-8835;1-800-8-SOFREL
Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108 800-628-8862
§ Spectral Dynamics Division, Scientific-Atlanta, Inc., San Diego, CA 92123-0575 619-496-3400
Strawberry Tree Computers, Sunnyvale, CA 94086 408-736-3083
§ Sunshine Scientific Instruments, Philadelphia, PA 19115 215-673-5600
§ Superior Electric, Bristol, CT 06010 203-582-9561
† Syscon Intl, Inc., So. Bend, IN 46618-1096 219-232-3900
Technical Service Laboratory Inc., Ft. Walton Beach, FL 32548 904-243-3722
Teledyne Semiconductor, Mountain View, CA 94039-7267 415-968-9241
§ Tempil Div., Big Three Inds., S. Plainfield, NJ 07080 201-757-8300
§ Temptronic Corporation, Newton, MA 02158 617-969-2501
Texmate, Inc., Solana Beach, CA 92075 619-481-7177
† Thermo Electric, Saddle Brook, NJ 07662 201-843-5800
† VirTis Co., Gardiner, NY 12525 914-255-5000
Warren G-V, Unit of Signal Co., Whippany, NJ 07981 201-386-1200
§ Yellow Springs Instrument Co., Yellow Springs, OH 45387 513-767-7241
§ Yokogawa Corp. of America, Newnan, GA 30265 404-253-7000

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Dixson, Inc., Grand Junction, CO 81503, 303-242-8863 (ext 223) ..... D•1381,1384-1385
† Infodex, Inc., Wolcott, CT 06716, 203-879-4944 ..... B•1010-1011,1088
Intronics, Inc., Newton, MA 02158, 617-964-4000 ..... B•1018
† Aydin Corp., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Computer Doctors, College Park, MD 20740 ..... 1-800-RAM-STAR;301-474-3095
§ Science/Electronics, Dayton, OH 45401-0986 513-859-5555
§ Sofrel, Inc., Eden Prairie, MN 55344 ..... 612-937-8835;1-800-8-SOFREL
§ Sunshine Scientific Instruments, Philadelphia, PA 19115 215-673-5600

Motor & Generator Armatures, Rotors, Stators-3500

Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040, 815-397-7400 ..... B•1235
† Georator Corp., Manassas, VA 22110-0070, 703-368-2101 ..... D•2198-2199
Inland Motor/Kollmorgen, Sierra Vista, AZ 85635, 602-459-1150 ... B•1260-1264
Penn-Tran Corp., Wingate, PA 16880, 814-355-1521 ..... A•1246
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... B•1037,1316
Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867 603-335-1100
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 818-998-4850
† Danmar Inds., Chatsworth, CA 91311 ..... 818-882-7979/5280
Eastern Air Devices, Inc., Dover, NH 03820 603-742-3330
† EEMCO Div., Datron Systems Inc., Los Angeles, CA 90039 818-247-7060
† Fabricast, S. El Monte, CA 91733 818-443-3247
Framar Metal Products Co., Inc., Kenilworth, NJ 07033 201-241-0710
† Globe Motors, Dayton, OH 45404 513-228-3171
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
§ Industrial Indexing Systems, Inc., Victor, NY 14564 716-924-9181
† Inland Motor, Kollmorgen Corp., Radford, VA 24141 703-639-9045
† Magnetic Technology, Canoga Pk, CA 91303 818-887-7700
† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
PMI Motion Technologies, Commack, NY 11725-5703 516-864-1000
§ Powertron, Contraves Goerz Corp., Charlotte, NC 28210 704-525-8962
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
† Valley Electromagnetics, Spring Valley, IL 61362 815-664-2348

Motor Assemblies with Integral Tachometer/Encoder-3500

Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040, 815-397-7400 ..... B•1235
Data Technology, Inc., Woburn, MA 01811, 617-935-8820 ..... B•1945-1947
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116, 918-438-7800 ..... B•1253
† Industrial Drives, A Kollmorgen Div., Radford, VA 24141, 703-639-2495 ..... B•1258
† Maxon Precision Motors, Inc., Burlingame, CA 94010, 415-697-9614 ..... B•1278
§† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1281, 1966
† Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ..... B•1284-1286
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601 ..... B•1296
§ Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605, 818-764-4266 ... B•1303
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1305
§ Altech Corp., Somerville, NJ 08876 201-359-4454
† Astromec, Inc., Carson City, NV 89706 702-883-9226
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018 215-622-1000
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
Escap Products, Hauppauge, NY 11788 516-234-3900
Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
§ Industrial Indexing Systems, Inc., Victor, NY 14564 716-924-9181
† Inland Motor/Kollmorgen, Sierra Vista, AZ 85635 602-459-1150
† Inland Motor, Kollmorgen Corp., Radford, VA 24141 703-639-9045
† Magnetic Technology, Canoga Pk, CA 91303 818-887-7700
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
Parvex Division, Alsthom International, Inc., Spring Valley, NY 10977 914-425-6908
PMI Motion Technologies, Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
§ Westamp, Santa Monica, CA 90404 213-393-0401

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Motorized Components — See Potentiometers, Motorized (Vol.), Rheostats, Motorized (Vol.), Transformers, Variable, Motorized

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Motors, Brush, DC-3500

Automotion, Inc., Ann Arbor, MI 48108, 313-662-7771 ..... B•1234
Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040, 815-397-7400 ..... B•1235
§ Bodine Electric Company, Chicago, IL 60618, 312-478-3515 ..... B•1236
Crouzet Controls, Inc., Schaumburg, IL 60173-5419, 312-843-2200 ..... B•1239
† Eltrol Corporation, Canoga Park, CA 91304, 818-709-0131 ..... B•1241
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116, 918-438-7800 ..... B•1253
† Industrial Drives, A Kollmorgen Div., Radford, VA 24141, 703-639-2495 ..... B•1258-1259
† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1280-1281
† Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ..... B•1284-1286
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601 ..... B•1296-1297
Super Vexta, Torrance, CA 90503-7395, 213-515-2264 ..... B•1293
TS Products, Inc., Arleta, CA 91331, 818-896-6676 ..... D•2248
† American Electronics, Fullerton, CA 92631 714-871-3020
† Astromec, Inc., Carson City, NV 89706 702-883-9226
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
Bosch, Robert, Corp., Broadview, IL 60153 312-865-5200
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
† Dynamic Air Engrg., Inc., Santa Ana, CA 92705-5697 714-540-1000
§ Electric Motor Engineering, Glendale, CA 91201 818-502-1866
Electrol Co., York, PA 17405 717-848-1722
Escap Products, Hauppauge, NY 11788 516-234-3900
Fincor, York, PA 17402 717-751-4206
§ General Industries, Elyria, OH 44035 216-323-3136
General Numeric Corporation, Elk Grove Village, IL 60007 312-640-1595
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
IMC Magnetics Corp., IMC/Hansen, Princeton, IN 47670-0023 812-385-3415
Industrial Indexing Systems, Inc., Victor, NY 14564 716-924-9181
† Inland Motor/Kollmorgen, Sierra Vista, AZ 85635 602-459-1150
† Inland Motor, Kollmorgen Corp., Radford, VA 24141 703-639-9045
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621 714-671-4500
Mabuchi Motor America Corp., New York, NY 10016 212-686-3622
† Maxon Precision Motors, Inc., Burlingame, CA 94010 415-697-9614
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
§ Pacific Scientific Co., Rockford, IL 61105 815-226-3100
Parvex Division, Alsthom International, Inc., Spring Valley, NY 10977 914-425-6908
Performance Controls, Inc., Horsham, PA 19044 215-675-6500
PMI Motion Technologies, Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
Robbins & Myers/Electro-Craft, Eden Prairie, MN 55344 612-942-3600
Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605 818-764-4266
Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
§ SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
Vasak Inds., Inc., Valhalla, NY 10595 ..... 1-800-67-VASAK
§ Westamp, Santa Monica, CA 90404 213-393-0401

Motors, Brushless, DC-3500

† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... B•1226-1227
† BEI Motion Systems Company, Kimco Magnetics Division, San Marcos, CA 92069, 619-744-5671 ..... B•1934
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018, 215-622-1000 ..... B•1238
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910, 818-882-0424 ..... B•1942
§ Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330 ..... B•1240
§ ebm Industries, Inc., Farmington, CT 06032, 203-674-1515 ..... C•1644,1646
† Eltrol Corporation, Canoga Park, CA 91304, 818-709-0131 ..... B•1241

Hathaway Corporation:Motion Control Div., Tulsa, OK 74116, 918-438-7800 ..... **B•1253**
Indek Corporation, San Jose, CA 95131, 408-432-1199 ..... **C•1665**
† **Industrial Drives, A Kollmorgen Div., Radford, VA 24141, 703-639-2495** ..... **B•1258-1259**
† **Maxon Precision Motors, Inc., Burlingame, CA 94010, 415-697-9614** ..... **B•1278**
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151 ..... **B•1279**
† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529** ..... **B•1280-1281**
† **Motor Technology, Inc., Dayton, OH 45429, 513-294-1041** ..... **B•1284-1286**
NMB Technologies, Chatsworth, CA 91311, 818-341-3355 ..... **B•1288-1289**
§ **Oriental Motor U.S.A. Corporation, Torrance, CA 90503, 213-515-2264** ..... **B•1290-1292**
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601 ..... **B•1295**
SAIA Inc., Elkhart, IN 46515-3030, 219-262-4418 ..... **B•1300-1301**
§ **Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605, 818-764-4266** ... **B•1303**
† **Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300** ..... **B•1305**
Superior Electric, Bristol, CT 06010, 203-582-9561 ..... **B•1306**
Synektron Corporation, Portland, OR 97223, 503-684-3090 ..... **B•1308-1309**
U.S. Toyo Fan Corp., San Gabriel, CA 91776, 818-287-5297 ..... **C•1695**
† **Vernitron Controls, Vernitron Corporation, San Diego, CA 92073, 619-428-5581** ..... **B•1313-1314**
Airpax Co., Cheshire Div., Cheshire, CT 06410 203-271-6000
Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867 603-335-1100
† Astro Dynamics, Inc., Woburn, MA 01801 617-935-4944
† Astromec, Inc., Carson City, NV 89706 702-883-9226
Automotion, Inc., Ann Arbor, MI 48108 313-662-7771
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 818-998-4850
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
Bosch, Robert, Corp., Broadview, IL 60153 312-865-5200
† Brailsford & Co., Rye, NY 10580 914-967-1820
Buehler Products, Inc., Raleigh, NC 27606 919-469-8522
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042 516-488-6700
Digital Motor, Inc., Portland, OR 97229-5892 503-629-9692
† EG & G Rotron, Custom Div., Woodstock, NY 12498 914-679-5201
† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
ETRI, Inc., Monroe, NC 28110 704-289-5423
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
General Numeric Corporation, Elk Grove Village, IL 60007 312-640-1595
† Globe Motors, Dayton, OH 45404 513-228-3171
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
§ Industrial Indexing Systems, Inc., Victor, NY 14564 716-924-9181
† Inland Motor/Kollmorgen, Sierra Vista, AZ 85635 602-459-1150
† Inland Motor, Kollmorgen Corp., Radford, VA 24141 703-639-9045
§ Japanese Products Corp., Elmsford, NY 10523 914-592-8880
Litton Encoder Div., Chatsworth, CA 91311 818-341-6161
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621 714-671-4500
† Magnetic Technology, Canoga Pk., CA 91303 818-887-7700
Motion Control Group, American Precision Industries, Oceanside, CA 92054 619-439-7500
Motor-Tronics, Inc., Vista, CA 92083 619-727-7430
Namiki Precision Jewel Co., Ltd., Hackensack, NJ 07601 201-343-3080
† NIDEC Corporation, Torrington, CT 06790 203-482-4422
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
§† Pacific Scientific Co., Rockford, IL 61105 815-226-3100
Papst Mechatronic Corp., Newport, RI 02840 401-849-8810
Parker Hannifin Corporation, Compumotor Division, Petaluma, CA 94952 ..... 707-778-1244;800-358-9068
Parvex Division, Alsthom International, Inc., Spring Valley, NY 10977 914-425-6908
§ Powertron, Contraves Goerz Corp., Charlotte, NC 28210 704-525-8962
POWR-UPS Corp., Shirley, NY 11967 ..... 516-345-5700;1-800-333-POWR
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
Robbins & Myers/Electro-Craft, Eden Prairie, MN 55344 612-942-3600
† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
† Sterling Instruments, New Hyde Pk, NY 11040 516-328-3300
§ Super Vexta, Torrance, CA 90503-7395 213-515-2264
† Techno, A DSG Company, New Hyde Park, NY 11040 516-328-3970
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
Vasak Inds., Inc., Valhalla, NY 10595 ..... 1-800-67-VASAK
§ Westamp, Santa Monica, CA 90404 213-393-0401

Motors, Clock & Timing-3500

Airpax Co., International Div., Cheshire, CT 06410 203-272-0301
Autotrol Corporation, Crystal Lake, IL 60014 815-459-3080
§ Bodine Electric Company, Chicago, IL 60618 312-478-3515
§† Cramer Co., Old Saybrook, CT 06475 800-247-6784
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
Eastern Air Devices, Inc., Dover, NH 03820 603-742-3330
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
§† Hurst Manufacturing Corp., Emerson Elec. Co., Princeton, IN 47670 812-385-2564
IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
IMC Magnetics Corp., IMC/Hansen, Princeton, IN 47670-0023 812-385-3415
Inland Motor/Kollmorgen, Sierra Vista, AZ 85635 602-459-1150
§ Landis & Gyr, Inc., Pleasantville, NY 10570 914-747-3540
Mabuchi Motor America Corp., New York, NY 10016 212-686-3622
Magnetic Technology, Canoga Pk., CA 91303 818-887-7700
Mallory Timers, Emhart Elec./Elctrn. Grp., Indianapolis, IN 46201 317-636-5353
Micro Mo Electronics, Inc., St. Petersburg, FL 33701 813-822-2529
§ Paragon Electric Co., Inc., Two Rivers, WI 54241 414-793-1161
SAIA Inc., Elkhart, IN 46515-3030 219-262-4418
Valley Electromagnetics, Spring Valley, IL 61362 815-664-2348

Motors, Control-3500

§ **Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040, 815-397-7400** ..... **B•1235**
§ **Bodine Electric Company, Chicago, IL 60618, 312-478-3515** ..... **B•1236**
† **Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018, 215-622-1000** ..... **B•1238**
† **Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910, 818-882-0424** ..... **B•1942**
§ **Hurst Manufacturing Corp., Emerson Elec. Co., Princeton, IN 47670, 812-385-2564** ..... **B•1256**
† **Industrial Drives, A Kollmorgen Div., Radford, VA 24141, 703-639-2495** ..... **B•1258**
† **Motor Technology, Inc., Dayton, OH 45429, 513-294-1041** ..... **B•1284-1286**
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601 ..... **B•1295**
† **Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300** ..... **B•1305**
Vernitron Controls, Vernitron Corporation, San Diego, CA 92073, 619-428-5581 ..... **B•1313**
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
Airpax Co., International Div., Cheshire, CT 06410 203-272-0301
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Somerville, NJ 08876 201-359-4454
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
§ Anaheim Automation, Anaheim, CA 92801 714-992-6990
Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
ASC Systems, St. Clair Shores, MI 48081 313-779-8700
† Astro Instrument Corp., Pompano Beach, FL 33064 305-973-8900
Automotion, Inc., Ann Arbor, MI 48108 313-662-7771
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 818-998-4850
§ B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
§ Berkeley Process Control, Inc., Richmond, CA 94804 415-526-3333
Bertsch U.S., Vista, CA 92083 619-727-7420
Buehler Products, Inc., Raleigh, NC 27606 919-469-8522
§ Carter Motor, Warren, IL 61087-0647 815-745-2100
§ Centent Co., Santa Ana, CA 92707 714-979-6491
§† Cramer Co., Old Saybrook, CT 06475 800-247-6784
Cross Electronics, Warrendale, PA 15086 412-776-1591
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
Eastern Air Devices, Inc., Dover, NH 03820 603-742-3330
† EEMCO Div., Datron Systems Inc., Los Angeles, CA 90039 818-247-7060
† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
§† Electrol Co., York, PA 17405 717-848-1722
Escap Products, Hauppauge, NY 11788 516-234-3900
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
Fincor, York, PA 17402 717-751-4206
General Numeric Corporation, Elk Grove Village, IL 60007 312-640-1595
† Globe Motors, Dayton, OH 45404 513-228-3171
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
† Honeywell Inc., Commercial Bldgs. Grp., MN 27-4231, Minneapolis, MN 55408 612-870-2294
Howard Industries, Inc., Milford, IL 60953 815-889-4105
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
§ Industrial Indexing Systems, Inc., Victor, NY 14564 716-924-9181
§ Inertial Motors, Doylestown, PA 18901 215-345-1010
Inland Motor/Kollmorgen, Sierra Vista, AZ 85635 602-459-1150
† Inland Motor, Kollmorgen Corp., Radford, VA 24141 703-639-9045
§ Klockner Moeller, Natick, MA 01760 508-655-1910
Lincoln Laser Co., Phoenix, AZ 85004 602-257-0407
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621 714-671-4500
† Magnetic Technology, Canoga Pk., CA 91303 818-887-7700
Magnum Opus Custom Elctrn. Engrg., Iselin, NJ 08830 201-283-4925
Mallory Timers, Emhart Elec./Elctrn. Grp., Indianapolis, IN 46201 317-636-5353
† Maxon Precision Motors, Inc., Burlingame, CA 94010 415-697-9614
Micro Mo Electronics, Inc., St. Petersburg, FL 33701 813-822-2529
† Micro Networks, Unitrode Corporation, Worcester, MA 01606 508-852-5400
Motion Control Group, American Precision Industries, Oceanside, CA 92054 619-439-7500
Motor-Tronics, Inc., Vista, CA 92083 619-727-7430
§ Oriental Motor U.S.A. Corporation, Torrance, CA 90503 213-515-2264
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
§ Pacific Scientific Co., Rockford, IL 61105 815-226-3100
Parvex Division, Alsthom International, Inc., Spring Valley, NY 10977 914-425-6908
PMI Motion Technologies, Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
Robbins & Myers/Electro-Craft, Eden Prairie, MN 55344 612-942-3600
Servo-Tek Products Co., Hawthorne, NJ 07506 201-427-3100
Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605 818-764-4266
† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 407-848-4311
† Sterling Instruments, New Hyde Pk., NY 11040 516-328-3300
§† Superior Electric, Bristol, CT 06010 203-582-9561
§ Super Vexta, Torrance, CA 90503-7395 213-515-2264
† Techno, A DSG Company, New Hyde Park, NY 11040 516-328-3970
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300

Triac Electronic Systems, Inc., Glendale, NY 11385 718-441-4759
† Vernitech:Vernitron Corp., Deer Pk, NY 11729 516-586-5100
§ Westinghouse Electric Corp., Control Division, Oldsmar, FL 34667 813-855-4621

Motors, DC Timing-3500

Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330 ..... B•1240
Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605, 818-764-4266 ... B•1303
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1305
Airpax Co., Cheshire Div., Cheshire, CT 06410 203-271-6000
Airpax Co., International Div., Cheshire, CT 06410 203-272-0301
Autotrol Corporation, Crystal Lake, IL 60014 815-459-3080
Bertsch U.S., Vista, CA 92083 619-727-7420
Cramer Co., Old Saybrook, CT 06475 800-247-6784
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
IMC Magnetics Corp., IMC/Hansen, Princeton, IN 47670-0023 812-385-3415
Micro Mo Electronics, Inc., St. Petersburg, FL 33701 813-822-2529
Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300

Motors, Drag Cup-3500

† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† American Electronics, Fullerton, CA 92631 714-871-3020
† Astro Instrument Corp., Pompano Beach, FL 33064 305-973-8900
† EEMCO Div., Datron Systems Inc., Los Angeles, CA 90039 818-247-7060
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
Parvex Division, Alsthom International, Inc., Spring Valley, NY 10977 914-425-6908
SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
† Vernitech:Vernitron Corp., Deer Pk, NY 11729 516-586-5100

Motors, Fractional Horsepower-3500

† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... B•1225-1227
§ Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040, 815-397-7400 ..... B•1235
† BEI Motion Systems Company, Kimco Magnetics Division, San Marcos, CA 92069, 619-744-5671 ..... B•1934
§ Bodine Electric Company, Chicago, IL 60618, 312-478-3515 ..... B•1236
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018, 215-622-1000 ..... B•1238
Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330 ..... B•1240
§ ebm Industries, Inc., Farmington, CT 06032, 203-674-1515 ..... C•1644,1646
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116, 918-438-7800 ..... B•1253
§ Howard Industries, Inc., Milford, IL 60953, 815-889-4105 ..... C•1660
§ Mabuchi Motor America Corp., New York, NY 10016, 212-686-3622 ..... B•1277
† Maxon Precision Motors, Inc., Burlingame, CA 94010, 415-697-9614 ..... B•1278
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151 ..... B•1279
§† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1280-1281
† Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ..... B•1284-1286
NMB Technologies, Chatsworth, CA 91311, 818-341-3355 ..... B•1288-1289
§ Oriental Motor U.S.A. Corporation, Torrance, CA 90503, 213-515-2264 ..... B•1290-1292
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601 ..... B•1295-1297
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1305
Superior Electric, Bristol, CT 06010, 203-582-9561 ..... B•1306
§ Super Vexta, Torrance, CA 90503-7395, 213-515-2264 ..... B•1293
Synektron Corporation, Portland, OR 97223, 503-684-3090 ..... B•1308-1309
† Airpax Co., Cheshire Div., Cheshire, CT 06410 203-271-6000
Airpax Co., International Div., Cheshire, CT 06410 203-272-0301
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
† American Electronics, Fullerton, CA 92631 714-871-3020
Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867 603-335-1100
† Astro Instrument Corp., Pompano Beach, FL 33064 305-973-8900
† Astromec, Inc., Carson City, NV 89706 702-883-9226
† Autotrol Corporation, Crystal Lake, IL 60014 815-459-3080
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 818-998-4850
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
Berger-Lahr Corp., Jaffrey, NH 03452 603-532-7701
Bertsch U.S., Vista, CA 92083 619-727-7420
Buehler Products, Inc., Raleigh, NC 27606 919-469-8522
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042 516-488-6700
§ Carter Motor, Warren, IL 61087-0647 815-745-2100
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
§† Cramer Co., Old Saybrook, CT 06475 800-247-6784
Digital Motor, Inc., Portland, OR 97229-5892 503-629-9692
† EG & G Rotron, Custom Div., Woodstock, NY 12498 914-679-5201
† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
§ Electric Motor Engineering, Glendale, CA 91201 818-502-1866
§ Electrol Co., York, PA 17405 717-848-1722
Escap Products, Hauppauge, NY 11788 516-234-3900
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
Fincor, York, PA 17402 717-751-4206
§ General Industries, Elyria, OH 44035 216-323-3136
General Numeric Corporation, Elk Grove Village, IL 60007 312-640-1595
§† Globe Motors, Dayton, OH 45404 513-228-3171
Hankscraft Motors, Div. of Gerber Prods. Co., Reedsburg, WI 53959 608-524-4341
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
† Hertner Div.:Exide Corp., Cleveland, OH 44111 216-252-4242
§ Hurst Manufacturing Corp., Emerson Elec. Co., Princeton, IN 47670 812-385-2564
IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
IMC Magnetics Corp., IMC/Hansen, Princeton, IN 47670-0023 812-385-3415
Inland Motor/Kollmorgen, Sierra Vista, AZ 85635 602-459-1150
† Inland Motor, Kollmorgen Corp., Radford, VA 24141 703-639-9045
§ Japanese Products Corp., Elmsford, NY 10523 914-592-8880
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621 714-671-4500
† Magnetic Technology, Canoga Pk, CA 91303 818-887-7700
† McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550 .. 609-799-0100
† Merrill, Inc., Gwynedd Valley, PA 19437 215-643-2116
Motor-Tronics, Inc., Vista, CA 92083 619-727-7430
Namiki Precision Jewel Co., Ltd., Hackensack, NJ 07601 201-343-3080
§† Pacific Scientific Co., Rockford, IL 61105 815-226-3100
Papst Mechatronic Corp., Newport, RI 02840 401-849-8810
Parker Hannifin Corporation, Compumotor Division, Petaluma, CA 94952 ..... 707-778-1244;800-358-9068
Parvex Division, Alsthom International, Inc., Spring Valley, NY 10977 914-425-6908
PMI Motion Technologies, Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
§ Powertron, Contraves Goerz Corp., Charlotte, NC 28210 704-525-8962
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
Robbins & Myers/Electro-Craft, Eden Prairie, MN 55344 612-942-3600
SAIA Inc., Elkhart, IN 46515-3030 219-262-4418
§ Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605 818-764-4266
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
† Sterling Instruments, New Hyde Pk, NY 11040 516-328-3300
† Techno, A DSG Company, New Hyde Park, NY 11040 516-328-3970
Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
† Valley Electromagnetics, Spring Valley, IL 61362 815-664-2348
Vasak Inds., Inc., Valhalla, NY 10595 ..... 1-800-67-VASAK
† Vernitech:Vernitron Corp., Deer Pk, NY 11729 516-586-5100
Vernitron Controls, Vernitron Corporation, San Diego, CA 92073 619-428-5581

Motors, Gearhead-3500

§ Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040, 815-397-7400 ..... B•1235
§ Bodine Electric Company, Chicago, IL 60618, 312-478-3515 ..... B•1236
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042, 516-488-6700 ..... B•1237
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419, 312-843-2200 ..... B•1239
Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330 ..... B•1240
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116, 918-438-7800 ..... B•1253
§ Howard Industries, Inc., Milford, IL 60953, 815-889-4105 ..... C•1660
Industrial Drives, A Kollmorgen Div., Radford, VA 24141, 703-639-2495 ..... B•1258
† Maxon Precision Motors, Inc., Burlingame, CA 94010, 415-697-9614 ..... B•1278
§† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1280-1281
† Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ..... B•1284-1286
§ Oriental Motor U.S.A. Corporation, Torrance, CA 90503, 213-515-2264 ..... B•1290-1292
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438, 215-256-6601 ..... B•1295,1297
§ Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605, 818-764-4266 ... B•1303
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1305
§ Superior Electric, Bristol, CT 06010, 203-582-9561 ..... B•1306
§ Super Vexta, Torrance, CA 90503-7395, 213-515-2264 ..... B•1293
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... B•1316
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
Airpax Co., International Div., Cheshire, CT 06410 203-272-0301
† American Electronics, Fullerton, CA 92631 714-871-3020
Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867 603-335-1100
† Astro Instrument Corp., Pompano Beach, FL 33064 305-973-8900
† Astromec, Inc., Carson City, NV 89706 702-883-9226
Autotrol Corporation, Crystal Lake, IL 60014 815-459-3080
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
§† Berger-Lahr Corp., Jaffrey, NH 03452 603-532-7701
Bertsch U.S., Vista, CA 92083 619-727-7420
Buehler Products, Inc., Raleigh, NC 27606 919-469-8522
§ Carter Motor, Warren, IL 61087-0647 815-745-2100
§† Cramer Co., Old Saybrook, CT 06475 800-247-6784
† EEMCO Div., Datron Systems Inc., Los Angeles, CA 90039 818-247-7060
† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
§ Electric Motor Engineering, Glendale, CA 91201 818-502-1866
§ Electrol Co., York, PA 17405 717-848-1722
Escap Products, Hauppauge, NY 11788 516-234-3900
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
§ General Industries, Elyria, OH 44035 216-323-3136
§† Globe Motors, Dayton, OH 45404 513-228-3171
Hankscraft Motors, Div. of Gerber Prods. Co., Reedsburg, WI 53959 608-524-4341
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441

§† Hurst Manufacturing Corp., Emerson Elec. Co., Princeton, IN 47670 812-385-2564
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
§ Japanese Products Corp., Elmsford, NY 10523 914-592-8880
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621 714-671-4500
† Motion Control Group, American Precision Industries, Oceanside, CA 92054 619-439-7500
Motor-Tronics, Inc., Vista, CA 92083 619-727-7430
Namiki Precision Jewel Co., Ltd., Hackensack, NJ 07601 201-343-3080
NIDEC Corporation, Torrington, CT 06790 203-482-4422
† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
PMI Motion Technologies, Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
Robbins & Myers/Electro-Craft, Eden Prairie, MN 55344 612-942-3600
SAIA Inc., Elkhart, IN 46515-3030 219-262-4418
Servo-Tek Products Co., Hawthorne, NJ 07506 201-427-3100
§ SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
† Valley Electromagnetics, Spring Valley, IL 61362 815-664-2348

Motors, Gyro-3500

† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... B•1316
† Vernitron Controls, Vernitron Corporation, San Diego, CA 92073, 619-428-5581 ..... B•1313
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 818-998-4850
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018 215-622-1000
† EEMCO Div., Datron Systems Inc., Los Angeles, CA 90039 818-247-7060
§† Harowe Servo Controls, Inc:A Fasco Co., West Chester, PA 19380 215-692-2700
Magnetic Technology, Canoga Pk, CA 91303 818-887-7700
SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300

Motors, Hysteresis-3500

§ Oriental Motor U.S.A. Corporation, Torrance, CA 90503, 213-515-2264 ..... B•1290-1292
§ Super Vexta, Torrance, CA 90503-7395, 213-515-2264 ..... B•1293
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... B•1316
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† American Electronics, Fullerton, CA 92631 714-871-3020
Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867 603-335-1100
† Astro Instrument Corp., Pompano Beach, FL 33064 305-973-8900
Autotrol Corporation, Crystal Lake, IL 60014 815-459-3080
§ B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
§ Bodine Electric Company, Chicago, IL 60618 312-478-3515
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018 215-622-1000
§ Cramer Co., Old Saybrook, CT 06475 800-247-6784
Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
Eastern Air Devices, Inc., Dover, NH 03820 603-742-3330
† EEMCO Div., Datron Systems Inc., Los Angeles, CA 90039 818-247-7060
† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
§ General Industries, Elyria, OH 44035 216-323-3136
§† Globe Motors, Dayton, OH 45404 513-228-3171
§† Hurst Manufacturing Corp., Emerson Elec. Co., Princeton, IN 47670 812-385-2564
IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
IMC Magnetics Corp., IMC/Hansen, Princeton, IN 47670-0023 812-385-3415
§ Japanese Products Corp., Elmsford, NY 10523 914-592-8880
Lincoln Laser Co., Phoenix, AZ 85004 602-257-0407
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621 714-671-4500
Magnetic Technology, Canoga Pk, CA 91303 818-887-7700
† McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550 609-799-0100
† NIDEC Corporation, Torrington, CT 06790 203-482-4422
† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
Papst Mechatronic Corp., Newport, RI 02840 401-849-8810
Paragon Electric Co., Inc., Two Rivers, WI 54241 414-793-1161
§ Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605 818-764-4266
† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
Valley Electromagnetics, Spring Valley, IL 61362 815-664-2348

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Motors, Induction-3500

Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040, 815-397-7400 ..... B•1235
§ Bodine Electric Company, Chicago, IL 60618, 312-478-3515 ..... B•1236
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419, 312-843-2200 ..... B•1239
Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330 ..... B•1240
† Industrial Drives, A Kollmorgen Div., Radford, VA 24141, 703-639-2495 ..... B•1259
§ Oriental Motor U.S.A. Corporation, Torrance, CA 90503, 213-515-2264 ..... B•1290-1292
§ Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605, 818-764-4266 ... B•1303
§ Super Vexta, Torrance, CA 90503-7395, 213-515-2264 ..... B•1293
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† American Electronics, Fullerton, CA 92631 714-871-3020
Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867 603-335-1100
† Astro Dynamics, Inc., Woburn, MA 01801 617-935-4944
† Astro Instrument Corp., Pompano Beach, FL 33064 305-973-8900
† Astromec, Inc., Carson City, NV 89706 702-883-9226
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 818-998-4850
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018 215-622-1000
† EEMCO Div., Datron Systems Inc., Los Angeles, CA 90039 818-247-7060
† EG & G Rotron, Custom Div., Woodstock, NY 12498 914-679-5201
† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
Electro-Pacific, Goleta, CA 93117 805-964-0751
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
General Numeric Corporation, Elk Grove Village, IL 60007 312-640-1595
§† Globe Motors, Dayton, OH 45404 513-228-3171
† Hertner Div.:Exide Corp., Cleveland, OH 44111 216-252-4242
§ Howard Industries, Inc., Milford, IL 60953 815-889-4105
§† Hurst Manufacturing Corp., Emerson Elec. Co., Princeton, IN 47670 812-385-2564
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
§ Japanese Products Corp., Elmsford, NY 10523 914-592-8880
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621 714-671-4500
† McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550 609-799-0100
† Merrill, Inc., Gwynedd Valley, PA 19437 215-643-2116
Micro Mo Electronics, Inc., St. Petersburg, FL 33701 813-822-2529
NIDEC Corporation, Torrington, CT 06790 203-482-4422
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
Papst Mechatronic Corp., Newport, RI 02840 401-849-8810
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
Robbins & Myers/Electro-Craft, Eden Prairie, MN 55344 612-942-3600
† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
Valley Electromagnetics, Spring Valley, IL 61362 815-664-2348
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

Motors, Linear-3500

† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1305
Airpax Co., Cheshire Div., Cheshire, CT 06410 203-271-6000
Anorad Corp., Hauppauge, NY 11788 516-231-1995
§ B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
† Component Specialties Corp., Temple City, CA 91780 213-283-0015
Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
Inland Motor, Kollmorgen Corp., Radford, VA 24141 703-639-9045
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
† Optima Precision, Inc., Rancho Palos Verdes, CA 90274 .. 800-544-4418;213-377-4118
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
Parker Hannifin Corporation. Compumotor Division, Petaluma, CA 94952 ..... 707-778-1244;800-358-9068
Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
Unico, Franksville, WI 53126-0505 414-886-5678

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§ Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040, 815-397-7400 ..... B•1235
† BEI Motion Systems Company, Kimco Magnetics Division, San Marcos, CA 92069, 619-744-5671 ..... B•1934
§ Bodine Electric Company, Chicago, IL 60618, 312-478-3515 ..... B•1236
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018, 215-622-1000 ..... B•1238
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419, 312-843-2200 ..... B•1239
Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330 ..... B•1240
† Eltrol Corporation, Canoga Park, CA 91304, 818-709-0131 ..... B•1241
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116, 918-438-7800 ..... B•1253
† Industrial Drives, A Kollmorgen Div., Radford, VA 24141, 703-639-2495 ..... B•1258-1259
† Maxon Precision Motors, Inc., Burlingame, CA 94010, 415-697-9614 ..... B•1278
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151 ..... B•1279
§† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1280-1281
† Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ..... B•1284-1286
NMB Technologies, Chatsworth, CA 91311, 818-341-3355 ..... B•1288-1289
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§ Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605, 818-764-4266 ... B•1303
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1305
§† Superior Electric, Bristol, CT 06010, 203-582-9561 ..... B•1306
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
§ Aerotech, Inc., Pittsburgh, PA 15238 412-963-7470
† Airpax Co., Cheshire Div., Cheshire, CT 06410 203-271-6000
† Airpax Co., International Div., Cheshire, CT 06410 203-272-0301
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
† American Electronics, Fullerton, CA 92631 714-871-3020
§ Anaheim Automation, Anaheim, CA 92801 714-992-6990
Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
† Astro Instrument Corp., Pompano Beach, FL 33064 305-973-8900
† Astromec, Inc., Carson City, NV 89706 702-883-922
† Autotrol Corporation, Crystal Lake, IL 60014 815-459-308
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 818-998-485
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-471

§ B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
§† Berger-Lahr Corp., Jaffrey, NH 03452 603-532-7701
Bertsch U.S., Vista, CA 92083 619-727-7420
Buehler Products, Inc., Raleigh, NC 27606 919-469-8522
§ Carter Motor, Warren, IL 61087-0647 815-745-2100
§† Cramer Co., Old Saybrook, CT 06475 800-247-6784
Digital Motor, Inc., Portland, OR 97229-5892 503-629-9692
† EEMCO Div., Datron Systems Inc., Los Angeles, CA 90039 818-247-7060
† EG & G Rotron, Custom Div., Woodstock, NY 12498 914-679-5201
† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
§ Electric Motor Engineering, Glendale, CA 91201 818-502-1866
§ Electrol Co., York, PA 17405 717-848-1722
Escap Products, Hauppauge, NY 11788 516-234-3900
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
Fincor, York, PA 17402 717-751-4206
§ General Industries, Elyria, OH 44035 216-323-3136
General Numeric Corporation, Elk Grove Village, IL 60007 312-640-1595
† Giannini Institute, Indio, CA 92201 619-347-2833
§† Globe Motors, Dayton, OH 45404 513-228-3171
Hankscraft Motors, Div. of Gerber Prods. Co., Reedsburg, WI 53959 608-524-4341
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
§ Howard Industries, Inc., Milford, IL 60953 815-889-4105
§† Hurst Manufacturing Corp., Emerson Elec. Co., Princeton, IN 47670 812-385-2564
IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
IMC Magnetics Corp., IMC/Hansen, Princeton, IN 47670-0023 812-385-3415
§† Inertial Motors, Doylestown, PA 18901 215-345-1010
† Inland Motor/Kollmorgen, Sierra Vista, AZ 85635 602-459-1150
† Inland Motor, Kollmorgen Corp., Radford, VA 24141 703-639-9045
§ Japanese Products Corp., Elmsford, NY 10523 914-592-8880
§ Landis & Gyr, Inc., Pleasantville, NY 10570 914-747-3540
Litton Encoder Div., Chatsworth, CA 91311 818-341-6161
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621 714-671-4500
§ Mabuchi Motor America Corp., New York, NY 10016 212-686-3622
† Magnetic Technology, Canoga Pk, CA 91303 818-887-7700
Mallory Timers, Emhart Elec./Elctrn. Grp., Indianapolis, IN 46201 317-636-5353
Micronel U.S., Vista, CA 92083 619-727-7400
Namiki Precision Jewel Co., Ltd., Hackensack, NJ 07601 201-343-3080
NIDEC Corporation, Torrington, CT 06790 203-482-4422
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
Ormec Systems Corp., Rochester, NY 14625 716-385-3520
§† Pacific Scientific Co., Rockford, IL 61105 815-226-3100
Papst Mechatronic Corp., Newport, RI 02840 401-849-8810
Paragon Electric Co., Inc., Two Rivers, WI 54241 414-793-1161
PMI Motion Technologies, Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
Robbins & Myers/Electro-Craft, Eden Prairie, MN 55344 612-942-3600
Servo-Tek Products Co., Hawthorne, NJ 07506 201-427-3100
† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
§ SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
† Valley Electromagnetics, Spring Valley, IL 61362 815-664-2348
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100
§ Westamp, Santa Monica, CA 90404 213-393-0401

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Motors, Squirrel Cage-3500

§ Bodine Electric Company, Chicago, IL 60618, 312-478-3515 ..... B•1236
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
§ Altech Corp., Somerville, NJ 08876 201-359-4454
Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
Eastern Air Devices, Inc., Dover, NH 03820 603-742-3330
§ ebm Industries, Inc., Farmington, CT 06032 203-674-1515
† EEMCO Div., Datron Systems Inc., Los Angeles, CA 90039 818-247-7060
† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
Electro-Pacific, Goleta, CA 93117 805-964-0751
† Hertner Div.:Exide Corp., Cleveland, OH 44111 216-252-4242
§ Howard Industries, Inc., Milford, IL 60953 815-889-4105
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621 714-671-4500
† McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550 609-799-0100
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
SAIA Inc., Elkhart, IN 46515-3030 219-262-4418
† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100

Motors, Stepping-3500

§ Bodine Electric Company, Chicago, IL 60618, 312-478-3515 ..... B•1236
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042, 516-488-6700 ..... B•1237
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018, 215-622-1000 ..... B•1238
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419, 312-843-2200 ..... B•1239
§† Hurst Manufacturing Corp., Emerson Elec. Co., Princeton, IN 47670, 812-385-2564 ..... B•1254-1256
Inland Motor/Kollmorgen, Sierra Vista, AZ 85635, 602-459-1150 ... B•1260-1264
NMB Technologies, Chatsworth, CA 91311, 818-341-3355 ..... B•1288
§ Oriental Motor U.S.A. Corporation, Torrance, CA 90503, 213-515-2264 ..... B•1290-1292
SAIA Inc., Elkhart, IN 46515-3030, 219-262-4418 ..... B•1300-1301
§ Shinano Kenshi Corp. (SKC), N. Hollywood, CA 91605, 818-764-4266 ... B•1303
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1305
§† Superior Electric, Bristol, CT 06010, 203-582-9561 ..... B•1306
§ Super Vexta, Torrance, CA 90503-7395, 213-515-2264 ..... B•1293
† Techno, A DSG Company, New Hyde Park, NY 11040, 516-328-3970 ..... B•1310-1311
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... B•1037,1316
Vernitron Controls, Vernitron Corporation, San Diego, CA 92073, 619-428-5581 ..... B•1313
† Abrams Instrument Corp., Okemos, MI 48864 517-332-6405
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
§ Aerotech, Inc., Pittsburgh, PA 15238 412-963-7470
Airpax Co., International Div., Cheshire, CT 06410 203-272-0301
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
† American Electronics, Fullerton, CA 92631 714-871-3020
§ Anaheim Automation, Anaheim, CA 92801 714-992-6990
Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
† Astro Instrument Corp., Pompano Beach, FL 33064 305-973-8900
Autotrol Corporation, Crystal Lake, IL 60014 815-459-3080
§ B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
§† Berger-Lahr Corp., Jaffrey, NH 03452 603-532-7701
Cyberpak Co., La Grange, IL 60525 312-354-0012
Digital Motor, Inc., Portland, OR 97229-5892 503-629-9692
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
Eastern Air Devices, Inc., Dover, NH 03820 603-742-3330
Electric Motor Engineering, Glendale, CA 91201 818-502-1866
Escap Products, Hauppauge, NY 11788 516-234-3900
§ FDK America, Inc., Fuji Electrochemical Co., Ltd., Cerritos, CA 90701 213-404-1770
† GAP Instrument Corp., Hauppauge, NY 11788 516-273-0909
§† Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
Inland Motor, Kollmorgen Corp., Radford, VA 24141 703-639-9045
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
§ Japanese Products Corp., Elmsford, NY 10523 914-592-8880
Litton Encoder Div., Chatsworth, CA 91311 818-341-6161
Magnetic Technology, Canoga Pk, CA 91303 818-887-7700
Matrix Corp., Raleigh, NC 27610 919-833-2000
Maxwell Electronics, Research Triangle Park, NC 27609 919-846-1633
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
Mesur-Matic Elctrns., Salem, MA 01970-2294 617-745-7000
Micro Mo Electronics, Inc., St. Petersburg, FL 33701 813-822-2529
† Motion Control Group, American Precision Industries, Oceanside, CA 92054 619-439-7500
Namiki Precision Jewel Co., Ltd., Hackensack, NJ 07601 201-343-3080
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
† Optima Precision, Inc., Rancho Palos Verdes, CA 90274 .. 800-544-4418;213-377-4118
§† Pacific Scientific Co., Rockford, IL 61105 815-226-3100
Parker Hannifin Corporation, Compumotor Division, Petaluma, CA 94952 ..... 707-778-1244;800-358-9068
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
§ SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
Valley Electromagnetics, Spring Valley, IL 61362 815-664-2348

Motors, Synchronous-3500

§ Bodine Electric Company, Chicago, IL 60618, 312-478-3515 ..... B•1236
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419, 312-843-2200 ..... B•1239
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§† Hurst Manufacturing Corp., Emerson Elec. Co., Princeton, IN 47670, 812-385-2564 ..... B•1254-1256
† Industrial Drives, A Kollmorgen Div., Radford, VA 24141, 703-639-2495 ..... B•1258
§ Oriental Motor U.S.A. Corporation, Torrance, CA 90503, 213-515-2264 ..... B•1290-1292
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† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1305
§† Superior Electric, Bristol, CT 06010, 203-582-9561 ..... B•1306
§ Super Vexta, Torrance, CA 90503-7395, 213-515-2264 ..... B•1293
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... B•1316
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
Airpax Co., International Div., Cheshire, CT 06410 203-272-0301
† American Electronics, Fullerton, CA 92631 714-871-3020
Anaheim Automation, Anaheim, CA 92801 714-992-6990
Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867 603-335-1100
† Astro Instrument Corp., Pompano Beach, FL 33064 305-973-8900
Autotrol Corporation, Crystal Lake, IL 60014 815-459-3080
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
§† Berger-Lahr Corp., Jaffrey, NH 03452 603-532-7701
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018 215-622-1000
§† Cramer Co., Old Saybrook, CT 06475 800-247-6784
EEMCO Div., Datron Systems Inc., Los Angeles, CA 90039 818-247-7060
† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
Fincor, York, PA 17402 717-751-4206
§ General Industries, Elyria, OH 44035 216-323-3136
General Numeric Corporation, Elk Grove Village, IL 60007 312-640-1595
§† Globe Motors, Dayton, OH 45404 513-228-3171

§† Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
† Inland Motor, Kollmorgen Corp., Radford, VA 24141 703-639-9045
§ Japanese Products Corp., Elmsford, NY 10523 914-592-8880
§ Landis & Gyr, Inc., Pleasantville, NY 10570 914-747-3540
Lincoln Laser Co., Phoenix, AZ 85004 602-257-0407
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621 714-671-4500
Magnetic Technology, Canoga Pk, CA 91303 818-887-7700
Mallory Timers, Emhart Elec./Elctrn. Grp., Indianapolis, IN 46201 317-636-5353
† McLean Engineering, Zero Corporation, Princeton Junction, NJ 08550 .. 609-799-0100
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
Micro Mo Electronics, Inc., St. Petersburg, FL 33701 813-822-2529
† Motion Control Group, American Precision Industries, Oceanside, CA 92054 619-439-7500
† NIDEC Corporation, Torrington, CT 06790 203-482-4422
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
§† Pacific Scientific Co., Rockford, IL 61105 815-226-3100
Papst Mechatronic Corp., Newport, RI 02840 401-849-8810
§ Paragon Electric Co., Inc., Two Rivers, WI 54241 414-793-1161
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
Robbins & Myers/Electro-Craft, Eden Prairie, MN 55344 612-942-3600
† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
§ SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
Valley Electromagnetics, Spring Valley, IL 61362 815-664-2348

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† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... B•1227
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§ Bodine Electric Company, Chicago, IL 60618, 312-478-3515 ..... B•1236
Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042, 516-488-6700 ..... B•1237
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018, 215-622-1000 ..... B•1238
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910, 818-882-0424 ..... B•1942
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419, 312-843-2200 ..... B•1239
Eastern Air Devices, Inc., Dover, NH 03820, 603-742-3330 ..... B•1240
ETI Systems, Polaris Indl. Entprs., Oceanside, CA 92054, 619-757-7770 ..... B•1244
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116, 918-438-7800 ..... B•1253
Hurst Manufacturing Corp., Emerson Elec. Co., Princeton, IN 47670, 812-385-2564 ..... B•1254-1255
† Industrial Drives, A Kollmorgen Div., Radford, VA 24141, 703-639-2495 ..... B•1258
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151 ..... B•1279
† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1281
† Motor Technology, Inc., Dayton, OH 45429, 513-294-1041 ..... B•1284-1286
NMB Technologies, Chatsworth, CA 91311, 818-341-3355 ..... B•1289
§ Oriental Motor U.S.A. Corporation, Torrance, CA 90503, 213-515-2264 ..... B•1290-1292
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Arc Systems, Inc., Hauppauge, NY 11788 516-582-8020
† Ashland Elec. Prods., Inc., Rochester, NH 03867 603-335-1100
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 818-998-4850
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
Buehler Products, Inc., Raleigh, NC 27606 919-469-8522
Cramer Co., Old Saybrook, CT 06475 800-247-6784
† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
† Globe Motors, Dayton, OH 45404 513-228-3171
§ Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
Howard Industries, Inc., Milford, IL 60953 815-889-4105
IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
† Inland Motor/Kollmorgen, Sierra Vista, AZ 85635 602-459-1150
† Inland Motor, Kollmorgen Corp., Radford, VA 24141 703-639-9045
§ Japanese Products Corp., Elmsford, NY 10523 914-592-8880
Litton Encoder Div., Chatsworth, CA 91311 818-341-6161
† Magnetic Technology, Canoga Pk, CA 91303 818-887-7700
† Maxon Precision Motors, Inc., Burlingame, CA 94010 415-697-9614
MFE Instruments Corp., Salem, NH 03079 603-893-1921
Micronel U.S., Vista, CA 92083 619-727-7400
† NIDEC Corporation, Torrington, CT 06790 203-482-4422
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
§ Pacific Scientific Co., Rockford, IL 61105 815-226-3100
Parvex Division, Alsthom International, Inc., Spring Valley, NY 10977 914-425-6908
PMI Motion Technologies, Commack, NY 11725-5703 516-864-1000
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
† Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300

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† Autotrol Corporation, Crystal Lake, IL 60014 815-459-3080
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
§ Carter Motor, Warren, IL 61087-0647 815-745-2100
† Dynamic Air Engrg., Inc., Santa Ana, CA 92705-5697 714-540-1000
† Electric Indicator Company Inc., Norwalk, CT 06851 203-847-5861
§† Globe Motors, Dayton, OH 45404 513-228-3171
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
Micro Mo Electronics, Inc., St. Petersburg, FL 33701 813-822-2529
Parvex Division, Alsthom International, Inc., Spring Valley, NY 10977 914-425-6908
PITTMAN, Penn Engrg. & Mfg. Corp., Harleysville, PA 19438 215-256-6601
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
§ SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
† Valley Electromagnetics, Spring Valley, IL 61362 815-664-2348

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† Industrial Drives, A Kollmorgen Div., Radford, VA 24141, 703-639-2495 ..... B•1259
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† Astromec, Inc., Carson City, NV 89706 702-883-9226
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018 215-622-1000
† Hertner Div.:Exide Corp., Cleveland, OH 44111 216-252-4242
† IMC Magnetics Corp., Eastern Div., Westbury, NY 11590 516-334-7070
† Lucas Western Inc., Electro Systems Division, Brea, CA 92621 714-671-4500
† Micro Mo Electronics, Inc., St. Petersburg, FL 33701 813-822-2529
† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
Sierracin/Magnedyne, Carlsbad, CA 92008 619-438-3321
SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222

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Dale Electronics, Inc., El Paso Div., El Paso, TX 79926-6728, 915-592-3253 ..... B•1890,1893
§† Fenwal Electronics/APD, Kidde, Inc., Milford, MA 01757, 508-478-6000 .. B•1896
Quality Thermistor, Boise, ID 83709, 208-377-3373 ..... A•2199, B•1914
Western Elctrn. Comps. Corp., Camarillo, CA 93010, 805-482-8002 .. B•1922-1925
† Globe Plastics, Pomona, CA 91766 714-623-2747
Ketema/Rodan Division, Anaheim, CA 92806 714-630-0081
† Maury Microwave Corp., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
Micro Plastics Inc., Flippin, AR 72634 501-453-2261
† Milross Controls, Inc., Southampton, PA 18966 215-355-0200
Omega Engineering, Stamford, CT 06907 800-826-6342
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6102

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AMP, Harrisburg, PA 17105, 717-564-0100 ..... C•1157
† Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727 ..... B•1214

† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 703-953-4751** ..... **B•1212**
§† **MERET, Inc., Santa Monica, CA 90404-4998, 213-828-7496** ..... **B•1215**
† **Optelecom, Inc., Gaithersburg, MD 20877, 301-840-2121** ..... **B•1216**
§† APEC Fiber Optics Corp., College Station, TX 77840 409-693-5397
AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
Atlantic Scientific Corporation, Melbourne, FL 32901 1-800-544-4737
Aydin Corp., Horsham, PA 19044 215-657-7510
§† Canoga-Perkins Corp., Chatsworth, CA 91311 818-718-6300
† CATEL Telecommunications, Fremont, CA 94537 415-659-8988
§ Control Cable, Inc., Baltimore, MD 21207 301-298-4411
§† Dataproducts New England, Inc., Wallingford, CT 06492 203-265-7151
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-921-2726
† Fibronics International Inc., Communications Way, Hyannis, MA 02601-1892 508-778-0700
† Foundation Instruments Inc., Nepean, ON, CANADA K2E 7J6 613-226-4000
GTE Fiberoptic Products, Williamsport, PA 17701 ... 717-326-6591;1-800-FBR-OPTICS
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
§ ICS Electronics Corp., San Jose, CA 95131 408-432-9009
Kinetic Systems Corp., Lockport, IL 60441 815-838-0005
† Lightwave Communications, Inc., Ridgefield, CT 06877 203-438-3591
3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
MICRO DATA SYSTEMS, Thomasville, GA 31799 912-226-1709
RE Instruments Corp., Westlake, OH 44145 216-871-7617
§ SC Technology, Inc., Livermore, CA 94550 415-373-9230
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683

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§ **Bourns, Inc., Resistive Components Group, Riverside, CA 92507, 714-781-5050** ..... **A•1877**
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-564-3131 ..... **A•1940-1942**
§† **Dale Electronics, Inc., El Paso Div., El Paso, TX 79926-6728, 915-592-3253** ..... **A•1928**
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... **A•1935-1936**
† **Electro-Films, Inc., Warwick, RI 02886, 401-738-9150** ..... **A•1945**
International Resistive Company, Boone, NC 28607, 704-264-8861 ..... **A•1955**
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501, 818-990-1192 ..... **A•1964-1965**
† **Mepco/Centralab, North American Philips Corporation, Mineral Wells, TX 76067, 817-325-7871** ..... **A•1981, B•1022-1023**
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... **A•1997**
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... **A•2025**
† **Piconics, Tyngsboro, MA 01879, 508-649-7501** ..... **A•2031**
§† **RCD Components, Inc., Manchester, NH 03103, 603-669-0054** ..... **A•2043**
Ultronix, Inc., Vishay, Grand Junction, CO 81502, 303-242-0810 ..... **A•2058**
Vishay Resistive Systems Group, Malvern, PA 19355, 215-644-1300 ..... **A•2076-2077**
§† Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
Beckman Industrial Corp., Subsidiary of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
CTS Corp., Resistor Network Div., (Formerly CTS Corp., Berne Div.), Berne, IN 46711 219-589-3111
† Magnetic Component Engineering, Inc., Culver City, CA 90230 213-398-4761
† Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, Riviera Beach, FL 33404 407-881-3200
Mepco/Centralab, North American Philips Corporation, W. Palm Bch., FL 33407 305-842-3201
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
† Northwest Microcircuits, Inc., Corvallis, OR 97333 503-753-8242
† Philips Circuit Assemblies, A Subdivision of North American Philips Corp., West Lafayette, IN 47906 317-463-2536
Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697 412-925-7272
§† Sfernice, Inc., Grand Junction, CO 81502 303-242-0810
Sprague Electric Company:Thick Film Products, Hudson, NH 03051 603-881-7200
Sprague Electric Company, FIL-MAG Business Unit, San Diego, CA 92154-3483 619-575-9353
Techno, Inc., Van Nuys, CA 91405 818-781-1642

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§ **PolyPhaser Corporation, Gardnerville, NV 89410-1237, 702-782-2511;800-325-7170** ..... **B•1405**
Axis Corporation, San Diego, CA 92111 619-560-7737
General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530

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Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 703-953-4751 ..... **B•1213**
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 .... **B•1328-1331**
§ Aerotech, Inc., Pittsburgh, PA 15238 412-963-7470
† Balzers Optical Corporation, Marlboro, MA 01752 617-481-9860
Burleigh Instruments, Fishers, NY 14453 716-924-9355
† Diversified Optical Products, Inc., Diversified Optical Corp., Salem, NH 03079 603-898-1880
† D. O. Industries, Rochester, NY 14623 716-359-4000
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§† Ercona, Patchogue, NY 11772 516-758-0700
Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
§† General Cable Co., Fiber Optics Div., S. Plainfield, NJ 07080 201-769-3200
† KLC/Karl Lambrecht Corp., Chicago, IL 60618 312-472-5442
† Math Assocs., Westbury, NY 11590 516-334-6800
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600
Noll, J. A. Co., Monroeville, PA 15146 412-733-1089
§ Optics for Research, Inc., Caldwell, NJ 07006 201-228-4480
† Optima Precision, Inc., Rancho Palos Verdes, CA 90274 .. 800-544-4418;213-377-4118
Opto Technology, Inc., Wheeling, IL 60090 312-537-4277
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
† Pomfret Research Optics, Orange, VA 22960 703-854-4350
Rolyn Optics Co., Covina, CA 91722-2199 ..... 818-915-5707/5717
† Carl Zeiss, Inc., Thornwood, NY 10594 914-747-1800

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§ A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269, 201-231-8300 ..... B•1127
§ Amperex Electronic Company, A Div. of North American Philips Corporation, Slatersville, RI 02876, 401-762-3800 ..... B•1317
§ Clairex Electronics, Clairex Corporation, Mt. Vernon, NY 10550, 914-664-6602 ..... B•1320
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1213
§ Marktech International Corp., Menands, NY 12204, 518-436-5865 ... B•1172-1173
§† Motorola Semiconductor Prods. Sector, Phoenix, AZ 85018-6606, 602-244-6900 ..... A•2191-2193
§ Optek Technology Inc., McKinney, TX 75069, 214-542-9461 ..... B•1333
Opto Diode Corp., Newbury Park, CA 91320, 805-499-0335 ..... B•1334
§ Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1219,1335-1338,1995
Silicon Detector Corp., Camarillo, CA 93010, 805-484-2884 ..... B•1348-1349
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 ..... B•1347
AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§ General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
Philips Electronics Ltd, Philips Comps., Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§† Quality Technologies, Palo Alto, CA 93404 415-493-0400
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
§ Three-Five Sys., Inc., Phoenix, AZ 85201 602-496-0035

Optocouplers, Surface Mount-3700

A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269, 201-231-8300 ..... B•1127
§ Marktech International Corp., Menands, NY 12204, 518-436-5865 ... B•1172-1173
Motorola Semiconductor Prods. Sector, Phoenix, AZ 85018-6606, 602-244-6900 ..... A•2191-2192
§ Optek Technology Inc., McKinney, TX 75069, 214-542-9461 ..... B•1333
Opto Diode Corp., Newbury Park, CA 91320, 805-499-0335 ..... B•1334
§ Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1219,1335-1338
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 ..... B•1347
Amperex Electronic Company, A Div. of North American Philips Corporation, Slatersville, RI 02876 401-762-3800
† Crystek Corp, Ft. Myers, FL 33906 813-936-2109
§ General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
§† Quality Technologies, Palo Alto, CA 93404 415-493-0400
§ Three-Five Sys., Inc., Phoenix, AZ 85201 602-496-0035

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Austron, Inc., Austin, TX 78761-4766, 512-251-2341 ..... A•1348
B-D Crystal Entprs., Inc., Subsidiary of HY-Q Int'l, Erlanger, KY 41018, 606-283-5000 ..... A•1350
† Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... A•1351
† Connor-Winfield Corp., Aurora, IL 60505-1335, 312-851-4722 ..... A•1369
† CTS Corp., Frequency Control Div., (Formerly Knights Div.), Sandwich, IL 60548, 815-786-8411 ..... A•1375,1385-1387,1390
Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... A•1397
Datum Inc., Timing/Aacom Divisions, Anaheim, CA 92806-5790, 714-533-6333 ..... D•1066
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1409
Litton Electron Devices, San Carlos, CA 94070, 415-591-8411 ..... B•1021
† McCoy Electronics Co., A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1423,1425
MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ..... A•1426-1427
Micro Crystal Division, SMH, New York, NY 10010, 212-505-5340 ... A•1429-1430
Microsonics Inc., Weymouth, MA 02188, 617-337-4200 ..... A•1442
§† Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ... A•1436-1437
† Q-Tech Corp., Culver City, CA 90232-3510, 213-836-7900 ..... A•1469-1470
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013, 717-243-5929 ..... A•1472-1473
Spectrum Technology, Inc., DATUM, Incorporated, Goleta, CA 93436, 805-964-7791 ..... A•1484-1487
Statek Corp., Orange, CA 92668, 714-639-7810 ..... A•1489
† Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433 ..... A•1492-1493, 1496
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Comstron Corp., Melville, NY 11747 516-756-1100
† Crystek Corp, Ft. Myers, FL 33906 813-936-2109
CTS Corporation, Elkhart, IN 46514 219-293-7511
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† Frequency and Time Systems, Inc., DATUM, INC., Beverly, MA 01915 ... 508-927-8220
Frequency Control Products, Inc., American Time Products Div., Deer Pk, NY 11729 516-243-5730
† FSI/Fork Standards, Inc., Lombard, IL 60148 ..... 312-231-3511;312-932-9380
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
Hughes Aircraft Co., Microelctrns. Sys. Div., Irvine, CA 92715 714-752-3800
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
MITEQ Inc., Hauppauge, NY 11788 516-436-7400
† Ovenaire-Audio-Carpenter, Oak Industries, Charlottesville, VA 22901 804-977-8050
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-327-1282
TOYOCOM USA INC., Arlington Heights, IL 60005 312-593-8780
† Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831
§ Zeta Labs., San Jose, CA 95134 408-434-3600

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† Andersen Laboratories, Bloomfield, CT 06002, 203-286-9090 ..... A•1343
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† Connor-Winfield Corp., Aurora, IL 60505-1335, 312-851-4722 ..... A•1368
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M-Tron Industries, Yankton, SD 57078, 605-665-9321 ..... A•1439
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† Vectron Laboratories, Inc., Norwalk, CT 06850, 203-853-4433 ..... A•1492
† Anghel Laboratories, Inc., Fairfield, NJ 07006 201-575-1116
§† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080

† Aydin Corp., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Comstron Corp., Melville, NY 11747 516-756-1100
† Crystek Corp, Ft. Myers, FL 33906 813-936-2109
Damon Electronics Div., Westwood, MA 02090 617-329-2460
† Eaton Corporation, Microwave Products Division, Sunnyvale, CA 94086 408-773-3700
Epsilon-Lambda Elctrns. Corp., Geneva, IL 60134 312-232-9611
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
HDS Inc., Reston, VA 22091 703-620-6200
Hughes Aircraft Co., Microelctms. Sys. Div., Irvine, CA 92715 714-752-3800
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
Luff Research, Jackson Hgts., NY 11372 718-429-5900
MACOM, Inc., Burlington, MA 01803 617-272-3000
† Magnum Microwave Corp., Fremont, CA 94538 415-657-9898
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
MITEQ Inc., Hauppauge, NY 11788 516-436-7400
† Ovenaire-Audio-Carpenter, Oak Industries, Charlottesville, VA 22901 804-977-8050
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
Sanders Associates, Inc., ECBD, A Lockheed Company, Manchester, NH 03108-8500 603-645-5548
† Sanders/A Lockheed Co. Div. Microwave Technlg. Ctr., Manchester, NH 03108 ..... 603-645-6000 X 5548
Sivers IMA, Div. of Philips, Culver City, CA 90230 213-390-7477
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Texas Instrs., Data Sys. Group, Dallas, TX 75380-9063 1-800-527-3500
§† Toko America, Inc., Mt. Prospect, IL 60056 312-297-0070
† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
† Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831
WILMANCO, Northridge, CA 91324 ..... 818-993-1662/1663
† Z Communications, Inc., Ft. Lauderdale, FL 33309 305-735-1000
§ Zeta Labs., San Jose, CA 95134 408-434-3600

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Bergquist, Minneapolis, MN 55435, 800-328-3882 ..... B•1858
Sam Sung Elctrn. Dvcs., America, Inc., La Mirada, CA 90638, 213-802-8425 ..... B•1107-1108
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
AND, William J. Purdy Co., Burlingame, CA 94010 415-347-9916
Automation Displays Inc., Eau Claire, WI 54703 715-834-9595
† Barrington Plastics, Mt. Laurel, NJ 08054 609-235-5151
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
† Control Displays, Inc., Colmar, PA 18915 215-822-3383
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022 201-941-4455
Display Devices, Inc., Encinitas, CA 92024 619-753-0113
† DOW SWITCH, Wilmington, MA 01887 617-935-6395
† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
† E-L Products Corp., Sub.of Astronics Co., E. Aurora, NY 14052 716-655-0800
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
† Hallmark Nameplate, Inc., Farmingdale, NY 11735 800-645-9502
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
† Korry Electronics Co., Criton Technologies, Seattle, WA 98109 206-281-1300
§ Lucas Duralith Corporation, Millville, NJ 08332 609-825-6900
Mauell Corp., Dillsburg, PA 17019 717-432-8686
§† Miller Dial Corp., El Monte, CA 91731 818-444-4555
OMNI Switch USA, Inc., Phoenix, AZ 85027 602-582-0629
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
† Spectra Lux Corp., Kirkland, WA 98034 206-747-0560
Technical Panels, Inc., Temple City, CA 91780 800-343-1170
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300

Panels, Electroluminescent-2450

Bergquist, Minneapolis, MN 55435, 800-328-3882 ..... B•1858
Bonar Kard-O-Lite, Inc., King of Prussia, PA 19406 215-277-2910
Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087 312-360-3500
Dio-Rey, Div. of Info-Lite, Fairview, NJ 07022 201-941-4455
DOW SWITCH, Wilmington, MA 01887 617-935-6395
† E-L Products Corp., Sub.of Astronics Co., E. Aurora, NY 14052 716-655-0800
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§† Miller Dial Corp., El Monte, CA 91731 818-444-4555
† Spectra Lux Corp., Kirkland, WA 98034 206-747-0560
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300

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§ Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016, 312-824-1188 ..... B•1381
Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... B•1408
Accurate Electronics, Elyria, OH 44036 216-366-6330
Augat/RDI, Carol Stream, IL 60188 312-682-4100
§ Beswick:Cooper U.K. Ltd., Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
Doran Manufacturing Co., Cincinnati, OH 45225 513-681-5424
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
Fil-Coil Company, Inc., Garden City, NY 11530 516-228-9445
† Grim Corporation, Medford, NJ 08055-0968 609-267-7950
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
Marway Prods. Inc., Santa Ana, CA 92703 714-973-1800
§† Meco Industries, Mechanical Engraving Co., Inc., Bronx, NY 10470 212-324-4455
Ratelco, Power Systems Div., Seattle, WA 98109-5589 206-624-7770
§ San-O Industrial Corp., Bohemia, NY 11716 516-567-5556
§ Trimm, Inc., Div. of Newton Instr. Co., Libertyville, IL 60048 312-362-3700
§ USD Products, Cooper Industries, Chicago, IL 60656 312-867-4600

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Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
† Centronic, Inc., Morgan Crucible Co., Electronics Div., Newbury Park, CA 91320-1702 805-499-5902
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173 312-843-7900
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085

Photodectectors, Silicon-3700

A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269, 201-231-8300 ..... B•1127
§ Clairex Electronics, Clairex Corporation, Mt. Vernon, NY 10550, 914-664-6602 ..... B•1320
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Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
† Atlantic Solar Products, Baltimore, MD 21237 ..... 301-686-2500;800-237-6527
† Centronic, Inc., Morgan Crucible Co., Electronics Div., Newbury Park, CA 91320-1702 805-499-5902
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§ Ercona, Patchogue, NY 11772 516-758-0700
§ General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
† Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
Hamamatsu Corporation, Bridgewater, NJ 08807 201-231-0960
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173 312-843-7900
§ Optek Technology Inc., McKinney, TX 75069 214-542-9461
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
Thomson Electron Tubes & Devices Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000
§ Three-Five Sys., Inc., Phoenix, AZ 85201 602-496-0035

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§† Datak Corp., N. Bergen, NJ 07047, 201-863-7667 ..... C•1726
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400

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§† Daburn Electronics & Cable Corp., Northvale, NJ 07647, 201-768-5400 ..... C•1848,1853
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U.S. Terminals, Cincinnati, OH 45243, 513-561-8145 ..... C•1557
† ADC Telecommunications, Inc., Minneapolis, MN 55435 612-835-6800
Breeze-Illinois, TransTechnology Corp., Peoria, IL 61615-1584 309-693-3300
Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
† DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011 212-691-9050
† Lynn Electronics, Feasterville, PA 19047 ..... 215-677-6700;800-523-6075
§† M/A-COM Omni Spectra, Inc., Merrimack, NH 03054 603-424-4111
† Trompter Electronics, Inc., Sterling Holding, Westlake Village, CA 91359-5069 818-707-2020

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AMP, Harrisburg, PA 17105, 717-564-0100 ..... C•1157
† Melles Griot, Inc., Irvine, CA 92714 714-261-5600

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§† Bourns, Inc., Resistive Components Group, Riverside, CA 92507, 714-781-5050 ..... A•2087
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820, 603-742-1120,800-872-0042 ..... A•2089, B•1009
§† Dale Electronics, Techno Division, Van Nuys, CA 91405-1139, 818-781-1642 ..... A•2100-2103
IET Labs, Inc., Westbury, NY 11590, 516-334-5959 ..... D•1286,1289
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§† Mepcopal Company, San Diego, CA 92121, 619-453-0332 ..... A•2132
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•2137
Ohmite Manufacturing Co., Skokie, IL 60076, 312-675-2600 ..... A•2139
† Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380 ..... A•2141
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§† Vernitron Corp., VRN Div., St. Petersburg, FL 33743, 813-347-2181 ..... A•2149, B•1038
§† Vishay Resistive Systems Group, Malvern, PA 19355, 215-644-1300 ..... A•2151
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† Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
§ Mallory Components Division, Emhart Elec./Elctrn. Grp., Woodstock, Ont., CANADA N4S 7W8 519-539-4891
† Penny & Giles, Santa Monica, CA 90401 213-393-1497
† Robert Shaw Instrument Div., Natick, MA 01760 617-875-9711
§† Sfernice, Inc., Grand Junction, CO 81502 303-242-0810
Techno, Inc., Van Nuys, CA 91405 818-781-1642
§† Varnistor Corp., Sevierville, TN 37862 615-453-0001

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† **Acopian, Easton, PA 18044, 215-258-5441** ..... **D•1587**
† **Advanced Analog, Intech, Santa Clara, CA 95050, 408-988-4930** ..... **D•1616**
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† **Applied Power Conversion, Technology Dynamics, Inc., Bergenfield, NJ 07621, 201-385-0500** ..... **D•1620-1622,1625**
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† **Del Elctrns. Corp., Mt. Vernon, NY 10550, 914-699-2000** ..... **D•1719,1721**
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† **EMCO High Voltage Co., Sutter Creek, CA 95685, 209-223-3626** ..... **D•1751**
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† **Litton Electron Devices, San Carlos, CA 94070, 415-591-8411** .. **B•1021, D•1898**
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† **Modular Devices, Shirley, NY 11967, 516-345-3100** ..... **D•1918**
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Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ..... **D•2218**
† **Penn-Tran Corp., Wingate, PA 16880, 814-355-1521** ..... **B•1027, D•1945**
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Ritz Electronics/Relco, New Dundee, Ont., CANADA NOB 2EO, 519-696-2616 ..... **C•1087, D•2041**
† **RO Associates, Inc., Sunnyvale, CA 94088, 408-744-1450** ..... **B•1028-1030**
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† **Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001** ..... **D•2081**
U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 213-316-9984 ..... **C•1087**
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† Adtech Power Inc., Anaheim, CA 92806 714-634-9211
† Advance Conversion Devices Co., Randolph, NJ 07869 201-989-0095
Astrosystems, Lake Success, NY 11042 516-328-1600
† ATC Power Systems, Inc., Nashua, NH 03063 603-882-1366
Autronics Corp., Arcadia, CA 91006 818-445-5470
§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
† B C Systems, Inc., Setauket, NY 11790 516-751-9370
† Boeing Electronics, Seattle, WA 98124-6269 206-657-7474
† Brandt Electronics, Inc., Mountain View, CA 94043 415-967-4944
† CEAG Electric Corp., Hauppauge, NY 11788 516-582-4422
† CML MACARR, A Marine Electric Systems Co., Clifton, NJ 07014-1135 201-471-6800
† Computer Products Inc., Power Conversion, Fremont, CA 94538 415-657-9837
§† CPS, Inc., Sunnyvale, CA 94089 408-734-8980
Custom Power Systems, Ronkonkoma, NY 11779-9990 516-467-5328
† Electronic Development Associated, Inc., Dix Hills, NEW YORK 11746 .. 516-673-3881
† Electro Vector, Inc., Forestville, CA 95436 707-887-2292
Elgar Electronics Corporation, San Diego, CA 92121 ..... 619-450-0085;800-854-2213
† E M S Development Corp., Farmingdale, NY 11735 516-293-7900
† Engineered Magnetics, Inc., A Fleet Aerospace Company, Rancho Dominguez, CA 90221 213-635-9555
† ETM Electromatic Inc, Newark, CA 94560 415-797-1100
† Ferranti Venus, Inc., Ferranti International, Farmingdale, NY 11735 516-293-4100
§ HBS Equipment Corporation, Los Angeles, CA 90040 213-726-3033
† Helionetics, Inc., DECC Div., Irvine, CA 92714 714-261-8313
High Voltage Technology Inc., Yonkers, NY 10701 914-423-6636
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Keltec Florida, Inc., Microwave Pro, Amstar Electronics Group, Ft. Walton Bch., FL 32549-2917 904-244-0043
† LH Research, Inc., Tustin, CA 92680 1-800-547-2537
† Mep Controls, Bordentown, NJ 08505 609-298-7300
MIL Electronics, Inc., Dracut, MA 01826 508-453-8000
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 508-475-7831
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
† Oeco Corp., Milwaukie, OR 97222 503-659-7932
OPT Industries Inc., Phillipsburg, NJ 08865 201-454-2600
† Orbit Instrument of Cal., Cypress, CA 90630 714-527-0561
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
Performance Controls, Inc., Horsham, PA 19044 215-675-6500
† Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
† Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821 617-667-9500
† Power Functions Engineering, Garland, TX 75042 214-278-0996
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 201-826-4700
Power Star, Inc., Irvine, CA 92714 ..... 714-261-5377;800-854-9420
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311 818-885-8223
Powertech, Inc., Fairlawn, NJ 07410 201-791-5050
Pylon Elex Development Co. Ltd., Lachine, PQ, CANADA H8S 1Z3 514-637-1186
† Rantec, Emerson Electric, Chatsworth, CA 91311 818-885-8223
† Rantec Division, Emerson Electric Co., Los Osos, CA 93402 805-528-5858
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
† SMI Corp., Superior Mfg. & Instr. Corp., Maspeth, NY 11378-1220 718-476-3000
Sola, A Unit of General Sign., Elk Grove Village, IL 60007-5666 312-439-2800
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803 516-349-8686
† Technology Dynamics Inc., Bergenfield, NJ 07621 201-385-0500
Tecnetics, Computer Products/Tecnetics, Boulder, CO 80306 303-442-3837
Tectrol, Inc., Downsview, Ontario, CANADA M3J 3E5 416-630-8108
Todd Products Corp., Brentwood, NY 11717 516-231-3366
† Trio Laboratories, Inc., Plainview, NY 11803 516-349-0400
Urban Electronics, Dover, MA 02030 617-329-4068
§† URDC, Acme Electric Corporation, West Jordan, UT 84084 801-561-9385
† Varian Microwave Equip. Div., Varian Assocs., Inc., Santa Clara, CA 95054 408-496-6273
Varo Electron Devices:An Imo Inds. Co., Garland, TX 75046 214-487-4129
Wall Industries, Exeter, NH 03833 ..... 603-778-2300;800-321-WALL
† Westcor Corporation, Los Gatos, CA 95032 408-395-7050

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Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
† Cuplex, Inc., Garland, TX 75040 214-276-0333
† DataCon, Inc., Burlington, MA 01803 617-273-5800
§† Digitran Division, Xcel Corporation, Pasadena, CA 91107 818-791-5600
DOW SWITCH, Wilmington, MA 01887 617-935-6395

† Electrohome Limited, Circuit Board Operations, Kitchener, Ontario, CANADA N2G 4J6 519-744-7111
Garry Electronics, Div. of Brintec Corp., Laghorne, PA 19047 215-949-2300
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
§† Injectorall Electronics (Woman Owned), Bohemia, NY 11716 516-563-3388
Intepro Systems Inc., Lexington, MA 02173 617-863-9500
† Logic Technology, Inc., Mtn. View, CA 94043 415-967-1007
§ Longshine Technlg. Inc., San Jose, CA 95132 408-942-1746
PCK Technology Div., Kollmorgen Corp., Melville, NY 11747 516-454-4400
† Poly Circuits, Inc., Bensenville, IL 60106 312-860-3560
† Precision Graphics Inc., Raritan, NJ 08869 201-707-8880
Ragen Corp., Systems Div., N. Arlington, NJ 07032 201-997-1000
Ritz Electronics/Relco, New Dundee, Ont, CANADA NOB 2EO 519-696-2616
† Rogers Corporation, Flexible Interconnections Div., Chandler, AZ 85244 602-963-4584
† Rogers Corporation, Soladyne Div., San Diego, CA 92111 619-279-7872
† Sheldahl, Inc., Northfield, MN 55057 507-663-8000
§ Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
Tadiran Elec. Inds. Inc., Port Washington, NY 11050 516-621-4980
§ U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503 213-316-9984
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Applied Data Systems, Baltimore, MD 21202 ..... 800-541-2003;301-576-0335
Genisco Memory Prods. Corp., Cypress, CA 90630 714-220-0720
† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000
† ISC Cardion Electronics, Inc., Woodbury, NY 11797 516-921-7300
† Kaiser Electronics, Kaiser Aerospace & Elctrns., San Jose, CA 95134 408-432-3000
Matrox Electronic Systems, Ltd., Dorval, QU, CANADA H9P 2T4 514-685-2630

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Programmers, Power Supply-4000 — ***See Vol. D***

Programmers, PROM & Logic Array-3130 — ***See Vol. A***

Programmers, Punched Card-2000 — ***See Vol. D***

Programmers, Tape-2000 — ***See Vol. D***

PROM Programmers — See Programmers, PROM & Logic Array (Vol. A)

Protectors, Brownout-4300

† Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2183-2184
Hipotronics Inc., Brewster, NY 10509, 914-279-8091 ..... D•2204-2205
Hitran Corporation, Flemington, NJ 08822-9943, 201-782-5525 ..... D•2201
† Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ..... D•2218
§ Perma Power Elctrns., Chicago, IL 60648, 312-647-9414 ..... B•1404
§ PolyPhaser Corporation, Gardnerville, NV 89410-1237, 702-782-2511;800-325-7170 ..... B•1405
Abacus Controls Inc., Somerville, NJ 08876 201-526-6010
Active Control Instrumentation, Key Largo, FL 33037 305-451-1000
Albar, Inc., Lynnwood, WA 98036 ..... 206-771-4006;800-822-5227
§† Brooks Power Systems, Bensalem, PA 19020 ..... 215-244-0264;1-800-523-1551
§ Control Cable, Inc., Baltimore, MD 21207 301-298-4411
† Deltec Corporation, A Fiskars Co., San Diego, CA 92110 .. 619-291-4211;800-854-2658
§ Diversified Electronics, Inc., Evansvills, IN 47706-1140 812-426-2806
§† EFI Elctrns., Salt Lake City, UT 84119 ..... 801-977-9009:800-221-1174
§ Elgar Electronics Corporation, San Diego, CA 92121 ..... 619-450-0085;800-854-2213
Globtek, Inc., N. Bergen, NJ 07047 201-861-0246
§† North Hills Electronics Inc., Power Products Div., Glen Cove, NY 11542-3796 516-671-5700
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Sola, A Unit of General Sign., Elk Grove Village, IL 60007-5666 312-439-2800
§ Sunshine Scientific Instruments, Philadelphia, PA 19115 215-673-5600
§† Superior Electric, Bristol, CT 06010 203-582-9561
Sylvania GTE Control Devices, Standish, ME 04084 207-642-4535
Topaz, Inc., San Diego, CA 92123-1165 619-279-0831

Protectors, Surge — See Suppressors, Transient Voltage (Vol. B)

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Punches, Chassis-5400 — ***See Vol. C***

Pyrometers, Infrared-2900 — ***See Vol. D***

Pyrometers, Optical, Noninfrared-5300

J-B-T Instruments, Inc., New Haven, CT 06508-1818, 203-776-1111 ..... D•1405
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... D•1415
Acme Elec. Heating Corp., Hialeah, FL 33013 305-685-8326
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
Beede Electrical Instrument Co., Inc., Penacook, NH 03303 603-753-6362
§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
§ Epic, Inc., New York, NY 10038 212-349-2470
§ Larson Instrument, Orangeburg, NY 10962 914-359-3800
Leeds & Northrup, General Signal, North Wales, PA 19454 215-699-2000
§† Mikron Instr., Wyckoff, NJ 07481 201-891-7330
Modutec, Manchester, NH 03103 603-669-5121
§ Syscon Intl, Inc., So. Bend, IN 46618-1096 219-232-3900
Triplett Corporation, Bluffton, OH 45817-9987 419-358-5015
§ Westberg Manufacturing Inc. (WESTACH), Sonoma, CA 95476 707-938-2121

Pyrometers, Recording-2900 — ***See Vol. D***

Q Bus — See Board Computers & Subassemblies (Vol. D)

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Racks, Desk & Console — See Enclosures, Equipment & Panel Mounting (Vol. C)

Racks, Module — See Enclosures, Circuit Board, Module & Relay Mounting (Vol. C)

Racks, Relay & Mounting — See Enclosures, Circuit Board, Module & Relay Mounting (Vol. C)

Radar Systems (MIL)-2440

Electronic Systems Div., Servo Corp. of America, Hicksville, NY 11802, 516-938-9700 ..... A•1782-1783
Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
† Datron Systems, Inc., Simi Valley, CA 93065-1650 805-584-1717
† E-Systems, Greenville Div., Greenville, TX 75401 214-455-3450
† E-Systems, Melpar Div., Falls Church, VA 22046 703-560-5000
† ITT Gilfillan, ITT Corp., Van Nuys, CA 91409 818-988-2600
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400

Radar System Components-3450 — *See Vol. A*

Radio Communications Systems — See Communications Systems (Vol. D)

Radiographic Equip. — See X-ray Inspection Equip. (Vol. D)

Radiometers-2900 — *See Vol. D*

Radomes & Windows, Microwave-3450 — *See Vol. A*

Reactors, Charging-5600 — *See Vol. A*

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Reactors, Filter-5600 — *See Vol. A*

Reactors, Loading-5600 — *See Vol. A*

Reactors, Saturable-1800 — *See Vol. A*

Reactors (MIL)-2440

§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
† Del Electrns. Corp., Mt. Vernon, NY 10550 914-699-2000
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 213-234-9091
§† Microtran Co. Inc., Valley Stream, NY 11582 516-561-6050
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
OPT Industries Inc., Phillipsburg, NJ 08865 201-454-2600
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Torotel Prods. Inc., Grandview, MO 64030-3199 816-761-6314
§† United Transformer Co.:Div. of Opt Industries Inc., Phillipsburg, NJ 08865 201-454-2600
† Wirebenders, Inc., Phoenix, AZ 85021 602-861-1856

Readers, Badge-2000 — *See Vol. D*

Readers, Bar Code-2000 — *See Vol. D*

Readers, Character-2000 — *See Vol. D*

Readers, Key-2000 — *See Vol. D*

Readers, Magnetic Card-2000 — *See Vol. D*

Readers, Magnetic Stripe Card-2000 — *See Vol. D*

Readers, Punched Card-2000 — *See Vol. D*

Readers, Punched Tape-2000 — *See Vol. D*

Readers, Static Card-2000 — *See Vol. D*

Readers, Time Code-2000 — *See Vol. D*

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Reamers-5400 — *See Vol. C*

Receivers, AM/FM (Incl. Precision Test)-2900 — *See Vol. D*

Receivers, Communication-1900 — *See Vol. D*

Receivers, Fiber Optic-2475

AMP, Harrisburg, PA 17105, 717-564-0100 ..... C•1157
† Analog Modules, Inc., Longwood, FL 32750, 407-339-4355 ..... D•1004
Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727 ..... B•1214
§† MERET, Inc., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1215
† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ... B•1217, D•1340
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1219
Antel Optronics Inc., Burlington, Ontario, CANADA L7M 1A6 416-335-5507
§† APEC Fiber Optics Corp., College Station, TX 77840 409-693-5397
§ Artel Communications Corp., Hudson, MA 01749 617-562-2100
AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
§ Dymec Silicon Transistor Corp., Winchester, MA 01890 617-729-7870
† Force, Inc., Christiansburg, VA 24073 703-382-0462
† Foundation Instruments Inc., Nepean, ON, CANADA K2E 7J6 613-226-4000
H & L Instruments, Burlingame, CA 94010 415-342-7850
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§† Honeywell Optoelectronics, Richardson, TX 75081 214-470-4271
§† Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 703-953-4751
† Manage, Inc., Fibre Optics Elctrns. Sys. Grp., Chicopee, MA 01014 413-592-9123
† Math Assocs., Westbury, NY 11590 516-334-6800
§ 3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
3 M Photodyne Inc., Camarillo, CA 93010 805-388-8378
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Optelecom, Inc., Gaithersburg, MD 20877 301-840-2121
† Ortel Corp., Alhambra, CA 91803 818-281-3636
Silicon Detector Corp., Camarillo, CA 93010 805-484-2884
§† SpecTran Corp., Sturbridge, MA 01566 508-347-2751
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† Vicon Industries, Inc., Melville, NY 11747 516-293-2200

Receivers, Field Intensity, Microwave — See Receivers, Microwave (Vol. D)

Receivers, Fixed Frequency-2900 — *See Vol. D*

Receivers, Frequency Shift-1900 — *See Vol. D*

Receivers, Headphone — See Handsets, etc. (Vol. D)

Receivers, Loran & Omega-1900 — *See Vol. D*

Receivers, Microwave-3400 — *See Vol. D*

Receivers, Monitoring, Communications-1900 — *See Vol. D*

Receivers, NBS-2900 — *See Vol. D*

Receivers, Telemetry-1900 — *See Vol. D*

Receivers, Tone-1900 — *See Vol. D*

Receivers, TV — See Monitors, Video (Vol. D)

Receivers (MIL)-2440

† Datum Inc., Timing/Aacom Divisions, Anaheim, CA 92806-5790, 714-533-6333 ..... D•1066
Electronic Systems Div., Servo Corp. of America, Hicksville, NY 11802, 516-938-9700 ..... A•1782-1783
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1208-1211
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
† California Microwave, Sunnyvale, CA 94086 408-732-4000
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† Frequency and Time Systems, Inc., DATUM, INC., Beverly, MA 01915 508-927-8220
† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000
Hughes Aircraft Co., Microelctrns. Sys. Div., Irvine, CA 92715 714-752-3800
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
† Stanford Telecommunications, Inc., Santa Clara, CA 95054 408-748-1010
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291

Receivers (MIL), Elint-2440

Adams-Russell, Inc., Hunt Valley, MD 21030 301-771-0077
American Electronic Laboratories, Inc., Lansdale, PA 19446 215-822-2929
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† Condor Systems, Inc., San Jose, CA 95124 408-371-9580
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
† RHG Electronics Laboratory, Inc., Adams Russell, Deer Park, NY 11729 516-242-1100
ST Research Corporation, Newington, VA 22122 703-550-7000
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Receivers (MIL), ESM-2440

† American Electronic Laboratories, Inc., Lansdale, PA 19446 215-822-2929
† Anaren Microwave, E. Syracuse, NY 13057 315-432-8909
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† Cincinnati Elctrns., Cincinnati, OH 45241 513-733-6100
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
MITEQ Inc., Hauppauge, NY 11788 516-436-7400

ST Research Corporation, Newington, VA 22122 703-550-7000
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Receivers (MIL), Radio-2440

Electronic Systems Div., Servo Corp. of America, Hicksville, NY 11802, 516-938-9700 ..... A•1782-1783
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1208-1211
† Aydin Corp., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
† Cincinnati Elctrns., Cincinnati, OH 45241 513-733-6100
† Collins Avionics Divisions, Rockwell Intl., Cedar Rapids, IA 52498 319-395-1000
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† E-Systems, Melpar Div., Falls Church, VA 22046 703-560-5000
† Gorman-Redlich Mfg. Co., Athens, OH 45701 614-593-3150
† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Receivers (MIL), Surveillance-2440

Electronic Systems Div., Servo Corp. of America, Hicksville, NY 11802, 516-938-9700 ..... A•1782-1783
Adams-Russell, Inc., Hunt Valley, MD 21030 301-771-0077
† American Electronic Laboratories, Inc., Lansdale, PA 19446 215-822-2929
† Andersen Laboratories, Bloomfield, CT 06002 203-286-9090
† Condor Systems, Inc., San Jose, CA 95124 408-371-9580
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
† LNR Communications, Inc., Hauppauge, NY 11788 516-273-7111
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
† RHG Electronics Laboratory, Inc., Adams Russell, Deer Park, NY 11729 516-242-1100
† Stanford Telecommunications, Inc., Santa Clara, CA 95054 408-748-1010
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

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Recorders, Event/Multievent-3000 — *See Vol. D*

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Recorders, Video-1900 — *See Vol. D*

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Recorders (MIL), Magnetic Tape-2440

Phi Technologies, Inc., Oklahoma City, OK 73105, 405-521-9000 ..... D•1048,1074-1075
† Analog Equipment Corporation, Palm Bch. Gardens, FL 33418 407-622-3715
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
† Fairchild Weston, Data Recorders, Fairchild Weston Sys., Inc., Sarasota, FL 34230 813-371-0811
† Genisco Memory Prods. Corp., Cypress, CA 90630 714-220-0720
† Lockheed Electronics Co., Inc., Lockheed Corporation, Plainfield, NJ 07061 201-757-1600
† Reproduction Technologies Inc., Bristol, IN 46507-0518 219-848-5233
† Sea Data, Inc., Newton, MA 02158 617-244-8191
Thorn EMI Technology Inc., Atlanta, GA 30350 ..... 404-587-0017;800-243-2572

Recorders (MIL), RHAW-2440

† Analog Equipment Corporation, Palm Bch. Gardens, FL 33418 407-622-3715
† Fairchild Weston, Data Recorders, Fairchild Weston Sys., Inc., Sarasota, FL 34230 813-371-0811
† Reproduction Technologies Inc., Bristol, IN 46507-0518 219-848-5233

Recording Systems (MIL)-2440

§† Astro-Med, Inc., W. Warwick, RI 02893, 401-828-4000 ..... D•1437
Phi Technologies, Inc., Oklahoma City, OK 73105, 405-521-9000 ..... D•1048,1074-1075
† Analog Equipment Corporation, Palm Bch. Gardens, FL 33418 407-622-3715
Digital Dynamics, Inc., Scotts Valley, CA 95066 408-438-4444
† Fairchild Weston, Data Recorders, Fairchild Weston Sys., Inc., Sarasota, FL 34230 813-371-0811
† Image Graphics, Inc., Shelton, CT 06484 203-926-0100
† Reproduction Technologies Inc., Bristol, IN 46507-0518 219-848-5233
§† Saylor Electronics Int'l, Inc., Carson City, NV 89703 702-883-4184
† Sea Data, Inc., Newton, MA 02158 617-244-8191

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Rectifiers, Blocks-4800 — *See Vol. A*

Rectifiers, Bridges & Assemblies-4800 — *See Vol. A*

Rectifiers, Cartridge-4800 — *See Vol. A*

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Rectifiers, Schottky, Surface Mount-4800 — *See Vol. A*

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Rectifiers, Silicon Controlled — See Thyristors (Vol. A)

Rectifiers, Surface Mount-4800 — *See Vol. A*

Rectifiers, Ultrafast-4800 — *See Vol. A*

Rectifiers (MIL), Semiconductor-2440

† Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400 ..... A•2178-2179
† Voltage Multipliers, Inc., Visalia, CA 93291, 209-651-1402 .. A•2208-2209, B•1039
§† International Rectifier Corp., Semiconductor Div., El Segundo, CA 90245 213-772-2000
§† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
Semicon Components, Inc., Div. of Semicon, Inc., Burlington, MA 01803 617-272-9015
§† Semtech, Newbury Park, CA 91320 805-498-2111
Sprague Electric Company, Distbn.Div., Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, The Semiconductor Group, Worcester, MA 01613-2036 617-853-5000

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Reels, Tape — See Tape Recording Accessories (Vol. D)

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Regulators, Current-4000 — *See Vol. D*

Regulators, Frequency-4050 — *See Vol. D*

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Regulators & Stabilizers, Voltage-Also See Transformers, Voltage Regulating-4000 — *See Vol. D*

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Regulators, Voltage, Surface Mount-4800 — *See Vol. A*

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Relays, Coaxial — See Relays, RF (Vol. B)

Relays, Contact — See Relays, Power (Vol. B)

Relays, Cradle-4500

§ Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1416,1419
§ Aromat Corp., New Providence, NJ 07974, 201-464-3550 ..... B•1432,1435
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440 ..... B•1470-1471
§ Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1617-1622
§ Alarm Controls Corporation, Deer Park, NY 11729 516-586-4220
§ American Zettler, Aliso Viejo, CA 92656 714-831-5000
§ FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
§ Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336

§ Phoenix Contact, Harrisburg, PA 17111 717-944-1300
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 812-386-1000

Relays, Crystal Can, 1/2 Crystal Can-4500

§† Airpax Co., Frederick Div., Frederick, MD 21701, 301-663-5141 ..... B•1413
† Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1415-1416
Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... B•1421
† Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000 ..... B•1469
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 ..... B•1488-1489
§† HI-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600 ..... B•1523-1527,1529-1530,1532
§† Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1597,1599,1606
Aromat Corp., New Providence, NJ 07974 201-464-3550
† Babcock, Inc., Orange, CA 92667 714-633-3700
§† Communications Instruments, inc., Fairview, NC 28730 704-628-1711
† Computer Components, Inc., Pelham, NY 10803 914-738-1611
§† Deutsch Relays, Inc., East Northport, NY 11731 516-499-6000
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† Sigma Instuments, Pacific Scientific, Weymouth, MA 02189 617-340-0700
§† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§† Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
§† Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532 803-393-5421
† Wall, A. T., Co., Warwick, RI 02886 401-739-0740

Relays, Current Sensing-4500

Airpax Co., Frederick Div., Frederick, MD 21701, 301-663-5141 ..... B•1413
Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1417
§ Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... B•1421
§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1422
§ American Zettler, Aliso Viejo, CA 92656, 714-831-5000 ..... B•1428-1431
§ Aromat Corp., New Providence, NJ 07974, 201-464-3550 ..... B•1432-1434
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1442
Coto Corporation, Providence, RI 02907, 401-943-2686 ..... B•1451
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1465
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 ..... B•1488
§† Heinemann Electric Co., Lawrenceville, NJ 08648-0800, 609-882-4800 ... B•1370
Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600 ..... B•1529-1532
Leach Relay Division, Leach Corporation, Los Angeles, CA 90003, 213-232-8221 ..... B•1560
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200 ..... B•1566-1568
LSI Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1570-1571
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ... B•1582
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1597
Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1617-1622
Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532, 803-393-5421 ..... B•1634-1639
§ Action Instruments, San Diego, CA 92123 619-279-5726
† American Aerospace Controls, Farmingdale, NY 11735 516-694-5100
§† Amperite Co., Inc., Union City, NJ 07087 201-864-9503
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
† Argent Electronics, Troy, OH 45373 513-335-0031
† Babcock, Inc., Orange, CA 92667 714-633-3700
§ Basler Elec., Highland, IL 62249 618-654-2341
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Computer Components, Inc., Pelham, NY 10803 914-738-1611
§ Cornell-Dubilier Elctrns./Sangamo Comps., New Bedford, MA 02744, MA 02741 508-996-8561
Crompton Instruments, Inc., Glendale Heights, IL 60139 312-351-9888
Crompton Instrs., Hawker Siddley, Elk Grove Village, IL 60007 312-593-1107
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
Elec-Trol, Inc., Saugus, CA 91350 805-252-8330
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
§ Furnas Elec., Batavia, IL 60510 312-879-6000
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
INRESCO, Inc., Pt. Pleasant, NJ 08742 201-892-5881
§ Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101 312-543-6200
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
† Jettron Products Inc., E. Hanover, NJ 07936 201-887-0571
§ Larson Instrument, Orangeburg, NY 10962 914-359-3800
§† Leach Control Products Div., Leach Corporation, Buena Pk, CA 90620 .. 714-739-0770
Liberty Controls, Shorewood, IL 60435 815-725-2241
§† Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Ohmite Manufacturing Co., Skokie, IL 60076 312-675-2600
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Sigma Instuments, Pacific Scientific, Weymouth, MA 02189 617-340-0700
§ Square D Co., Palatine, IL 60067 312-397-2600
§† STI, Control Components Div., San Diego, CA 92126-4507 ..... 619-566-7680; 800-826-5053
Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
§ Theta-J Corporation, Wakefield, MA 01880 617-246-4000
§ Time Mark Corp., Tulsa, OK 74116 918-438-1220
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
§ Wabash Magnetics, Wabash, IN 46992 219-563-2191
† Wilmar Electronics, Inc., Torrance, CA 90505 213-326-6668

Relays, Differential-4500

§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1442
§† Leach Relay Division, Leach Corporation, Los Angeles, CA 90003, 213-232-8221 ..... B•1559
§ Action Instruments, San Diego, CA 92123 619-279-5726
§† Amperite Co., Inc., Union City, NJ 07087 201-864-9503
§† Antex Electronics Corp., Gardena, CA 90248 213-532-3092
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
† Argent Electronics, Troy, OH 45373 513-335-0031
§ Basler Elec., Highland, IL 62249 618-654-2341
Cardinal Control Co., Kensington, CT 06037 203-828-6379
† Computer Components, Inc., Pelham, NY 10803 914-738-1611
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
§ Larson Instrument, Orangeburg, NY 10962 914-359-3800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 812-386-1000
§ Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532 803-393-5421
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
† Wilmar Electronics, Inc., Torrance, CA 90505 213-326-6668

Relays, Frequency Selective-4500

§ Altech Corp., Somerville, NJ 08876 201-359-4454
§† Antex Electronics Corp., Gardena, CA 90248 213-532-3092
† Argent Electronics, Troy, OH 45373 513-335-0031
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Crompton Instruments, Inc., Glendale Heights, IL 60139 312-351-9888
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
† Electronic Specialty Corp., Vancouver, WA 98665 206-574-5000
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
§† Leach Control Products Div., Leach Corporation, Buena Pk, CA 90620 .. 714-739-0770
§† Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Matrix Systems Corp., Calabasas, CA 91302 818-992-6776
§ McCurdy Radio Industries Limited, Toronto, Ont., CAN M4A 2L4 416-751-6262
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
† Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
§ Tetragenics, Butte, MT 59701 406-782-9161
† Wilmar Electronics, Inc., Torrance, CA 90505 213-326-6668

Relays, General Purpose-4500

Airpax Co., Frederick Div., Frederick, MD 21701, 301-663-5141 ..... B•1413
§ Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1417,1419
Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... B•1421
§ American Zettler, Aliso Viejo, CA 92656, 714-831-5000 ..... B•1428-1431
§ Aromat Corp., New Providence, NJ 07974, 201-464-3550 ..... B•1432,1435,1438
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845, 508-685-4371 ..... B•1686-1687
C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1442
Coto Corporation, Providence, RI 02907, 401-943-2686 ..... B•1451
Crydom Company, Cerritos, CA 90701, 213-865-3536 ..... B•1458
§ Deltrol Controls, Milwaukee, WI 53215, 414-671-6800 ..... B•1462-1463
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440 ..... A•1652,1654, B•1470-1471
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1474-1475
§ Fujitsu of America, Santa Clara, CA 95054, 408-562-1000 ..... B•1478-1479,1481-1482,1484-1487
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 ..... B•1491
§ Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... B•1493
Gordos, A Flint Industries Company, Rogers, AR. 72757, AR 72757, 501-636-5000 ..... B•1495
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1510
Hamlin, Lake Mills, WI 53551, 414-648-2361 ..... B•1513
§† Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600 ..... B•1522,1531
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1540
International Rectifier Corp., Semiconductor Div., El Segundo, CA 90245, 213-772-2000 ..... B•1543
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 ..... B•1544-1545,1548-1551
§† Leach Relay Division, Leach Corporation, Los Angeles, CA 90003, 213-232-8221 ..... B•1559-1560
§† Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1565
Mallory Timers, Emhart Elec./Elctrn. Grp., Indianapolis, IN 46201, 317-636-5353 ..... B•1575
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1580-1581
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 .... B•1586,1588
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1823
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1593-1594,1596
§† Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1597,1602

§ Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1617-1622
§ Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1632-1633
§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532, 803-393-5421 ..... B•1634-1639
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... B•1640-1650
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 203-399-6253
Antex Electronics Corp., Gardena, CA 90248 213-532-3092
§† Associated Electronics & Mfg. Corp., Upper Montclair, NJ 07043 201-783-7800
§ Automatic Switch Co., Florham Park, NJ 07932 1-201-966-2000
Babcock, Inc., Orange, CA 92667 714-633-3700
§ Bosch, Robert, Corp., Broadview, IL 60153 312-865-5200
§ Brentek International, Inc., Reading, PA 19601 215-375-7200
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§† Communications Instruments, Inc., Fairview, NC 28730 704-628-1711
§ Cornell-Dubilier Elctrns./Sangamo Comps., New Bedford, MA. 02744, MA 02741 508-996-8561
§ Cornell-Dubilier Elctrns., Wayne, NJ 07470 201-694-8600
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
Elec-Trol, Inc., Saugus, CA 91350 805-252-8330
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 312-882-5757
† Electronic Specialty Corp., Vancouver, WA 98665 206-574-5000
Elmwood Sensors, Pawtucket, RI 02861 401-727-1300
§ Erni Components, Richmond, VA 23236 804-794-6367
§ FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
§ Furnas Elec., Batavia, IL 60510 312-879-6000
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, Northlake, IL 60164 312-681-7100
§ Guardian Elec. Mfg. Co., Chicago, IL 60607 815-337-0050
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
Hold-Heet Products Corp., Chicago, IL 60640 ..... 312-728-4454;312-728-4455
§ Inmark Corp., Norwalk, CT 06854 203-866-8474
§ Interconnect Devices, Inc., Kansas City, KS 66106 913-342-5544
International Mircoelectronics, Arlington, TX 76003 817-561-2244
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Ohmite Manufacturing Co., Skokie, IL 60076 312-675-2600
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
§ Philips ECG, American Philips Co., Waltham, MA 02254 617-890-6107
Relay Service Co., Chicago, IL 60651 312-252-2700
† Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Palatine, IL 60067 312-397-2600
§ Stancor Products, Hamilton Standard Controls, Logansport, IN 46947 219-722-2244
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
† STI, Control Components Div., San Diego, CA 92126-4507 ..... 619-566-7680; 800-826-5053
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ Syracuse Elctrns. Div. of Pass & Seymour, Syracuse, NY 13221 315-488-4911
§ Syracuse Electronics, Pass & Seymour, Inc., Syracuse, NY 13221 315-468-6211
Tane Alarm Products, Floral Park, NY 11001 516-328-3351
§ T-Bar Incorporated, a Data Switch Co., Shelton, CT 06484 203-926-1801
§ Theta-J Corporation, Wakefield, MA 01880 617-246-4000
§ Time Mark Corp., Tulsa, OK 74116 918-438-1220
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
Vanguard Relay Corp., Warwick, RI 02886 401-732-0700

Relays, High Voltage (500 Volts & Over)-4500

§ Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... B•1421
§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1422
Aromat Corp., New Providence, NJ 07974, 201-464-3550 ..... B•1434
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1442
† Computer Components, Inc., Pelham, NY 10803, 914-738-1611 ..... B•1449
Coto Corporation, Providence, RI 02907, 401-943-2686 ..... B•1451-1453,1455
§ Crydom Company, Cerritos, CA 90701, 213-865-3536 ..... B•1456,1458
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1464-1465,1468
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1475
Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... C•1369
§ Gordos, A Flint Industries Company, Rogers, AR. 72757, AR 72757, 501-636-5000 ..... B•1495,1498,1504
§ International Rectifier Corp., Semiconductor Div., El Segundo, CA 90245, 213-772-2000 ..... B•1543
† Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560 ..... B•1552-1557
† LSI Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1571-1572
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1587
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1596
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1597
§† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... B•1615
§ Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390 ... B•1624-1626
Airpax Co., Frederick Div., Frederick, MD 21701 301-663-5141
Allied Control, Plantsville, CT 06479 203-621-6771
Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
Elec-Trol, Inc., Saugus, CA 91350 805-252-8330
Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188 617-335-5200
§ FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
Gordon Products, Brookfield, CT 06804 203-775-4501
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114 203-522-8600
§† Interconnect Devices, Inc., Kansas City, KS 66106 913-342-5544
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Square D Co., Palatine, IL 60067 312-397-2600
Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
§ Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532 803-393-5421
§ Wabash Magnetics, Wabash, IN 46992 219-563-2191

Relays, Hybrid-4500

§ Aromat Corp., New Providence, NJ 07974, 201-464-3550 ..... B•1439
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1442
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 ..... B•1488
§ Gordos, A Flint Industries Company, Rogers, AR. 72757, AR 72757, 501-636-5000 ..... B•1499,1501-1502,1504
§† Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600 ..... B•1534-1535
§† Leach Relay Division, Leach Corporation, Los Angeles, CA 90003, 213-232-8221 ..... B•1559
Matrix Systems Corp., Calabasas, CA 91302, 818-992-6776 ..... B•1579
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1597,1603
§ Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390 ... B•1624-1627
§ T-Bar Incorporated, a Data Switch Co., Shelton, CT 06484, 203-926-1801 ..... B•1850
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... B•1640-1650
Antex Electronics Corp., Gardena, CA 90248 213-532-3092
† Argent Electronics, Troy, OH 45373 513-335-0031
† Babcock, Inc., Orange, CA 92667 714-633-3700
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Control Engrg., Inc., West Springfield, MA 01089 413-781-1330
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
Elec-Trol, Inc., Saugus, CA 91350 805-252-8330
Electronic Specialty Corp., Vancouver, WA 98665 206-574-5000
§ Erni Components, Richmond, VA 23236 804-794-6367
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
§† Leach Control Products Div., Leach Corporation, Buena Pk., CA 90620 .. 714-739-0770
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Midtex Relays, Inc., El Paso, TX 79906 ..... 915-772-1061;1-800-MIDTEX1
§ Phoenix Contact, Harrisburg, PA 17111 717-944-1300
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Square D Co., Palatine, IL 60067 312-397-2600
§ Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532 803-393-5421
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077
§ Theta-J Corporation, Wakefield, MA 01880 617-246-4000
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
Vanguard Relay Corp., Warwick, RI 02886 401-732-0700

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Relays, I/O Modules — See Modules, I/O Relays (Vol. A)

Relays, Latching-4500

§ Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1419
§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1422
§ American Zettler, Aliso Viejo, CA 92656, 714-831-5000 ..... B•1428-1431
§ Aromat Corp., New Providence, NJ 07974, 201-464-3550 ..... B•1432,1434,1437,1439
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1442
§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ..... B•1444-1445

Coto Corporation, Providence, RI 02907, 401-943-2686 ..... B•1451
§ Deltrol Controls, Milwaukee, WI 53215, 414-671-6800 ..... B•1462
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440 ..... B•1470-1471
† Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000 ..... B•1469
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1474
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 ..... B•1488-1489
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 .. B•1546-1550
§† Leach Relay Division, Leach Corporation, Los Angeles, CA 90003, 213-232-8221 ..... B•1559-1563
§† Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1565
† LSI Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1572-1573
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1581-1582
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1586-1587,1591
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1592-1596
§† Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1597,1603,1606
§ Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1617-1622
§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532, 803-393-5421 ..... B•1635-1636,1638
§ T-Bar Incorporated, a Data Switch Co., Shelton, CT 06484, 203-926-1801 ..... B•1850
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... B•1640-1650
§ Wabash Magnetics, Wabash, IN 46992, 219-563-2191 ..... B•1653
§ Action Instruments, San Diego, CA 92123 619-279-5726
A.D. Data, Inc.:Photographic Sciences Corp.(PSC), Webster, NY 14580 .. 716-265-1600
Advanced Components Inds., Inc., Spitznagel GmbH, El Segundo, CA 90245 213-322-4249
Airpax Co., Frederick Div., Frederick, MD 21701 301-663-5141
† Alarm Controls Corporation, Deer Park, NY 11729 516-586-4220
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
Amerace Corp., Elastimold Div., Hackettstown, NJ 07840 201-852-1122
† Babcock, Inc., Orange, CA 92667 714-633-3700
Cardinal Control Co., Kensington, CT 06037 203-828-6379
† Computer Components, Inc., Pelham, NY 10803 914-738-1611
Control Engrg., Inc., West Springfield, MA 01089 413-781-1330
§ Cornell-Dubilier Elctrns./Sangamo Comps., New Bedford, MA. 02744, MA 02741 508-996-8561
§ Cornell-Dubilier Elctrns., Wayne, NJ 07470 201-694-8600
§† Deutsch Relays, Inc., East Northport, NY 11731 516-499-6000
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
† Dow-Key Microwave Corporation, Ventura, CA 93003 805-650-0260
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Elec-Trol, Inc., Saugus, CA 91350 805-252-8330
Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188 617-335-5200
§ FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
§ Furnas Elec., Batavia, IL 60510 312-879-6000
§† Gems Sensors Division, IMO Delaval Inc., Plainville, CT 0602-1198 203-677-1311
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, Northlake, IL 60164 312-681-7100
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
Information Transfer Indl. Inc., Holcomb, NY 14469 716-657-7074
§ Inmark Corp., Norwalk, CT 06854 203-866-8474
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
† Kilovac Corp., Santa Barbara, CA 93140-4422 805-684-4560
Liberty Controls, Shorewood, IL 60435 815-725-2241
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Matrix Systems Corp., Calabasas, CA 91302 818-992-6776
§ Ohmite Manufacturing Co., Skokie, IL 60076 312-675-2600
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
Relay Service Co., Chicago, IL 60651 312-252-2700
† Relay Specialties, Oakland, NJ 07436 201-337-1000
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Sigma Instuments, Pacific Scientific, Weymouth, MA 02189 617-340-0700
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Palatine, IL 60067 312-397-2600
Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
§† Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077
Vanguard Relay Corp., Warwick, RI 02886 401-732-0700

Relays, Mercury-Wetted Contacts-4500

§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1422
§† C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1442-1443
† Computer Components, Inc., Pelham, NY 10803, 914-738-1611 ..... B•1449
Coto Corporation, Providence, RI 02907, 401-943-2686 ..... B•1451-1452,1455
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1474-1475
§ Gordos, A Flint Industries Company, Rogers, AR. 72757, AR 72757, 501-636-5000 ..... B•1495-1498
§ Hamlin, Lake Mills, WI 53551, 414-648-2361 ..... B•1513
Leach Relay Division, Leach Corporation, Los Angeles, CA 90003, 213-232-8221 ..... B•1562
Matrix Systems Corp., Calabasas, CA 91302, 818-992-6776 ..... B•1579
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ... B•1584
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1591
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1597
† Babcock, Inc., Orange, CA 92667 714-633-3700
§ Cosar Corporation, Dallas, TX 75238 ..... 214-340-4584;800-527-1207
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§ El & S Corporation, Stoneham, MA 02180 617-438-5300
§ Elec-Trol, Inc., Saugus, CA 91350 805-252-8330
Gordon Products, Brookfield, CT 06804 203-775-4501
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
§† Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532 803-393-5421
§ Wabash Magnetics, Wabash, IN 46992 219-563-2191

Relays, Meter-4500

§† NES, Inc. (Nationwide Electronic Systems), Carpentersville, IL 60110, 312-426-5900 ..... B•1098, D•1410
A & D Elec. Instrs., Glendale, NY 11385 718-275-6516
Airpax Co., Sensor Div., A Division of North American Philips Corp., Cheshire, CT 06410 203-272-0301
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
§ Beckman Industrial Corp., Emerson Electric Co., San Diego, CA 92123 .. 619-495-3200
§ Beede Electrical Instrument Co., Inc., Penacook, NH 03303 603-753-6362
Calex Mfg. Co., Inc., Pleasant Hill, CA 94523 415-932-3911
Crompton Instruments, Inc., Glendale Heights, IL 60139 312-351-9888
Crompton Instrs., Hawker Siddley, Elk Grove Village, IL 60007 312-593-1107
Digitec, Marion, OH 43302 614-387-3444
§ Electro Industries, Div. E.I. Elctrns., Inc., Westbury, NY 11590 516-334-0870
I.M.C., (International Microtronics Corp.), Tuscon, AZ 85714 ..... 602-748-7900; 1-800-433-3767
§† International Instruments:APrime Technology Company, N. Branford, CT 06471 203-481-5721
§ Jewell Electrical Instruments, Manchester, NH 03108-4038 603-669-6400
§ Larson Instrument, Orangeburg, NY 10962 914-359-3800
§ LFE, Instruments Div., Clinton, MA 01510-3099 508-835-1000
§ Martel Electronics, Windham, NH 03087 ..... 603-893-0886;800-821-0023
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Newport Electronics, Santa Ana, CA 92704-4426 714-540-4914
Q.V.S., Inc., East Orange, NJ 07017 201-673-3996
§ Sigma Instuments, Pacific Scientific, Weymouth, MA 02189 617-340-0700
§ Simpson Electric Co., Elgin, IL 60120 312-697-2260
§ Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532 803-393-5421
Texmate, Inc., Solana Beach, CA 92075 619-481-7177
§ Yokogawa Corp. of America, Newnan, GA 30265 404-253-7000

Relays, Motor Start-4500

Airpax Co., Frederick Div., Frederick, MD 21701, 301-663-5141 ..... B•1413
§ Aromat Corp., New Providence, NJ 07974, 201-464-3550 ..... B•1437,1439
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1442
Coto Corporation, Providence, RI 02907, 401-943-2686 ..... B•1451
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1466-1468
Fujitsu of America, Santa Clara, CA 95054, 408-562-1000 ..... B•1480
Hasco Components, Inc., Bellrose Village, NY 11001, 516-328-9292 ..... B•1521
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 ..... B•1551
§† Leach Relay Division, Leach Corporation, Los Angeles, CA 90003, 213-232-8221 ..... B•1559-1563
§ Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1565
LSI Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1571
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1584-1585
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1597,1601
§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532, 803-393-5421 ..... B•1635,1637
§ Altech Corp., Somerville, NJ 08876 201-359-4454
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
Bosch, Robert, Corp., Broadview, IL 60153 312-865-5200
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§ Cornell-Dubilier Elctrns./Sangamo Comps., New Bedford, MA. 02744, MA 02741 508-996-8561
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
Electronic Specialty Corp., Vancouver, WA 98665 206-574-5000
Elmwood Sensors, Pawtucket, RI 02861 401-727-1300
§ Furnas Elec., Batavia, IL 60510 312-879-6000

§ Gordos, A Flint Industries Company, Rogers, AR. 72757, AR 72757 501-636-5000
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
§ KB Electronics, Brooklyn, NY 11207 718-257-3300
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
§ Payne Engineering, Scott Depot, WV 25560 304-757-7353
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
§ Sigma Instuments, Pacific Scientific, Weymouth, MA 02189 617-340-0700
§ Square D Co., Palatine, IL 60067 312-397-2600
§ Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
Vanguard Relay Corp., Warwick, RI 02886 401-732-0700

Relays, Phase Sensing-4500

§ Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... B•1421
§† Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600 ..... B•1538
Leach Relay Division, Leach Corporation, Los Angeles, CA 90003, 213-232-8221 ..... B•1561
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1583-1585
§ Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390 ... B•1624-1625
§† STI, Control Components Div., San Diego, CA 92126-4507, 619-566-7680;800-826-5053 ..... B•1631
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§† Antex Electronics Corp., Gardena, CA 90248 213-532-3092
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
† Argent Electronics, Troy, OH 45373 513-335-0031
† Babcock, Inc., Orange, CA 92667 714-633-3700
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Crompton Instruments, Inc., Glendale Heights, IL 60139 312-351-9888
Crompton Instrs., Hawker Siddley, Elk Grove Village, IL 60007 312-593-1107
Crydom Company, Cerritos, CA 90701 213-865-3536
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 312-882-5757
† Electronic Specialty Corp., Vancouver, WA 98665 206-574-5000
§ Furnas Elec., Batavia, IL 60510 312-879-6000
§† Leach Control Products Div., Leach Corporation, Buena Pk., CA 90620 .. 714-739-0770
† Logitek, Inc., Ronkonkoma, NY 11779 516-467-4200
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532 803-393-5421
§ Syracuse Elctms. Div. of Pass & Seymour, Syracuse, NY 13221 315-488-4911
† Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
§ Time Mark Corp., Tulsa, OK 74116 918-438-1220
† Wilmar Electronics, Inc., Torrance, CA 90505 213-326-6668

Relays, Plug-in-4500

† Airpax Co., Frederick Div., Frederick, MD 21701, 301-663-5141 ..... B•1413
Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1415-1419
Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... B•1421
§ Aromat Corp., New Providence, NJ 07974, 201-464-3550 ..... B•1435,1437-1439
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1442
† Computer Components, Inc., Pelham, NY 10803, 914-738-1611 ..... B•1449
§ Deltrol Controls, Milwaukee, WI 53215, 414-671-6800 ..... B•1462-1463
§† Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000 ..... B•1469
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 ..... B•1489
Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... C•1369
§ Gordos, A Flint Industries Company, Rogers, AR. 72757, AR 72757, 501-636-5000 ..... B•1503,1505-1506
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1510
§† Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600 ..... B•1528,1538
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 .. B•1547,1551
§† Leach Relay Division, Leach Corporation, Los Angeles, CA 90003, 213-232-8221 ..... B•1561-1563
§† Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1565
Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 .. B•1576-1577
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1580-1581
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1595-1596
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1597,1600-1601,1603-1604,1606-1608,1610-1611
§ Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1617-1622
STI, Control Components Div., San Diego, CA 92126-4507, 619-566-7680;800-826-5053 ..... B•1631
§† Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1632-1633
§† Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532, 803-393-5421 ..... B•1636-1637
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... B•1640-1650
§ Action Instruments, San Diego, CA 92123 619-279-5726
Advanced Components Inds., Inc., Spitznagel GmbH, El Segundo, CA 90245 213-322-4249
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 203-399-6253
§ American Zettler, Aliso Viejo, CA 92656 714-831-5000
§† Amperite Co., Inc., Union City, NJ 07087 201-864-9503
Antex Electronics Corp., Gardena, CA 90248 213-532-3092
† Babcock, Inc., Orange, CA 92667 714-633-3700
§ Bosch, Robert, Corp., Broadview, IL 60153 312-865-5200
§ Brentek International, Inc., Reading, PA 19601 215-375-7200
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§† Communications Instruments, Inc., Fairview, NC 28730 704-628-1711
Cornell-Dubilier Elctrns./Sangamo Comps., New Bedford, MA. 02744, MA 02741 508-996-8561
§ Cornell-Dubilier Elctrns., Wayne, NJ 07470 201-694-8600
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, Northlake, IL 60164 312-681-7100
§ Guardian Elec. Mfg. Co., Chicago, IL 60607 815-337-0050
§ Gunther, W., GmbH, D 8500 Numberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
Information Transfer Indl. Inc., Holcomb, NY 14469 716-657-7074
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
Leach Control Products Div., Leach Corporation, Buena Pk., CA 90620 .. 714-739-0770
Liberty Controls, Shorewood, IL 60435 815-725-2241
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
§ Ohmite Manufacturing Co., Skokie, IL 60076 312-675-2600
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ Sigma Instuments, Pacific Scientific, Weymouth, MA 02189 617-340-0700
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Palatine, IL 60067 312-397-2600
§ Stancor Products, Hamilton Standard Controls, Logansport, IN 46947 ... 219-722-2244
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
§ Vanguard Relay Corp., Warwick, RI 02886 401-732-0700

Relays, Power-4500

Airpax Co., Frederick Div., Frederick, MD 21701, 301-663-5141 ..... B•1413
Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1417
§ Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... B•1421
§ American Zettler, Aliso Viejo, CA 92656, 714-831-5000 ..... B•1428-1431
§ Aromat Corp., New Providence, NJ 07974, 201-464-3550 ..... B•1432-1433,1436-1439
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1442
Coto Corporation, Providence, RI 02907, 401-943-2686 ..... B•1451
§ Crydom Company, Cerritos, CA 90701, 213-865-3536 ..... B•1456,1458
§ Deltrol Controls, Milwaukee, WI 53215, 414-671-6800 ..... B•1462-1463
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1464-1468
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440 ... A•1652, B•1470-1471
Fujitsu of America, Santa Clara, CA 95054, 408-562-1000 ..... B•1485-1487
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 ..... B•1489,1491
§ Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... B•1493
§ Gordos, A Flint Industries Company, Rogers, AR. 72757, AR 72757, 501-636-5000 ..... B•1499-1500
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1510
Hamlin, Lake Mills, WI 53551, 414-648-2361 ..... B•1513
Hasco Components, Inc., Bellrose Village, NY 11001, 516-328-9292 ..... B•1516-1521
§† Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600 ..... B•1522,1530-1531
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1540
International Rectifier Corp., Semiconductor Div., El Segundo, CA 90245, 213-772-2000 ..... B•1543
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 .. B•1547,1551
† Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560 ..... B•1552-1557
§† Leach Relay Division, Leach Corporation, Los Angeles, CA 90003, 213-232-8221 ..... B•1559,1561-1563
§ Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1565
† LSI Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1571-1572
Mallory Timers, Emhart Elec./Elctrn. Grp., Indianapolis, IN 46201, 317-636-5353 ..... B•1575
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ..... D•2214
Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 ..... B•1576
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1580-1585
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 .... B•1588-1589
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1594-1596

§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1597,1604-1606
§† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... B•1615
§ Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1617-1622
§ Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390 ... B•1624-1627
§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532, 803-393-5421 ..... B•1634-1639
Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... B•1640-1650
Advanced Components Inds., Inc., Spitznagel GmbH, El Segundo, CA 90245 213-322-4249
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 203-399-6253
§† Antex Electronics Corp., Gardena, CA 90248 213-532-3092
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
† Babcock, Inc., Orange, CA 92667 714-633-3700
§ Basler Elec., Highland, IL 62249 618-654-2341
§ Bosch, Robert, Corp., Broadview, IL 60153 312-865-5200
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§† Communications Instruments, Inc., Fairview, NC 28730 704-628-1711
† Compac, Holbrook, NY 11741 516-585-3400
§ Cornell-Dubilier Elctrns./Sangamo Comps., New Bedford, MA. 02744, MA 02741 508-996-8561
Crompton Instruments, Inc., Glendale Heights, IL 60139 312-351-9888
Crompton Instrs., Hawker Siddley, Elk Grove Village, IL 60007 312-593-1107
Cross Electronics, Warrendale, PA 15086 412-776-1591
§ Curtis Instruments, Inc., Mt. Kisco, NY 10549 914-666-2971
§† Deutsch Relays, Inc., East Northport, NY 11731 516-499-6000
† Dow-Key Microwave Corporation, Ventura, CA 93003 805-650-0260
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
Elec-Trol, Inc., Saugus, CA 91350 805-252-8330
Electronic Specialty Corp., Vancouver, WA 98665 206-574-5000
§ Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188 617-335-5200
Elmwood Sensors, Pawtucket, RI 02861 401-727-1300
§ Emi Components, Richmond, VA 23236 804-794-6367
§ FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
Liberty Controls, Shorewood, IL 60435 815-725-2241
§ Love Controls Corp., Wheeling, IL 60090 312-541-3232
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
§ Ohmite Manufacturing Co., Skokie, IL 60076 312-675-2600
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
§ Opto 22, Huntington Bch., CA 92649 714-891-5861
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
§ Payne Engineering, Scott Depot, WV 25560 304-757-7353
§ Phoenix Contact, Harrisburg, PA 17111 717-944-1300
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Palatine, IL 60067 312-397-2600
§ Stancor Products, Hamilton Standard Controls, Logansport, IN 46947 219-722-2244
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ Syracuse Elctrns. Div. of Pass & Seymour, Syracuse, NY 13221 315-488-4911
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
Vanguard Relay Corp., Warwick, RI 02886 401-732-0700
Wilmar Electronics, Inc., Torrance, CA 90505 213-326-6668

Relays, Printed Circuit Mounting (Incl. Transistor & DIP Case Types)-4500

Airpax Co., Frederick Div., Frederick, MD 21701, 301-663-5141 ..... B•1413
§ Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1415,1418-1419
§ Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... B•1421
§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1422
§ American Zettler, Aliso Viejo, CA 92656, 714-831-5000 ..... B•1428-1431
§ Aromat Corp., New Providence, NJ 07974, 201-464-3550 ..... B•1432-1441
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1442-1443
§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ... B•1448
† Computer Components, Inc., Pelham, NY 10803, 914-738-1611 ..... B•1449
Coto Corporation, Providence, RI 02907, 401-943-2686 ..... B•1451-1455
§ Crydom Company, Cerritos, CA 90701, 213-865-3536 ..... B•1456,1458,1460
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1465,1468
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440 ..... A•1652,1655, B•1470-1471
Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000 ..... B•1469
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1474-1475
§ Fujitsu of America, Santa Clara, CA 95054, 408-562-1000 ..... B•1478-1487
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 ..... B•1488,1490
§ Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... B•1493
§ Gordos, A Flint Industries Company, Rogers, AR. 72757, AR 72757, 501-636-5000 ..... B•1494,1496-1499,1501-1502
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1510-1511
§ Hamlin, Lake Mills, WI 53551, 414-648-2361 ..... B•1513
Hasco Components, Inc., Bellrose Village, NY 11001, 516-328-9292 ..... B•1514-1521
§† Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600 ..... B•1522-1529
Hold-Heet Products Corp., Chicago, IL 60640, 312-728-4454;312-728-4455 ..... B•1539
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1541
International Rectifier Corp., Semiconductor Div., El Segundo, CA 90245, 213-772-2000 ..... B•1543
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 .. B•1544-1551
Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560 ..... B•1552-1553
§† Leach Relay Division, Leach Corporation, Los Angeles, CA 90003, 213-232-8221 ..... B•1562-1563
† LSI Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1570
Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 .. B•1576-1577
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1580-1581,1583-1585
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1586-1588,1590-1591
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1592-1596
§† Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1597-1602,1604,1607,1610-1612
§ Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1617-1622
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1623
§ Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390 ... B•1625,1627
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... B•1629
§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532, 803-393-5421 ..... B•1634,1639
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... B•1640-1650
§ Wabash Magnetics, Wabash, IN 46992, 219-563-2191 ..... B•1652-1653
Advanced Components Inds., Inc., Spitznagel GmbH, El Segundo, CA 90245 213-322-4249
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 203-399-6253
§† Amperite Co., Inc., Union City, NJ 07087 201-864-9503
Antex Electronics Corp., Gardena, CA 90248 213-532-3092
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
† Babcock, Inc., Orange, CA 92667 714-633-3700
§ Bosch, Robert, Corp., Broadview, IL 60153 312-865-5200
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§ Cornell-Dubilier Elctrns./Sangamo Comps., New Bedford, MA. 02744, MA 02741 508-996-8561
§ Cornell-Dubilier Elctrns., Wayne, NJ 07470 201-694-8600
§ Cosar Corporation, Dallas, TX 75238 ..... 214-340-4584;800-527-1207
§ Deltrol Controls, Milwaukee, WI 53215 414-671-6800
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§ Elec-Trol, Inc., Saugus, CA 91350 805-252-8330
† Electro National, Canton, MS 39046 601-859-5511
§ Emi Components, Richmond, VA 23236 804-794-6367
§ FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
Gordon Products, Brookfield, CT 06804 203-775-4501
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, Northlake, IL 60164 312-681-7100
§ Guardian Elec. Mfg. Co., Chicago, IL 60607 815-337-0050
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hughes Aircraft Co., Microelctrns. Sys. Div., Irvine, CA 92715 714-752-3800
§ Inmark Corp., Norwalk, CT 06854 203-866-8474
INRESCO, Inc., Pt. Pleasant, NJ 08742 201-892-5881
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
Leach Control Products Div., Leach Corporation, Buena Pk., CA 90620 .. 714-739-0770
Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
Mallory Timers, Emhart Elec./Elctrn. Grp., Indianapolis, IN 46201 317-636-5353
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
§ Opto 22, Huntington Bch., CA 92649 714-891-5861
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
Preferred Electronics, Inc., Westfield, MA 01086 413-568-2301
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ Sigma Instuments, Pacific Scientific, Weymouth, MA 02189 617-340-0700
§ Solid State Relays, Oak Brook, IL 60521 312-932-1660
Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
STI, Control Components Div., San Diego, CA 92126-4507 ..... 619-566-7680; 800-826-5053
§ Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
§† Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077
Thermosen, Stamford, CT 06904 203-324-6125
§† Theta-J Corporation, Wakefield, MA 01880 617-246-4000
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
Vanguard Relay Corp., Warwick, RI 02886 401-732-0700

Relays, Programmable-4500

Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... B•1421
§ Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600 ..... B•1538
Matrix Systems Corp., Calabasas, CA 91302, 818-992-6776 ..... B•1579
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ... B•1585
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1597,1607
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 203-399-6253
Cardinal Control Co., Kensington, CT 06037 203-828-6379
CDS - Colorado Data Sys., Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
CYTEC Corp., Penfield, NY 14526 ..... 716-381-4740;800-346-3117
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§ Gems Sensors Division, IMO Delaval Inc., Plainville, CT 0602-1198 203-677-1311
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, Northlake, IL 60164 312-681-7100
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Information Transfer Indl. Inc., Holcomb, NY 14469 716-657-7074
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487

Relays, RF (Incl. Antenna & Coaxial)-4500

§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1422
§ Aromat Corp., New Providence, NJ 07974, 201-464-3550 ..... B•1434
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1442
§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ..... B•1444-1445,1448
Compac, Holbrook, NY 11741, 516-585-3400 ..... B•1703
Coto Corporation, Providence, RI 02907, 401-943-2686 ..... B•1451
CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117 ..... D•1241
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1474
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 ..... B•1488-1490
Gordos, A Flint Industries Company, Rogers, AR. 72757, AR 72757, 501-636-5000 ..... B•1494-1496
§† Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600 ..... B•1522,1532
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 ..... B•1548
Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560 ..... B•1552-1556
† LSI Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1570-1573
Matrix Systems Corp., Calabasas, CA 91302, 818-992-6776 ..... B•1579
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1592-1593
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... B•1640-1650
CDS - Colorado Data Sys., Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
§ Cosar Corporation, Dallas, TX 75238 ..... 214-340-4584;800-527-1207
† Daico Industries, Inc., Compton, CA 90224 213-631-1143
§† Dow-Key Microwave Corporation, Ventura, CA 93003 805-650-0260
§ Elec-Trol, Inc., Saugus, CA 91350 805-252-8330
† Electronic Specialty Corp., Vancouver, WA 98665 206-574-5000
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
INRESCO, Inc., Pt. Pleasant, NJ 08742 201-892-5881
Leach Relay Division, Leach Corporation, Los Angeles, CA 90003 213-232-8221
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
MarLee Switch Co., Upland, CA 91786 714-982-8988
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Nepenthe, Inc., Palo Alto, CA 94303 ..... 415-856-9332;800-NEPENTHE
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Thermosen, Stamford, CT 06904 203-324-6125
† Transco Products, Inc., Camarillo, CA 93011-6003 805-987-8007
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831
Vanguard Relay Corp., Warwick, RI 02886 401-732-0700
§ Wabash Magnetics, Wabash, IN 46992 219-563-2191

Relays, Reed-4500

§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1422
§ Aromat Corp., New Providence, NJ 07974, 201-464-3550 ..... B•1433-1434,1439
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1442-1443
† Computer Components, Inc., Pelham, NY 10803, 914-738-1611 ..... B•1449
Coto Corporation, Providence, RI 02907, 401-943-2686 ..... B•1451-1455
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1464-1465
§ Gordos, A Flint Industries Company, Rogers, AR. 72757, AR 72757, 501-636-5000 ..... B•1494-1498
Hasco Components, Inc., Bellrose Village, NY 11001, 516-328-9292 ..... B•1514-1515
† LSI Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1572
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1584-1585
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1597-1598
§ Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1298, B•1629
§† Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1632-1633
§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532, 803-393-5421 ..... B•1639
§ Wabash Magnetics, Wabash, IN 46992, 219-563-2191 ..... B•1652-1653
† Babcock, Inc., Orange, CA 92667 714-633-3700
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Cosar Corporation, Dallas, TX 75238 ..... 214-340-4584;800-527-1207
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ El & S Corporation, Stoneham, MA 02180 617-438-5300
§ Elec-Trol, Inc., Saugus, CA 91350 805-252-8330
† Electro National, Canton, MS 39046 601-859-5511
§ Electronic Applications Co., El Monte, CA 91734 818-442-3212
§ Erni Components, Richmond, VA 23236 804-794-6367
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
Gordon Products, Brookfield, CT 06804 203-775-4501
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, Northlake, IL 60164 312-681-7100
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
§ Hamlin, Lake Mills, WI 53551 414-648-2361
Information Transfer Indl. Inc., Holcomb, NY 14469 716-657-7074
INRESCO, Inc., Pt. Pleasant, NJ 08742 201-892-5881
§ Interconnect Devices, Inc., Kansas City, KS 66106 913-342-5544
International Mircoelectronics, Arlington, TX 76003 817-561-2244
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Matrix Systems Corp., Calabasas, CA 91302 818-992-6776
§ MKC Electronics Corp., Overland Park, KS 66215 913-894-9711
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§ Solid State Relays, Oak Brook, IL 60521 312-932-1660
§ Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200
Tane Alarm Products, Floral Park, NY 11001 516-328-3351
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Thermosen, Stamford, CT 06904 203-324-6125

Relays, Reed, Surface Mount-4500

§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1422
† Computer Components, Inc., Pelham, NY 10803, 914-738-1611 ..... B•1449
§ Coto Corporation, Providence, RI 02907, 401-943-2686 ..... B•1451
§ Gordos, A Flint Industries Company, Rogers, AR. 72757, AR 72757, 501-636-5000 ..... B•1494
Hasco Components, Inc., Bellrose Village, NY 11001, 516-328-9292 ..... B•1514
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1597-1598
Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1617-1622
Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532, 803-393-5421 ..... B•1639
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Fujitsu of America, Santa Clara, CA 95054 408-562-1000
§ Hamlin, Lake Mills, WI 53551 414-648-2361
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
International Mircoelectronics, Arlington, TX 76003 817-561-2244
Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
§ Wabash Magnetics, Wabash, IN 46992 219-563-2191

Relays, Sealed-4500

Airpax Co., Frederick Div., Frederick, MD 21701, 301-663-5141 ..... B•1413
† Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1415,1417,1419
§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1422
§ American Zettler, Aliso Viejo, CA 92656, 714-831-5000 ..... B•1428-1431
§ Aromat Corp., New Providence, NJ 07974, 201-464-3550 ..... B•1432-1434,1436-1439
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1442-1443
§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ..... B•1444-1448
† Computer Components, Inc., Pelham, NY 10803, 914-738-1611 ..... B•1449
Coto Corporation, Providence, RI 02907, 401-943-2686 ..... B•1451
Deltrol Controls, Milwaukee, WI 53215, 414-671-6800 ..... B•1462-1463
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1465-1466
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440 ..... A•1652-1655, B•1470-1471
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1475
§ Fujitsu of America, Santa Clara, CA 95054, 408-562-1000 ..... B•1478-1485
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 ..... B•1488
§ Gordos, A Flint Industries Company, Rogers, AR. 72757, AR 72757, 501-636-5000 ..... B•1494-1502
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1510
Hasco Components, Inc., Bellrose Village, NY 11001, 516-328-9292 ..... B•1514,1516-1521
§† Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600 ..... B•1522,1528,1531-1532
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 ..... B•1544-1547,1549-1550
Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560 ..... B•1552-1553, 1555
§† Leach Relay Division, Leach Corporation, Los Angeles, CA 90003, 213-232-8221 ..... B•1561-1563

§† **Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137** ..... **B•1565**
† **LSI Jennings, San Jose, CA 95122-2696, 408-292-4025** ..... **B•1572**
§ **Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1** ..... **B•1580,1582-1585**
§ **NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000** .... **B•1586-1587**
§ **Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900** ..... **B•1592-1595**
§† **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000** ..... **B•1597-1599,1603,1606-1608**
§ **Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099** ..... **B•1617-1622**
STI, Control Components Div., San Diego, CA 92126-4507, 619-566-7680;800-826-5053 ..... **B•1631**
Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532, 803-393-5421 ..... **B•1634-1635**
§ **T-Bar Incorporated, a Data Switch Co., Shelton, CT 06484, 203-926-1801** ..... **B•1850**
Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... **B•1640-1650**
Advanced Components Inds., Inc., Spitznagel GmbH, El Segundo, CA 90245 213-322-4249
§ Brentek International, Inc., Reading, PA 19601 215-375-7200
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§ Cornell-Dubilier Elctrns./Sangamo Comps., New Bedford, MA. 02744, MA 02741 508-996-8561
§ Cornell-Dubilier Elctrns., Wayne, NJ 07470 201-694-8600
Daico Industries, Inc., Compton, CA 90224 213-631-1143
§† Deutsch Relays, Inc., East Northport, NY 11731 516-499-6000
Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
Elec-Trol, Inc., Saugus, CA 91350 805-252-8330
† Electronic Specialty Corp., Vancouver, WA 98665 206-574-5000
§ FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
Gordon Products, Brookfield, CT 06804 203-775-4501
§† Guardian Elec. Mfg. Co., Chicago, IL 60607 815-337-0050
§ Hamlin, Lake Mills, WI 53551 414-648-2361
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
§ Inmark Corp., Norwalk, CT 06854 203-866-8474
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
Leach Control Products Div., Leach Corporation, Buena Pk., CA 90620 .. 714-739-0770
§ Love Controls Corp., Wheeling, IL 60090 312-541-3232
Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
§ Sigma Instuments, Pacific Scientific, Weymouth, MA 02189 617-340-0700
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Thermosen, Stamford, CT 06904 203-324-6125

Relays, Solid State-4500

§ **Allied Control, Plantsville, CT 06479, 203-621-6771** ..... **B•1418**
Aromat Corp., New Providence, NJ 07974, 201-464-3550 ..... **B•1432,1439-1441**
§ **Crydom Company, Cerritos, CA 90701, 213-865-3536** ..... **B•1456-1460**
§ **Douglas Randall, Pawcatuck, CT 06379, 203-599-2075** ..... **B•1464,1466-1468**
§ **Gordos, A Flint Industries Company, Rogers, AR. 72757, AR 72757, 501-636-5000** ..... **B•1499-1500**
§ **Grayhill Inc., La Grange, IL 60525, 708-354-1040** ..... **B•1510**
§† **Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600** ..... **B•1522-1527,1532-1533,1537**
§ **IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550** ..... **B•1541**
§ **International Rectifier Corp., Semiconductor Div., El Segundo, CA 90245, 213-772-2000** ..... **B•1543**
§ **Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1** ..... **B•1582-1585**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... **B•1823, C•1907**
§ **Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900** ..... **B•1592-1593**
§ **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000** ..... **B•1597,1600,1609-1613**
§ **Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757** ..... **B•1623**
§ **Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390** ..... **B•1624-1625,1627**
Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... **B•1640-1650**
§ Action Instruments, San Diego, CA 92123 619-279-5726
Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§ Alpha Dist. Corp., Richfield, OH 44286 216-659-7100
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
Amerace Corp., Elastimold Div., Hackettstown, NJ 07840 201-852-1122
§† Antex Electronics Corp., Gardena, CA 90248 213-532-3092
† Applied Controls Co., Inc., Fairfield, NJ 07006-2828 201-227-5454
† Argent Electronics, Troy, OH 45373 513-335-0031
† Babcock, Inc., Orange, CA 92667 714-633-3700
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
§ Basler Elec., Highland, IL 62249 618-654-2341
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Cross Electronics, Warrendale, PA 15086 412-776-1591
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
† Dionics, Westbury, NY 11590 516-997-7474
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ EDL, Inc., Hauppauge, NY 11788 ..... 516-435-2808;1-800-DIAL EDL
§ El & S Corporation, Stoneham, MA 02180 617-438-5300
§ Elec-Trol, Inc., Saugus, CA 91350 805-252-8330
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 312-882-5757
Electronic Specialty Corp., Vancouver, WA 98665 206-574-5000
Enerco, Inc., Seattle, WA 98108 206-762-1422
§ Gems Sensors Division, IMO Delaval Inc., Plainville, CT 0602-1198 203-677-1311
§ Guardian Elec. Mfg. Co., Chicago, IL 60607 815-337-0050
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
§ Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101 312-543-6200
International Mircoelectronics, Arlington, TX 76003 817-561-2244
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
Klockner Moeller, Natick, MA 01760 508-655-1910
§† Leach Control Products Div., Leach Corporation, Buena Pk, CA 90620 .. 714-739-0770
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Matrix Systems Corp., Calabasas, CA 91302 818-992-6776
§ MKC Electronics Corp., Overland Park, KS 66215 913-894-9711
Mouser Electronics, Mansfield, TX 76063 800-346-6873
National Controls Corp., W. Chicago, IL 60185 312-231-5900
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
§ Opto 22, Huntington Bch., CA 92649 714-891-5861
Paragon Electric Co., Inc., Two Rivers, WI 54241 414-793-1161
§ Payne Engineering, Scott Depot, WV 25560 304-757-7353
Phase Control Electronics, Glendale, NY 11385 718-441-4278
§ Philips ECG, American Philips Co., Waltham, MA 02254 617-890-6107
§ Phoenix Contact, Harrisburg, PA 17111 717-944-1300
† Preferred Electronics, Inc., Westfield, MA 01086 413-568-2301
Princo Instruments, Inc., Southampton, PA 18966
† PSG Inds., Perkasie, PA 18944 215-257-3621
Regent Controls, Inc., Shelton, CT 06484-0767 203-736-2924
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
§ Scientific Technologies, Optical Sensor Div. Inc., Hayward, CA 94544 ... 415-471-9717
† Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§ Solid State Relays, Oak Brook, IL 60521 312-932-1660
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Palatine, IL 60067 312-397-2600
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
§ Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532 803-393-5421
§ Syracuse Electronics, Pass & Seymour, Inc., Syracuse, NY 13221 315-468-6211
Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312
§† Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077
Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
§† Theta-J Corporation, Wakefield, MA 01880 617-246-4000
† Tong Hsing Elctrn. Inds. Ltd., Orem, UT 84058 801-226-1383
Triac Electronic Systems, Inc., Glendale, NY 11385 718-441-4759
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
§ Wheelock, Inc., Long Branch, NJ 07740 201-222-6880

Relays, Solid State, Surface Mount-4500

Allied Control, Plantsville, CT 06479, 203-621-6771 ..... **B•1418**
Aromat Corp., New Providence, NJ 07974, 201-464-3550 ..... **B•1440-1441**
Crydom Company, Cerritos, CA 90701, 213-865-3536 ..... **B•1460**
Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 .. **B•1576-1577**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... **B•1823**
Altech Corp., Somerville, NJ 08876 201-359-4454
Midtex Relays, Inc., El Paso, TX 79906 ..... 915-772-1061;1-800-MIDTEX1
Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 812-386-1000
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487

Relays, Stepping-4500

† **Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621** ..... **B•1964-1965**
§ **Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000** ..... **B•1603**
§ **Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532, 803-393-5421** ..... **B•1636,1638**
Airpax Co., Frederick Div., Frederick, MD 21701 301-663-5141
§ Bellofram Corporation, Pelham, NH 03076 ..... 603-635-2103;800-343-0039
§† Communications Instruments, Inc., Fairview, NC 28730 704-628-1711
Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188 617-335-5200
GTE Switching & Telephone Products, Northlake, IL 60164 312-681-7100
§ Guardian Elec. Mfg. Co., Chicago, IL 60607 815-337-0050
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Midtex Relays, Inc., El Paso, TX 79906 ..... 915-772-1061;1-800-MIDTEX1
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
§ Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500

Relays, Telephone-4500

§ **American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447** ..... **B•1422**
§ **C.P. Clare Corp., Chicago, IL 60645, 312-262-7700** ..... **B•1442**
§† **Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711** ... **B•1445**
Coto Corporation, Providence, RI 02907, 401-943-2686 ..... **B•1451**
International Rectifier Corp., Semiconductor Div., El Segundo, CA 90245, 213-772-2000 ..... **B•1543**
§ **ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001** ..... **B•1547**

§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1592-1593
§ Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1617-1622
Airpax Co., Frederick Div., Frederick, MD 21701 301-663-5141
§ American Zettler, Aliso Viejo, CA 92656 714-831-5000
§ Aromat Corp., New Providence, NJ 07974 201-464-3550
Bosch, Robert, Corp., Broadview, IL 60153 312-865-5200
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Deltrol Controls, Milwaukee, WI 53215 414-671-6800
Elec-Trol, Inc., Saugus, CA 91350 805-252-8330
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
Gordos, A Flint Industries Company, Rogers, AR. 72757, AR 72757 501-636-5000
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, Northlake, IL 60164 312-681-7100
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
§† Interconnect Devices, Inc., Kansas City, KS 66106 913-342-5544
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
Liberty Controls, Shorewood, IL 60435 815-725-2241
§† Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Midtex Relays, Inc., El Paso, TX 79906 ..... 915-772-1061;1-800-MIDTEX1
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
§ Original Electric Mfg. Co., Inc., Middlesex, NJ 08846 201-271-5770
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 812-386-1000
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§† Theta-J Corporation, Wakefield, MA 01880 617-246-4000
§ Wheelock, Inc., Long Branch, NJ 07740 201-222-6880

Relays, Thermal-4500

Airpax Co., Frederick Div., Frederick, MD 21701, 301-663-5141 ..... B•1887
Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... B•1421
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1442
Coto Corporation, Providence, RI 02907, 401-943-2686 ..... B•1451-1453
Gordos, A Flint Industries Company, Rogers, AR. 72757, AR 72757, 501-636-5000 ..... B•1495
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ... B•1584
§† Amperite Co., Inc., Union City, NJ 07087 201-864-9503
Cambridge Aeroflo, Inc., Shirley, MA 01464 508-45-2346
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
Elec-Trol, Inc., Saugus, CA 91350 805-252-8330
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hold-Heet Products Corp., Chicago, IL 60640 ..... 312-728-4454;312-728-4455
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
† Jettron Products Inc., E. Hanover, NJ 07936 201-887-0571
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Princo Instruments, Inc., Southampton, PA 18966
† PSG Inds., Perkasie, PA 18944 215-257-3621
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Square D Co., Palatine, IL 60067 312-397-2600
§ Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532 803-393-5421
Sylvania GTE Control Devices, Standish, ME 04084 207-642-4535
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907 419-525-8500
§ Wabash Magnetics, Wabash, IN 46992 219-563-2191
Warren G-V, Unit of Signal Co., Whippany, NJ 07981 201-386-1200

Relays, Time Delay-4500

§ Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1418
§ Aromat Corp., New Providence, NJ 07974, 201-464-3550 ..... B•1432
Crydom Company, Cerritos, CA 90701, 213-865-3536 ..... B•1457
§ Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1464,1467
† Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000 ..... B•1469
§ Heinemann Electric Co., Lawrenceville, NJ 08648-0800, 609-882-4800 ... B•1370
§† Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600 ..... B•1534-1535,1538
Hold-Heet Products Corp., Chicago, IL 60640, 312-728-4454;312-728-4455 ..... B•1539
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200 ..... B•1568
Master Electronic Controls, Los Angeles, CA 90025, 213-452-1336 ..... B•1577
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1582-1585
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1597,1607-1608
Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1617-1622
§ Silicon Power Cube Corp., Long Beach, CA 90805, 213-634-9390 ..... B•1624
† STI, Control Components Div., San Diego, CA 92126-4507, 619-566-7680;800-826-5053 ..... B•1631
§† Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1632-1633
§† Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532, 803-393-5421 ..... B•1637
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ Air-O-Tronics, Trush Group, Cazenovia, NY 13035 315-655-2387
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Somerville, NJ 08876 201-359-4454
§† Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
Amerace Corp., Elastimold Div., Hackettstown, NJ 07840 201-852-1122
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 203-399-6253
§† Amperite Co., Inc., Union City, NJ 07087 201-864-9503
§† Antex Electronics Corp., Gardena, CA 90248 213-532-3092
† Argent Electronics, Troy, OH 45373 513-335-0031
§ Artisan Controls Corp., Parsippany, NJ 07054 201-428-1770
§ Automatic Timing & Controls Co., King of Prussia, PA 19406 ..... 215-337-5500; 800-441-8245
† Babcock, Inc., Orange, CA 92667 714-633-3700
§ Brentek International, Inc., Reading, PA 19601 215-375-7200
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§ Cornell-Dubilier Elctrns., Wayne, NJ 07470 201-694-8600
§ Cramer Co., Old Saybrook, CT 06475 800-247-6784
§ Deltrol Controls, Milwaukee, WI 53215 414-671-6800
§† Deutsch Relays, Inc., East Northport, NY 11731 516-499-6000
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 312-882-5757
§ Erni Components, Richmond, VA 23236 804-794-6367
§ Furnas Elec., Batavia, IL 60510 312-879-6000
§ Gems Sensors Division, IMO Delaval Inc., Plainville, CT 0602-1198 203-677-1311
Genicom Corp., Waynesboro, VA 22980 703-949-1471
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, Northlake, IL 60164 312-681-7100
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
§ Instrumentation & Control Sys., ICS Inc., Addison, IL 60101 312-543-6200
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
† Jettron Products Inc., E. Hanover, NJ 07936 201-887-0571
§ Law, R. E. Instrument, Inc., Palos Hills, IL 60465 312-974-4000
§† Leach Control Products Div., Leach Corporation, Buena Pk., CA 90620 .. 714-739-0770
§ Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
Macromatic Division, Milwaukee Elctrns. Corp., Milwaukee, WI 53223 ... 414-358-4000
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
§ MKC Electronics Corp., Overland Park, KS 66215 913-894-9711
§ National Controls Corp., W. Chicago, IL 60185 312-231-5900
Nolatron, Harrisburg, PA 17111 717-564-3398
§ Ohmite Manufacturing Co., Skokie, IL 60076 312-675-2600
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
Paragon Electric Co., Inc., Two Rivers, WI 54241 414-793-1161
Regent Controls, Inc., Shelton, CT 06484-0767 203-736-2924
† Relay Specialties, Oakland, NJ 07436 201-337-1000
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621
§ Scientific Technologies, Optical Sensor Div. Inc., Hayward, CA 94544 ... 415-471-9717
† Sigmapower, Inc., Carson, CA 90746 ..... 213-32-Sigma
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§ Square D Co., Palatine, IL 60067 312-397-2600
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§† Syracuse Elctrns. Div. of Pass & Seymour, Syracuse, NY 13221 315-488-4911
§ Syracuse Electronics, Pass & Seymour, Inc., Syracuse, NY 13221 315-468-6211
§† Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077
† Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
§ Tenor Company, New Berlin, WI 53151 414-782-3800
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907 419-525-8500
Timeco, Inc., Huntington, WV 25705 304-523-5149
§ Time Mark Corp., Tulsa, OK 74116 918-438-1220
Triac Electronic Systems, Inc., Glendale, NY 11385 718-441-4759
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
§ Vanguard Relay Corp., Warwick, RI 02886 401-732-0700
Warren G-V, Unit of Signal Co., Whippany, NJ 07981 201-386-1200
† Wilmar Electronics, Inc., Torrance, CA 90505 213-326-6668

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Relays, Vacuum-4500

Airpax Co., Frederick Div., Frederick, MD 21701, 301-663-5141 ..... B•1413
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1442
§ Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560 ..... B•1552-1556
† LSI Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1571-1573
† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... B•1615
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
§ Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500

§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532 803-393-5421

Relays, Voltage Sensitive-4500

Airpax Co., Frederick Div., Frederick, MD 21701, 301-663-5141 ..... B•1413
§ Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1419
§ Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... B•1421
§ American Relays, Inc., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1422
Aromat Corp., New Providence, NJ 07974, 201-464-3550 ..... B•1432-1435
§ C.P. Clare Corp., Chicago, IL 60645, 312-262-7700 ..... B•1442
† Computer Components, Inc., Pelham, NY 10803, 914-738-1611 ..... B•1449
Crydom Company, Cerritos, CA 90701, 213-865-3536 ..... B•1456,1458
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1465,1468
Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000 ..... B•1469
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 ..... B•1488-1489,1491
Hasco Components, Inc., Bellrose Village, NY 11001, 516-328-9292 ..... B•1516,1518
§† Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600 ..... B•1522
IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1541
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 ..... B•1547
Leach Relay Division, Leach Corporation, Los Angeles, CA 90003, 213-232-8221 ..... B•1561-1563
§† Line Electric Products, Hartford, CT 06141, 203-659-3573;1-800-331-1137 ..... B•1565
† Logitek, Inc., Ronkonkoma, NY 11779, 516-467-4200 ..... B•1568
§ Midtex Relays, Inc., El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1582-1585
Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1592
§† Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1597,1601-1602
Schrack North America Corp., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1617-1622
§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532, 803-393-5421 ..... B•1634-1639
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... B•1640-1650
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ American Zettler, Aliso Viejo, CA 92656 714-831-5000
§† Amperite Co., Inc., Union City, NJ 07087 201-864-9503
§ Antex Electronics Corp., Gardena, CA 90248 213-532-3092
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
† Argent Electronics, Troy, OH 45373 513-335-0031
† Calex Mfg. Co., Inc., Pleasant Hill, CA 94523 415-932-3911
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§† Communications Instruments, Inc., Fairview, NC 28730 704-628-1711
Control Engrg., Inc., West Springfield, MA 01089 413-781-1330
Crompton Instruments, Inc., Glendale Heights, IL 60139 312-351-9888
Crompton Instrs., Hawker Siddley, Elk Grove Village, IL 60007 312-593-1107
§ Diversified Electronics, Inc., Evansville, IN 47706-1140 812-426-2806
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§ Eagle Signal Controls:A Mark IV Inds. Co., Austin, TX 78753 512-837-8300
§ Grayhill Inc., La Grange, IL 60525 708-354-1040
§ Guardian Elec. Mfg. Co., Chicago, IL 60607 815-337-0050
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
INRESCO, Inc., Pt. Pleasant, NJ 08742 201-892-5881
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
Larson Instrument, Orangeburg, NY 10962 914-359-3800
§† Leach Control Products Div., Leach Corporation, Buena Pk., CA 90620 714-739-0770
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Sigma Instuments, Pacific Scientific, Weymouth, MA 02189 617-340-0700
§ Square D Co., Palatine, IL 60067 312-397-2600
† STI, Control Components Div., San Diego, CA 92126-4507 ..... 619-566-7680; 800-826-5053
§ Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
United Technologies Control Systems, Logansport, IN 47401 219-747-6142
§ Wabash Magnetics, Wabash, IN 46992 219-563-2191
Warren G-V, Unit of Signal Co., Whippany, NJ 07981 201-386-1200
† Wilmar Electronics, Inc., Torrance, CA 90505 213-326-6668

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† Airpax Co., Frederick Div., Frederick, MD 21701, 301-663-5141 ..... B•1413
† Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1415-1416
§† Communications Instruments, Inc., Fairview, NC 28730, 704-628-1711 ..... B•1444-1448
† Computer Components, Inc., Pelham, NY 10803, 914-738-1611 ..... B•1449
† Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000 ... B•1469,1664
§† Genicom Corp., Waynesboro, VA 22980, 703-949-1471 ..... B•1488-1489,1491
§† Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600 ..... B•1522-1528,1530
§† Leach Relay Division, Leach Corporation, Los Angeles, CA 90003, 213-232-8221 ..... B•1559-1563
† LSI Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1570-1573
§† Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1597,1606
Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1632-1633
§† Teledyne Relays, Teledyne, Inc., Hawthorne, CA 90250, 213-777-0077 ..... B•1640-1650
† Cornell-Dubilier Elctrns., Wayne, NJ 07470 201-694-8600
§† Deutsch Relays, Inc., East Northport, NY 11731 516-499-6000
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
Kilovac Corp., Santa Barbara, CA 93140-4422 805-684-4560
§† Leach Control Products Div., Leach Corporation, Buena Pk., CA 90620 714-739-0770
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
§ Scientific Technologies, Optical Sensor Div. Inc., Hayward, CA 94544 415-471-9717
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532 803-393-5421
§† Teledyne Solid State, A Div. of Teledyne Relays, Hawthorne, CA 90250 213-777-0077
† Theta-J Corporation, Wakefield, MA 01880 617-246-4000

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Resistors, Fuse-4300

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300; 800-999-3711 ..... A•1871
Bradford Electronics, Inc., Bradford, PA 16701, 814-362-5700 ..... A•1881
§ Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... A•1921
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-564-3131 ..... A•1938,1940-1942
§† International Resistive Company, Boone, NC 28607, 704-264-8861 ..... A•1960
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1970
§ KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ... A•1975
§† Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1990
§† RCD Components, Inc., Manchester, NH 03103, 603-669-0054 ..... A•2043
§ RCL-Shallcross, Inc., Smithfield, NC 27577, 919-934-5181 ..... A•1959
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
General Resistance, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ Jaro Components, Inc., Ft. Lauderdale, FL 33309-2883 305-771-7000
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
§ Liberty Intl. Corp., FIRSTOHM, Torrance, CA 90505 213-539-6452
Meissner Industries, Dover, NJ 07801 201-366-1700
§† Memcor-Truohm, Inc., Huntington, IN 46750 219-356-4300

§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
RCL-Shallcross, Manchester, NH 03102 603-627-3831
Sfernice, Inc., Grand Junction, CO 81502 303-242-0810
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
Techno, Inc., Van Nuys, CA 91405 818-781-1642
Tel Labs, Inc., Sfernice, Inc., Londonderry, NH 03053 603-625-8994
Ultronix, Inc., Vishay, Grand Junction, CO 81502 303-242-0810
† Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567
Vishay Resistive Systems Group, Malvern, PA 19355 215-644-1300

Resistors, Glass-4700 — *See Vol. A*

Resistors, Heat Sink Encased — See Resistors, Integral Heat Dissipator (Vol. A)

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Resistors, Temperature Sensitive-5300

Elliott/Jordan, A Sub. of Vishay Intertechnology, Malvern, PA 19355, 215-644-1300 ..... **A•1949**
§ International Resistive Company, Boone, NC 28607, 704-264-8861 ..... **A•1954**
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501, 818-990-1192 ... **A•1965**
§ Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... **B•1898-1900**
§† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... **A•1972-1973**
§† Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... **A•1988, B•1907**
Precision Resistor Co., Inc., Largo, FL 34647, 813-541-5771 .. **A•2035,2038-2039**
§† Quality Thermistor, Boise, ID 83709, 208-377-3373 ..... **A•2199**
§† RCD Components, Inc., Manchester, NH 03103, 603-669-0054 ..... **A•2042**
RCL-Shallcross, Inc., Smithfield, NC 27577, 919-934-5181 ..... **A•1961**
Vishay Resistive Systems Group, Malvern, PA 19355, 215-644-1300 ..... **A•2073**
Western Elctrn. Comps. Corp., Camarillo, CA 93010, 805-482-8002 .. **B•1922-1925**
Betatherm Corp., Shrewsbury, MA 01545 508-842-0516
California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 514-739-3274
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
§ Dale Electronics, Techno Division, Van Nuys, CA 91405-1139 818-781-1642
Degussa Corp., Temperature Sensing Products, So. Plainfield, NJ 07080 201-757-6500
† Electro-Films, Inc., Warwick, RI 02886 401-738-9150
† Imperial Astronics, Meridian Intl. Corp., Northridge, CA 91324 818-886-7672
§ Jaro Components, Inc., Ft. Lauderdale, FL 33309-2883 305-771-7000
† Lake Shore Cryotronics, Inc., Westerville, OH 43081 614-891-2243
§ Raltron Electronics, Miami, FL 33172 305-593-6033
RCL-Shallcross, Manchester, NH 03102 603-627-3831
§† Sfernice, Inc., Grand Junction, CO 81502 303-242-0810
Techno, Inc., Van Nuys, CA 91405 818-781-1642
Tel Labs, Inc., Sfernice, Inc., Londonderry, NH 03053 603-625-8994
Tepro of Florida, Clearwater, FL 33575 813-796-1044
† Thermometrics, Inc., Edison, NJ 08817-4695 201-287-2870
Ultronix, Inc., Vishay, Grand Junction, CO 81502 303-242-0810
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

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Angstrohm Precision, Inc., A Sub of Vishay Intertechnology, Malvern, PA 19355, 215-644-1300 ..... **A•1874-1875**
§† Bourns, Inc., Resistive Components Group, Riverside, CA 92507, 714-781-5050 ..... **A•1876**
§† Bradford Electronics, Inc., Bradford, PA 16701, 814-362-5700 ..... **A•1879-1880,1888**
Caddock Electronics, Inc., Riverside, CA 92507, 714-788-1700 ..... **A•1890-1891**
The Carborundum Company, Electronic Ceramics, Niagara Falls, NY 14302, 716-278-2000 ..... **A•1916**
Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820, 603-742-1120,800-872-0042 ..... **B•1009**
§ Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... **A•1921**
§† Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-564-3131 ..... **A•1939-1942**
Dale Electronics, Inc., El Paso Div., El Paso, TX 79926-6728, 915-592-3253 ..... **A•1927-1928**
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... **A•1929,1931-1933,1935-1936**
§ Dale Electronics, Techno Division, Van Nuys, CA 91405-1139, 818-781-1642 ..... **A•1924**
Elliott/Jordan, A Sub. of Vishay Intertechnology, Malvern, PA 19355, 215-644-1300 ..... **A•1948**
General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... **A•1950**
Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600 ..... **B•1529**
§† International Resistive Company, Boone, NC 28607, 704-264-8861 ..... **A•1960, B•1015-1016**
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... **A•1962**
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501, 818-990-1192 ..... **A•1964-1965**
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... **A•1968**
† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ... **A•1972**
† Mepco/Centralab, North American Philips Corporation, Mineral Wells, TX 76067, 817-325-7871 ..... **A•1981, B•1022-1023**
Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... **A•1987-1989**
† Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... **A•1992**
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... **A•1997**
§ Nytronics Components Grp., Inc., Darlington, SC 29532, 803-393-5421 .. **A•2001**
§† Ohmite Manufacturing Co., Skokie, IL 60076, 312-675-2600 ..... **A•2004,2007-2009,2011,2018**
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... **A•2020-2025**
† Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... **A•2028-2029**
Piconics, Tyngsboro, MA 01879, 508-649-7501 ..... **A•2031**
Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 .. **A•2033**
† Precision Resistor Co., Inc., Largo, FL 34647, 813-541-5771 ..... **A•2035-2036**
§† RCD Components, Inc., Manchester, NH 03103, 603-669-0054 ..... **A•2042-2043**
§† RCL-Shallcross, Inc., Smithfield, NC 27577, 919-934-5181 ..... **B•1017**
§† State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 .. **A•2045,2047**
§† Tepro of Florida, Clearwater, FL 33575, 813-796-1044 ... **A•2048-2050,2052-2053**
Victoreen, Inc., Solon, OH 44139, 216-248-9300 ..... **A•2064**
§† Vishay Resistive Systems Group, Malvern, PA 19355, 215-644-1300 ..... **A•2070,2072**
§† Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Bradford Elctrns., Inc., Special Resistor Div., Robbinsville, NC 28771-1179 704-479-6451
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
Electro-Films, Inc., Warwick, RI 02886 401-738-9150
Electronic Precision Components Corporation, Mt. Vernon, NY 10550 ... 914-664-2333
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
† Imperial Astronics, Meridian Intl. Corp., Northridge, CA 91324 818-886-7672
KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Memcor-Truohm, Inc., Huntington, IN 46750 219-356-4300
† Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, Riviera Beach, FL 33404 407-881-3200
Mepco/Centralab, North American Philips Corporation, Los Angeles, CA 90039 818-240-4880
Microplex, Inc., Anaheim, CA 92806 ..... 714-979-8833;714-634-1535
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
† Philips Circuit Assemblies, A Subdivision of North American Philips Corp., West Lafayette, IN 47906 317-463-2536
Pico Electronics, Inc., Mt. Vernon, NY 10552 ..... 914-699-5514;800-431-1064
Powerex, Westinghouse, GE, Mitsubishi, Youngwood, PA 15697 412-925-7272
§† RCL-Shallcross, Manchester, NH 03102 603-627-3831

§† Sfernice, Inc., Grand Junction, CO 81502 303-242-0810
§† Techno, Inc., Van Nuys, CA 91405 818-781-1642
Tel Labs, Inc., Sfernice, Inc., Londonderry, NH 03053 603-625-8994
§† Ultronix, Inc., Vishay, Grand Junction, CO 81502 303-242-0810
§† Varnistor Corp., Sevierville, TN 37862 615-453-0001
Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 802-253-8567

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Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... B•1421
§ American Zettler, Aliso Viejo, CA 92656 714-831-5000
§ FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001 812-386-1000

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Dymec Silicon Transistor Corp., Winchester, MA 01890, 617-729-7870 ..... B•1206-1207
Fiberoptic Systems, Inc., Simi Valley, CA 93063, 805-583-2088 ..... B•1205
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1208,1210,1213
Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... B•1217
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
Rehlander Assocs., Beverly, MA 01915 617-922-5961
Silicon Detector Corp., Camarillo, CA 93010 805-484-2884
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683

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Data Technology, Inc., Woburn, MA 01811, 617-935-8820 ..... B•1945-1947
Disc Instruments, Honeywell, Costa Mesa, CA 92626, 714-433-0343 ..... B•1949-1950

Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116 ..... B•1724-1725
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116, 918-438-7800 ..... B•1253
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1966
U. S. Digital Corp., Los Alamitos, CA 90720, 213-594-0094 ..... B•1997
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
§† Dova Controls, Redmond, WA 98052 206-881-7414
† Farrand Controls, Div. of Farrand Industries, Inc., Valhalla, NY 10595 914-761-2600
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
† Precision Specialties, Inc., Northridge, CA 91324 818-349-9774
Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000
† Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040 ..... 516-328-0200;328-3300
Teledyne Gurley, Troy, NY 12181 518-272-6300
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 312-364-7277
Trans-Tek, Ellington, CT 06029 203-872-8351

Sensors, CCD Image-3700

§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§† Amperex Electronic Company, A Div. of North American Philips Corporation, Slatersville, RI 02876 401-762-3800
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 408-738-4266
§ Fairchild Weston Systems, Inc., CCD Imaging Division, Milpitas, CA 95035 408-433-2500
Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
PULNiX America, Inc., Sunnyvale, CA 94086 408-733-1560
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§ Texas Instruments, Data/Image Sensing (Opto), Dallas, TX 75265 214-995-6611

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Sensors, Fiber Optic-2475

Fiberoptic Systems, Inc., Simi Valley, CA 93063, 805-583-2088 ..... B•1205
† Hathaway Corporation:Motion Control Div., Tulsa, OK 74116, 918-438-7800 ..... B•1253
§† MERET, Inc., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1215
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1219
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
§ APEC Fiber Optics Corp., College Station, TX 77840 409-693-5397
C.G. Instruments, Dayton, OH 45459 513-434-7643
Data Instruments, Inc., Acton, MA 01720 508-264-9550
Dolan-Jenner Inds., Woburn, MA 01801 617-935-7444
§ Efector, Inc., Exton, PA 19341 ..... 215-524-2000;800-441-8246
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 408-738-4266
† Force, Inc., Christiansburg, VA 24073 703-382-0462
FSI/Fork Standards, Inc., Lombard, IL 60148 ..... 312-231-3511;312-932-9380
† Galileo Electro-Optics Corp., Sturbridge, MA 01566 508-347-9191
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 703-953-4751
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
§ 3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
3 M Photodyne Inc., Camarillo, CA 93010 805-388-8378
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Motorola Semiconductor Prods. Sector, Phoenix, AZ 85018-6606 602-244-6900
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173 312-843-7900
Rehlander Assocs., Beverly, MA 01915 617-922-5961
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Scanning Devices, Inc., Waltham, MA 02154 617-891-8991
§ Scientific Technologies, Optical Sensor Div. Inc., Hayward, CA 94544 ... 415-471-9717
† Silicon Detector Corp., Camarillo, CA 93010 805-484-2884
§ Stenning Instrments, Inc., Pacific Palisades, CA 90272 213-459-2930
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
Welch Allyn, Inc., Industrial Products Division, Skaneateles Falls, NY 13153-0187 315-685-8945
† York Technology, Inc., Burbank, CA 91502 818-955-8927

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§ EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1321
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Mepco/Centralab, North American Philips Corporation, Mineral Wells, TX 76067, 817-325-7871 ..... A•1984
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 .... B•1328-1331
Opto Diode Corp., Newbury Park, CA 91320, 805-499-0335 ..... B•1334
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1345
† Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 ..... B•1347
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
§ Advanced Detector Corp., Applied Solar Energy Corp., Industry, CA 91746 818-369-6886
† Atlantic Solar Products, Baltimore, MD 21237 ..... 301-686-2500;800-237-6527
§ CCD Imaging, Fairchild Weston Systems, Inc., Milpitas, CA 95035 408-433-2500
Data Instruments, Inc., Acton, MA 01720 508-264-9550
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
EG&G Reticon, Div. of EG&G, Sunnyvale, CA 94086-4197 408-738-4266
Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Chiswick, London, ENGLAND W4 5HJ 01-994-3670
† Force, Inc., Christiansburg, VA 24073 703-382-0462
FSI/Fork Standards, Inc., Lombard, IL 60148 ..... 312-231-3511;312-932-9380
General Numeric Corporation, Elk Grove Village, IL 60007 312-640-1595
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Ramsey, NJ 07446 201-825-9696
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
§† Honeywell Optoelectronics, Richardson, TX 75081 214-470-4271
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
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§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
§† MERET, Inc., Santa Monica, CA 90404-4998 213-828-7496
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§ Optek Technology Inc., McKinney, TX 75069 214-542-9461
Opto Technology, Inc., Wheeling, IL 60090 312-537-4277
Rehlander Assocs., Beverly, MA 01915 617-922-5961
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Rodann Electronics Mfg. Co., Brea, CA 92621 714-529-1301
Scanning Devices, Inc., Waltham, MA 02154 617-891-8991
§ Scientific Technologies, Optical Sensor Div. Inc., Hayward, CA 94544 ... 415-471-9717
† Silicon Detector Corp., Camarillo, CA 93010 805-484-2884
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§ Skan-A-Matic, Electro Corporation, Sarasota, FL 34230-3049 813-355-8411
Sprague Electric Company, Distbn.Div., Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, The Semiconductor Group, Worcester, MA 01613-2036 617-853-5000
§ Sprague Semiconductor Group:Sprague Electric Co., Worcester, MA 01605 508-795-1300
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
§ Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006 201-575-5586
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
Varo Electron Devices:An Imo Inds. Co., Garland, TX 75046 214-487-4129
Welch Allyn, Inc., Industrial Products Division, Skaneateles Falls, NY 13153-0187 315-685-8945

Sensors, Liquid Flow-5500

E-T-A Circuit Breakers, Chicago, IL 60648, 312-647-8303 ..... B•1956
Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600 ..... B•1533,1538
§ Efector, Inc., Exton, PA 19341 ..... 215-524-2000;800-441-8246
§ FENWAL INC., Ashland, MA 01721 508-881-2000
† Force, Inc., Christiansburg, VA 24073 703-382-0462
Micro Pneumatic Logic, inc., Fort Lauderdale, FL 33309-1786 305-973-6166
Omega Engineering, Stamford, CT 06907 800-826-6342
† Thermometrics, Inc., Edison, NJ 08817-4695 201-287-2870

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Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1345
§ Hy-Cal Engineering, El Monte, CA 91731 818-444-4000
§ Moisture Register Products Div., Aqua Measure Instrument Co., Pomona, CA 91768-3267 714-594-5545
Omega Engineering, Stamford, CT 06907 800-826-6342
Primo Company Limited, Tokyo, JAPAN 181 0422-43-3121
Princo Instruments, Inc., Southampton, PA 18966

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§ **Jan Hardware Mfg. Co., Long Island City, NY 11101, 718-361-0800** ..... **C•1586**
MFM Technology, Inc., Affiliate of Unitrode Corp., Ronkonkoma, NY 11779, 516-467-5151 ..... **B•1279**
† **Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529** ..... **B•1966**
§ B & B Motor & Control Corp., B & B Long Island City, Burlington, CT 06013 ..... 203-673-7151;800-638-7808
§† Berg, W. M., Inc., East Rockaway, NY 11518 516-599-5010
§ Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
§ Machine Components Corp., Plainview, NY 11803 516-694-7222
§† Norelcom Inds., Farmingdale, NY 11735 516-249-7245
PIC Design, Remington Technologies, Inc., Middlebury, CT 06762 203-758-8272
§ Vemaline Prods. Div., Warwick, RI 02887 401-739-7600

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Ad-Vance Magnetics, Inc., Rochester, IN 46975, 219-223-3158 ..... **C•1730**
Atlee Inc., North Andover, MA 01845, 508-681-1003 ..... **C•1732**
Tech-Etch, Inc., Plymouth, MA 02360, 508-747-0300 ..... **C•1748**

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† Libbey-Owens-Ford Co., Liberty Mirror Products, Brackenridge, PA 15014 412-224-1800

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† **Control Technology Co., Inc., Long Island City, NY 11101, 718-361-2133** ..... D•2247

Intronics, Inc., Newton, MA 02158, 617-964-4000 ..... B•1018

† American Electronic Laboratories, Inc., Lansdale, PA 19446 215-822-2929
† Cincinnati Elctrns., Cincinnati, OH 45241 513-733-6100
† E M S Development Corp., Farmingdale, NY 11735 516-293-7900
Hadron, Inc., Fairfax, VA 22030 703-359-6100
† Locus, State College, PA 16804 814-466-6275
† Locus, Alexandria, VA 22303 703-960-1000
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
Republic Electronics Co., Hauppauge, NY 11788 516-273-9800
† Signatron, A Unit of Sundstrand Corp., Lexington, MA 02173 617-861-1500
ST Research Corporation, Newington, VA 22122 703-550-7000
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
† Tracor Flight Systems, Inc., Tracor, Inc., A Westmark Co., Santa Ana, CA 92705 714-662-0333

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† **Fabricast, S. El Monte, CA 91733, 818-443-3247** ..... B•1246,1248-1251
† **Graphite Metallizing Corp., Yonkers, NY 10702, 914-968-8400** ..... B•1252
† **Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 703-953-4751** ..... B•1267-1276
† **Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555** ..... A•2129
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† Danmar Inds., Chatsworth, CA 91311 ..... 818-882-7979/5280
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§ HBM, Inc., Marlboro, MA 01752 508-624-4500
† Precision Specialties, Inc., Northridge, CA 91324 818-349-9774
§† Superior Carbon Products, Inc., Walnut Grove, MS 39189 601-253-2442
† Tech Laboratories Inc., Palisades Pk., NJ 07650 201-944-2221
† Unit Industries, Fullerton, CA 92631 714-871-4161

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† **Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442** ..... B•1147-1149
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† **Ledtronics, Inc., Torrance, CA 90505, 213-549-9995** ..... B•1020,1167
§† **Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016, 312-824-1188** ..... B•1171
§ **Oshino Electric Lamp Works, Ltd., Shinagawa-Ku, Tokyo, JAPAN, 03-471-8548** ..... B•1176-1177
§ **Sloan Co., Sun Valley, CA 91353-0367, 213-875-1123** ..... B•1188-1195
† **Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240** ..... B•1198
§ **Visual Communications Co., Inc., San Diego, CA 92126, 619-549-6900** ..... B•1200-1203
† Alden Products Co., Brockton, MA 02403 508-583-0160
§ Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ American Ultraviolet, Murray Hill, NJ 07974 201-665-2211
Andon Elctrns. Corp., Lincoln, RI 02865 401-333-0388
§† Associated Electronics & Mfg. Corp., Upper Montclair, NJ 07043 201-783-7800
§ Augat Inc., Attleboro, MA 02703 617-222-2202
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
Autoswage Products, Shelton, CT 06484 203-929-1401
§ Bulbtronics, Inc., Farmingdale, NY 11735 ..... 516-249-2272;1-800-654-8542 Eastern Reg
Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007 312-981-6000
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
Communication Devices, Inc., Scarborough, Ont., CAN M1H3A4 416-439-6320
§ Data Display Products, Los Angeles, CA 90009 213-640-0442
Display Devices, Inc., Encinitas, CA 92024 619-753-0113
DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011 212-691-9050
Dupree, Inc., Chino, CA 91710 714-597-4889
Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† Electronic Essentials, Woodside, NY 11377 718-898-8300

§† Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
Entrelec, Alsthom International, Spring Valley, NY 10977 914-425-7460
Fastex, Illinois Tool Works, Des Plaines, IL 60016 312-299-2222
§† Garry Electronics, Div. of Brintec Corp., Laghorne, PA 19047 215-949-2300
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602 203-382-2000
§† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
§ Grayhill Inc., La Grange, IL 60525 708-354-1040
GTI/Electronics Div., Hadley, PA 16130 412-253-3161
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
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§ ITT Sealectro, Trumbull, CT 06611 203-372-4118
Korry Electronics Co., Criton Technologies, Seattle, WA 98109 206-281-1300
Lamb Industries, Inc., Portland, OR 97225 503-297-8878
§† Lamptronix Co., Ltd., Crystal Lake, IL 60014 815-455-0400
§† Ledco Div., St. Paul, MN 55107 612-222-2791
§ Leecraft Mfg., Long Island City, NY 11101 718-392-8800
Mark Eyelet Inc., AMP, Inc., Wolcott, CT 06716 203-756-8847
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§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
† Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
† Star Porcelain, Trenton, NJ 08638 609-392-3154
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630 312-792-2700
§† Sylvania Miniature Lighting, GTE Corporation, Hillsboro, NH 03244 603-464-5533
§ Syracuse Electronics, Pass & Seymour, Inc., Syracuse, NY 13221 315-468-6211
§ Three-Five Sys., Inc., Phoenix, AZ 85201 602-496-0035
§ Trimm, Inc., Div. of Newton Instr. Co., Libertyville, IL 60048 312-362-3700
UVP, Inc., San Gabriel, CA 91778 818-285-3123
§ Wall-Able Mfg. Corp., Elk Grove VI, IL 60007 312-956-8000
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† Jettron Products Inc., E. Hanover, NJ 07936, 201-887-0571 ..... C•1393
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† EBY Company, Philadelphia, PA 19124 215-537-4700
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Jan Hardware Mfg. Co., Long Island City, NY 11101 718-361-0800
Mark Eyelet Inc., AMP, Inc., Wolcott, CT 06716 203-756-8847
Master Electronic Controls, Los Angeles, CA 90025 213-452-1336
Oshino Electric Lamp Works, Ltd., Shinagawa-Ku, Tokyo, JAPAN 03-471-8548
Texas Instrs., Data Sys. Group, Dallas, TX 75380-9063 1-800-527-3500
§† Wells Electronics, South Bend, IN 46613 219-287-5941

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† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272
† CAD Engrg. & Assembly Inc., Mentor, OH 44060 216-255-7744
Cardinal Control Co., Kensington, CT 06037 203-828-6379
§† Chemtronics Inc., Hauppauge, NY 11788 ..... 516-582-3322;800-645-5244
† ELVO:Division of Zumbach Electronics Corporation, Mt. Kisco, NY 10549 914-241-1008
† Fusion Inc., Willoughby, OH 44094 216-946-3300
§† Gardiner Solder Co., Div. of Gardiner Metal Co., Chicago, IL 60632 312-847-0100
† GSI Corp., Timonium, MD 21093 301-252-1768
† Miller, L.C., Co., Monterey Pk, CA 91754 213-268-3611
Multicore Solders, Westbury, NY 11590 516-334-7997
§† OK Industries, Inc., Yonkers, NY 10701 914-969-6800

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† Electro-Mechanisms, Inc., Duarte, CA 91010, 818-359-2535 ..... B•1662-1663
† Electronic Specialty Corp., Vancouver, WA 98665, 206-574-5000 ..... B•1664
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† A.P.W. Co., Inc., Rockaway, NJ 07866 201-627-0643
§ Automatic Switch Co., Florham Park, NJ 07932 1-201-966-2000

† Component Specialties Corp., Temple City, CA 91780 213-283-0015
§† Densitron Corporation, Densitron International, Torrance, CA 90505 213-530-3530
§† Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., Chicago, IL 60641 312-283-4000
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
The Five Star Co., Plantsville, CT 06479 203-628-5561
§ Guardian Elec. Mfg. Co., Chicago, IL 60607 815-337-0050
† IMC Magnetics Corp., Arizona Div., Tempe, AZ 85281 602-968-4441
§† Linear Motions Co., Valinda, CA 91744 818-918-7806
† Lisk, G. W., Co., Clifton Springs, NY 14432 315-462-2611
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§ Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200
Vanguard Relay Corp., Warwick, RI 02886 401-732-0700
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§† Densitron Corporation, Densitron International, Torrance, CA 90505 213-530-3530
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
† Ideal Precision Meter, Brooklyn, NY 11222 212-383-6904
† Lisk, G. W., Co., Clifton Springs, NY 14432 315-462-2611
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† A.P.W. Co., Inc., Rockaway, NJ 07866 201-627-0643
† Ideal Precision Meter, Brooklyn, NY 11222 212-383-6904
† IMC Magnetics Corp., Arizona Div., Tempe, AZ 85281 602-968-4441
† Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
† Lisk, G. W., Co., Clifton Springs, NY 14432 315-462-2611
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† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200

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† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085

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† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... B•1615
§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
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§ Hobson Bros., Chicago, IL 60630-3884 312-283-3600
Ion Physics Co., Wilmington, MA 01887 508-658-6030
Joslyn Electronic Systems, Goleta, CA 93116 805-968-3551
† Lightning Protection Corp., Santa Barbara, CA 93160 ..... 805-967-5089/4577
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
† Physics International Co., Olin Defense Systems Grp., San Leandro, CA 94577 415-577-7236
§ PolyPhaser Corporation, Gardnerville, NV 89410-1237 ... 702-782-2511;800-325-7170
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§ World Products Inc., Sonoma, CA 95476 707-996-5201

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§† Audiosone, Inc., Stratford, CT 06497 203-377-4475
§† MG Electronics, Hauppauge, NY 11788 516-582-3400
† MISCO/Minneapolis Speaker Co., Inc., Minneapolis, MN 55409 612-825-1010
† Oaktron Manufacturing, Inc., Monroe, WI 53566 608-328-5560
§ Poly-Planar Inc., Warminster, PA 18974 215-675-7805
† Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757 ..... 516-957-8700; 800-645-5516

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† Foundation Instruments Inc., Nepean, ON, CANADA K2E 7J6 613-226-4000
† Power Technology, Inc., Little Rock, AR 72219 501-568-1995
§† Western Electronic Products Co., San Clemente, CA 92672 714-492-4677

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§† AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.: 1-800-553-2448
§† General Cable Co., Fiber Optics Div., S. Plainfield, NJ 07080 201-769-3200
GTE Fiberoptic Products, Williamsport, PA 17701 ... 717-326-6591;1-800-FBR-OPTICS
§ 3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961

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§ APEC Fiber Optics Corp., College Station, TX 77840 409-693-5397
§ Baldor Electric Company, Fort Smith, AR 72902 501-646-4711
§ Furnas Elec., Batavia, IL 60510 312-879-6000
§ NRD Inc., Subsidiary of Mark IV Inds., Inc., Grand Island, NY 14072 716-773-7634
Power Functions Engineering, Garland, TX 75042 214-278-0996

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Canon U.S.A., Elctrn. Comps. Div., Lake Success, NY 11042, 516-488-6700 ..... **B•1237**
Epson America, Inc./OEM Div., Torrance, CA 90505, 213-534-4500 ..... **A•1403**
† Stock Drive Products, Div. of Designatronics, Inc., New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... **B•1305**
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... **B•1316**
ADVANCED MICRO SYSTEMS, INC., Hudson, NH 03051 603-882-1447
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018 215-622-1000
Design Components, Inc., Franklin, MA 02038 ..... 508-528-7300;800-341-4811
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
Escap Products, Hauppauge, NY 11788 516-234-3900
Maxwell Electronics, Research Triangle Park, NC 27609 919-846-1633
Portescap U.S., Inc., Hauppauge, NY 11788 516-234-3900
§ SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
§† Superior Electric, Bristol, CT 06010 203-582-9561
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300

Steppers, Indexing, Switch-5100

† Machine Components Corp., Plainview, NY 11803 516-694-7222
§ SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222

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§ Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... **A•2176**
† Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... **D•2183-2184**
Dale Electronics, Inc., El Paso Div., El Paso, TX 79926-6728, 915-592-3253 ..... **B•1891-1892**
Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... **B•1369**
Hipotronics Inc., Brewster, NY 10509, 914-279-8091 ..... **D•2203-2205**
Hitran Corporation, Flemington, NJ 08822-9943, 201-782-5525 ..... **D•2201**
§ ITW Paktron, Div. of Illinois Tool Works, Lynchburg, VA 24502, 804-239-6941 ..... **A•1088-1092**
Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... **B•1898-1900**
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ..... **B•1901-1902**
Maida Development Co., Hampton, VA 23663, 804-723-0785 ..... **A•1104,1107,1978-1979**
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§† MCG Elctrns., Deer Park, NY 11729, 516-586-5125 ..... **B•1387**
§ Motorola Semiconductor Prods. Sector, Phoenix, AZ 85018-6606, 602-244-6900 ..... **A•2189**
† Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ..... **D•2218**
§ Perma Power Elctrns., Chicago, IL 60648, 312-647-9414 ..... **B•1404, C•1620-1621, D•2224-2225**
Philips ECG, American Philips Co., Waltham, MA 02254, 617-890-6107 ..... **A•2196-2197**
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... **A•1278**
§ PolyPhaser Corporation, Gardnerville, NV 89410-1237, 702-782-2511;800-325-7170 ..... **B•1405**
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 ..... **D•2228**
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§ Ritz Electronics/Relco, New Dundee, Ont., CANADA N0B 2E0, 519-696-2616 ..... **C•1087**
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§† Superior Electric, Bristol, CT 06010, 203-582-9561 ..... **D•2233**
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Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222 ..... **A•1679**
§ U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503, 213-316-9984 ..... **C•1087**
Vitec Electronic Corporation, Visalia, CA 93291, 209-739-1077 ..... **A•2510**
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 .. **A•1194-1195,2212-2213**
Acme Electric Corporation, Cuba, NY 14727 716-968-2400
Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 ... 919-738-1121
Anasco Corporation, Danvers, MA 01923 ..... 800-826-2726;508-777-8888
APX-Arstan Products International Inc., Jericho, NY 11753 516-333-8100
§ Atlantic Scientific Corporation, Melbourne, FL 32901 1-800-544-4737
§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
§ Beswick:Cooper U.K. Ltd., Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§ Brooks Electronics, Philadelphia, PA 19140 215-228-4433
§† Brooks Power Systems, Bensalem, PA 19020 ..... 215-244-0264;1-800-523-1551
§† Bud Industries, Inc., Willoughby, OH 44094-0431 216-946-3200
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
Computer Power Inc., High Bridge, NJ 08829 ..... 201-638-8000;800-526-5088
§ Computerware, Inc., Vienna, VA 22180 703-821-8200
§† Control Concepts Corp., Binghamton, NY 13902-1380 607-724-2484
Cuesta Systems Corporation, San Luis Obispo, CA 93401 ..... 805-541-4160; 800-332-3440
§† Current Technology, Inc., Richardson, TX 75081 214-238-5300
§ The Cylix Corporation, Westlake Vl, CA 91361 805-379-3155
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
§ Datatran Corp., Denver, CO 80223 303-778-0870
Deltron, Inc., N. Wales, PA 19454-9990 215-699-9261
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
Dowty RFL Inds. Inc./Communications Div., The Dowty Grp. PLC, Boonton, NJ 07005-0239 201-334-3100
§ Dynatech Computer Power, Inc., Scotts Valley, CA 95066 408-438-5760
† EEV Inc., Elmsford, NY 10523 914-592-6050
§† EFI Elctrns., Salt Lake City, UT 84119 ..... 801-977-9009;800-221-1174
Electrocube, San Gabriel, CA 91776 818-573-3300

§ Electronic Specialists, Natick, MA 01760 ..... 617-655-1532;800-225-4876
§ Electro Standards Lab., Inc., Providence, RI 02940 401-943-1164
Elgar Electronics Corporation, San Diego, CA 92121 ..... 619-450-0085;800-854-2213
§ Energy Electronic Systems, Inc, Timonium, MD 21093 ... 301-252-2240;800-233-4544
§ E.P.D./General Power Corp., Anaheim, CA 92805-8508 ..... 714-520-0881; 1-800-343-1813
§ Ericson Manufacturing Co., Willoughby, OH 44094 216-951-8000
Fagor Elctrn. Comps., Inc., Natl. Mktg. Sls. Offs., Fagor Electrotecnica S. Coop., Canoga Pk., CA 91304 ..... 818-718-2500;800-624-5367
§ FIC Corp., Rockville, MD 20852 ..... 301-881-8124;800-638-6594
§† General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
§† General Semiconductor Ind., Inc., Square D Company, Tempe, AZ 85281 602-968-3101
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
§ Hi-Tech Components, Mitsubishi International Corp., New York, NY 10022 212-605-2607
Instrument Specialties Co., Delaware Water Gap, PA 18327 717-424-8510
† International Power Machines, Garland, TX 75042 800-527-1208
Inter-Technical Group Inc., WIMA Div., Elmsford, NY 10523 914-591-8822
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
JMK, Inc., Amherst, NH 03031 ..... ;;;603-886-4115
Joslyn Electronic Systems, Goleta, CA 93116 805-968-3551
Kalglo Elctrns. Co., Inc., Bethlehem, PA 18017-9359 ..... 215-837-0700;800-524-0400
K-Tronics, K. T. Elctrns. Inc., Sunnyvale, CA 94086 ..... 1-800-888-ELCO
L-Com Inc., N. Andover, MA 01845 508-682-6936
† Lightning Protection Corp., Santa Barbara, CA 93160 ..... 805-967-5089/4577
Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016 312-824-1188
§ Love Controls Corp., Wheeling, IL 60090 312-541-3232
Magnetek Triad, Huntington, IN 46750 219-356-7100
Micro Devices Product Group, Therm-O-Disc, Inc., Mansfield, OH 44907 419-525-8500
§† Microsemi Corp., Santa Ana, CA 92704 714-979-8220
§ Midwest Components, Inc., Muskegon, MI 49443 616-777-2602
§ Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
† Noble U.S.A., Inc., Rolling Meadows, IL 60008 312-364-6038
North Hills Electronics Inc., Power Products Div., Glen Cove, NY 11542-3796 516-671-5700
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Omega Engineering, Stamford, CT 06907 800-826-6342
Phase Control Electronics, Glendale, NY 11385 718-441-4278
Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
§† Power Integrity Corp., Greensboro, NC 27429-0682 ..... 919-379-9773;800-237-6260
§ SAFE Power Systems, Acme Electric Corporation, Tempe, AZ 85282 ... 602-894-6864
Sanford-Miller Corp., Lynbrook, NY 11563 ..... 516-593-2025;800-645-5900
§ San-O Industrial Corp., Bohemia, NY 11716 516-567-5556
Semicon Components, Inc., Div. of Semicon, Inc., Burlington, MA 01803 617-272-9015
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
Semtech, Newbury Park, CA 91320 805-498-2111
§ Shape Magnetronics, Inc., Lombard, IL 60148 ..... 312-620-8394;1-800-367-5811
Shindengen America Inc., Westlake Vl, CA 91361 800-634-3654
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ SL Waber, Inc., Mt. Laurel, NJ 08054 ..... 609-866-8888;800-257-8384
§ Sola, A Unit of General Sign., Elk Grove Village, IL 60007-5666 312-439-2800
§ Square D Co., Palatine, IL 60067 312-397-2600
Staffall Inc., Cranston, RI 02910 401-461-5554
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§† St-Semiconductors of Indiana, Inc., Bloomington, IN 47402-0609 812-332-1435
§ Sunshine Scientific Instruments, Philadelphia, PA 19115 215-673-5600
§† Surgeonics Limited, Fort Edward, NY 12828 518-747-2156
Sutton Designs, Inc., Ithaca, NY 14850 607-277-4301
Sylvania GTE Control Devices, Standish, ME 04084 207-642-4535
§ Syracuse Electronics, Pass & Seymour, Inc., Syracuse, NY 13221 315-468-6211
§ Teccor Electronics, Inc., Irving, TX 75038 214-580-1515
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
Techno, Inc., Van Nuys, CA 91405 818-781-1642
§ Telebyte Technology, Inc., Greenlawn, NY 11740 ..... 516-423-3232;800-835-3298
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800
§ TII Industries Inc., Copiague, NY 11726 516-789-5000
Topaz, Inc., San Diego, CA 92123-1165 619-279-0831
§† Transtector Systems, Inc., Hayden Lake, ID 83835 800-635-2537
§ Tripp-Lite, Chicago, IL 60610 312-329-1777
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9 403-259-3200
Victoreen, Inc., Solon, OH 44139 216-248-9300
† Victor Elec. Wire & Cable, W. Warwick, RI 02893 .. 401-821-1700;SALES 401-821-7800
† The Wiremold Company, W. Hartford, CT 06110 203-233-6251
Xentek, Inc., Vista, CA 92083 619-727-0940

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Adams-Russell, Inc., Hunt Valley, MD 21030 301-771-0077
American Electronic Laboratories, Inc., Lansdale, PA 19446 215-822-2929
† Cohu, Inc., Elctrns. Div., San Diego, CA 92123 619-277-6700
† Condor Systems, Inc., San Jose, CA 95124 408-371-9580
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ..... 214-470-2106/2107
† E-Systems, Greenville Div., Greenville, TX 75401 214-455-3450
Mathematical Systems Design, Inc., Los Angeles, CA 90064 213-479-7180
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400

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§ Dreefs Switch, Inc., Waukegan, IL 60087, 312-662-7667;800-323-9605 ... B•1722
Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1743-1744
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119, 206-284-5475 ..... B•1866
Lucas Duralith Corporation, Millville, NJ 08332, 609-825-6900 ..... B•1873
MarLee Switch Co., Upland, CA 91786, 714-982-8988 ..... B•1789
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1813
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Amber Inds., Inc., Dallas, TX 75379 214-490-9801
CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501 .. 515-573-1300
§† EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ..... 214-470-2106/2107
Jayco Plastics of California, Inc., Orange, CA 92665 714-974-1701
Lamb Industries, Inc., Portland, OR 97225 503-297-8878
† Machine Components Corp., Plainview, NY 11803 516-694-7222
† Premier Microwave, Port Chester, NY 10573 914-939-8900

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† Advanced Systems Concepts, Altadena, CA 91001 818-791-0983
§ Altech Corp., Somerville, NJ 08876 201-359-4454
Bytex Corp., Southborough, MA 01772 617-480-0840
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
§ COMCAB, Wakefield National, Inc., Nashport, OH 43830 614-828-2468
§† EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
§ Electro Standards Lab., Inc., Providence, RI 02940 401-943-1164
KAYCEE INDUSTRIES LTD., Bombay-38, INDIA 263521/22/23
Lamb Industries, Inc., Portland, OR 97225 503-297-8878
† Machine Components Corp., Plainview, NY 11803 516-694-7222

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§ Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... B•1677
Burgess Switch Co., American Electronic Components, Elkhart, IN 46515, 219-262-8608 ..... B•1688-1689,1691
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1698
§ Dreefs Switch, Inc., Waukegan, IL 60087, 312-662-7667;800-323-9605 ... B•1722
Enprotech Corp., Kalamazoo, MI 49007, 616-381-0665 ..... B•1953
Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 312-537-1800 .... B•1757
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
† Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1831
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1833
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1851
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 203-399-6253
Astrosystems, Lake Success, NY 11042 516-328-1600
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Automatic Timing & Controls Co., King of Prussia, PA 19406 ..... 215-337-5500; 800-441-8245
Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Chicago Lock Co., Chicago, IL 60641 312-282-7177
† Cole Instrument Corp., Santa Ana, CA 92704 714-556-3100
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
§† EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188 617-335-5200
† EnTech Corporation, Simsbury, CT 06070 ..... 203-658-2740;203-651-9557
§ Entrelec, Alsthom International, Spring Valley, NY 10977 914-425-7460
Ghielmetti, Inc., Los Angeles, CA 90028-8770 213-463-5111
§† Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
J. R. Merritt Controls, Inc., Stamford, CT 06902 203-359-2113
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
† Precision Mechanisms, Westbury, NY 11590 ..... 516-ED3-5955
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
§ Square D Co., Palatine, IL 60067 312-397-2600
Techniques, Inc., Englewood, NJ 07631 201-569-5900

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§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1698
† Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 ..... B•1702
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419, 312-843-2200 ..... B•1711

§† **Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... B•1720**
§† **EECO Incorporated, Santa Ana, CA 92702-0659, 714-835-6000 .... B•1726-1727**
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1733,1735
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... B•1738
§ **Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1744,1749**
§ **Inter-Market, Glenview, IL 60025, 312-729-5330 ..... B•1178**
§ **Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010, 415-347-8217 .... B•1867**
§ **IVO Industries, Inc., Eatontown, NJ 07724, 201-542-5151;800-932-0489 .. B•1775**
† **Janco Corp., Burbank, CA 91504, 818-846-1800 ..... B•1779**
† **Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ..... B•1667,1784**
Mepcopal Company, San Diego, CA 92121, 619-453-0332 ..... B•1803
§ **NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1816,1818-1821**
§† **Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822**
§† **Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507, 312-844-4300 ..... B•1842**
† **Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1851**
Airflyte Elctrns. Co., Bayonne, NJ 07002 201-436-2230
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
American Control Technology, Inc., West Dundee, IL 60118 312-426-6780
AMP, Harrisburg, PA 17105 717-564-0100
Augat Inc., Attleboro, MA 02703 617-222-2202
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
CTS Corporation, Microelectronics Div., W. Lafayette, IN 47906 317-463-2565
§ CTS Corporation, Switch Div., Paso Robles, Paso Robles, CA 93446 805-238-0350
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
Enerco, Inc., Seattle, WA 98108 206-762-1422
§ Erni Components, Richmond, VA 23236 804-794-6367
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hartmann, Ijamsville, MD 21754 301-831-1055
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
JAE Electronics Inc., Santa Ana, CA 92705-5504 714-250-8770
† Maurey Instrument Corp., Chicago, IL 60629 312-581-4555
§ Noble U.S.A., Inc., Rolling Meadows, IL 60008 312-364-6038
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173 312-843-7900
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 312-390-6680;800-323-6693
SGS-THOMSON Microelectronics, Phoenix, AZ 85022 602-867-6100
Shallco, Inc., Smithfield, NC 27577 919-934-3135
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
Standard Grigsby Inc., W. Gunther GMBH, D 8500 Nurnberg 82, WEST GERMANY 0911-65521
TELTEC, INC., Minneapolis, MN 55425 612-854-9632
§ Via West Interface, Inc., Tucson, AZ 85705 602-623-5716

Switches, Crossbar — See Switches, Matrix (Vol. B)

Switches, Data, Manual-2325 — *See Vol. D*

Switches, Data, Programmable-2325 — *See Vol. D*

Switches, Decade-5100

§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1698**
§ **Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... B•1720**
IVO Industries, Inc., Eatontown, NJ 07724, 201-542-5151;800-932-0489 .. B•1775
JAE Electronics Inc., Santa Ana, CA 92705-5504, 714-250-8770 ..... B•1777
§† **Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822**
† **Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1851**
American Control Technology, Inc., West Dundee, IL 60118 312-426-6780
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
† Cole Instrument Corp., Santa Ana, CA 92704 714-556-3100
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
§† Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
§ EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
Hartmann, Ijamsville, MD 21754 301-831-1055
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 415-347-8217
Meissner Industries, Dover, NJ 07801 201-366-1700
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
§ Shallco, Inc., Smithfield, NC 27577 919-934-3135
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507 312-844-4300
§ Veeder-Root, Hartford, CT 06102 203-527-7201

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§† **American Research & Engineering, Elgin, IL 60123, 312-888-7245 ..... B•1680**
§ **Aries Electronics, Frenchtown, NJ 08825, 201-996-6841 ..... C•1272**
§ **Augat Alcoswitch, Augat Inc., N. Andover, MA 01845, 508-685-4371 ..... B•1686-1687**
Burgess Switch Co., American Electronic Components, Elkhart, IN 46515, 219-262-8608 ..... B•1688
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ... B•1692-1693**
CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501, 515-573-1300 ..... B•1704
§ **CTS Corporation, Switch Div., Paso Robles, Paso Robles, CA 93446, 805-238-0350 ..... B•1712-1716**
§ **EECO Incorporated, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1726**
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... B•1738
§† **Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1743-1744**
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010, 415-347-8217 .... B•1867
JAE Electronics Inc., Santa Ana, CA 92705-5504, 714-250-8770 .... B•1776-1777
§ **Lamb Industries, Inc., Portland, OR 97225, 503-297-8878 .... B•1164,1780-1781**
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-9440 ..... B•1786-1787
§ **Mepcopal Company, San Diego, CA 92121, 619-453-0332 .. A•2132-2133, B•1803**
§ **NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1816-1821**
§ **Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1825**
§ **Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122**
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
American Switch Corp., Wakefield, MA 01880 617-246-1007
§† AMP, Harrisburg, PA 17105 717-564-0100
§ Annulus Technical Industries, Inc., Ancaster, Ontario, CAN L9G 4G4 416-648-8100
§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 214-851-4005
§ Augat Inc., Attleboro, MA 02703 617-222-2202
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403 ..... 612-375-9639;800-826-8719
§ Guardian Elec. Mfg. Co., Chicago, IL 60607 815-337-0050
Hartmann, Ijamsville, MD 21754 301-831-1055
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
§ Indek Corporation, San Jose, CA 95131 408-432-1199
International Mircoelectronics, Arlington, TX 76003 817-561-2244
ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
ITT Schadow, Eden Prairie, MN 55344 612-934-4400
§ Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., Indianapolis, IN 46241 317-856-3731
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459 203-283-8261
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 312-364-6038
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
§ Shallco, Inc., Smithfield, NC 27577 919-934-3135
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ TELTEC, INC., Minneapolis, MN 55425 612-854-9632
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 312-364-7277
§ Vernitron Corp., VRN Div., St. Petersburg, FL 33743 813-347-2181

Switches, Fiber Optic-2475

AMP, Harrisburg, PA 17105, 717-564-0100 ..... C•1157
Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1749
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
§ EAO Switch Corp., Milford, CT 06460 203-877-4577
Fiberoptic Systems, Inc., Simi Valley, CA 93063 805-583-2088
† Frequency Control Products, Inc., American Time Products Div., Deer Pk., NY 11729 516-243-5730
Gems Sensors Division, IMO Delaval Inc., Plainville, CT 0602-1198 203-677-1311
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 703-953-4751
MarLee Switch Co., Upland, CA 91786 714-982-8988
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
§ 3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Otto Controls, Otto Engineering, Carpentersville, IL 60110 312-428-7171
† Penn Keystone Corp., Wallingford, CT 06492 203-294-0537
§ SC Technology, Inc., Livermore, CA 94550 415-373-9230
† York Technology, Inc., Burbank, CA 91502 818-955-8927

Switches, Float-5100

Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
§† Gems Sensors Division, IMO Delaval Inc., Plainville, CT 0602-1198 203-677-1311
† Pressure Controls, Inc., Belleville, NJ 07109 201-751-5002
Signal Systems International, Lavalette, NJ 08735 201-741-1120
† Square D Co., Palatine, IL 60067 312-397-2600

Switches, Foot Pedal, Mat, Ribbon, etc.-5100

§ **Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... B•1677**
§† **Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1831**
§ Furnas Elec., Batavia, IL 60510 312-879-6000
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
Ghielmetti, Inc., Los Angeles, CA 90028-8770 213-463-5111
§ Lektra Service Corp., College Point, NY 11356 718-939-7171
§† Linemaster Switch, Woodstock, CT 06281 203-974-1000
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
§ Marsh Products, Inc., Batavia, IL 60510 312-879-8008
J. R. Merritt Controls, Inc., Stamford, CT 06902 203-359-2113
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Square D Co., Palatine, IL 60067 312-397-2600
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312

Switches, Hall Effect-5100

§ **EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... B•1732**
§ CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501 .. 515-573-1300

Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
Linemaster Switch, Woodstock, CT 06281 203-974-1000
§ Machine Components Corp., Plainview, NY 11803 516-694-7222
Micro Pneumatic Logic, inc., Fort Lauderdale, FL 33309-1786 305-973-6166
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173 312-843-7900
SGS-THOMSON Microelectronics, Phoenix, AZ 85022 602-867-6100
Sprague Electric Company, Distbn.Div., Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, The Semiconductor Group, Worcester, MA 01613-2036 617-853-5000
Wabash Magnetics, Kearney-National Inc., Huntington, IN 46750 219-356-8300

Switches, High Voltage (Over 250 Volts)-5100

§† ASM Corporation, Smithfield, NC 27577, 919-934-3104 ..... B•1685
† Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 ..... B•1702
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1468
Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260 .... B•1721
§ Dreefs Switch, Inc., Waukegan, IL 60087, 312-662-7667;800-323-9605 ... B•1722
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116 ..... B•1724
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... B•1732
EnTech Corporation, Simsbury, CT 06070, 203-658-2740;203-651-9557 .. B•1739
Hamlin, Lake Mills, WI 53551, 414-648-2361 ..... B•1513,1751
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 ..... B•1753
Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 312-537-1800 .... B•1757
† LSI Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1571
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1824
† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... B•1615
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... B•1844-1845
§ Altech Corp., Somerville, NJ 08876 201-359-4454
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
Beckman Industrial Corp., Cedar Grove Div., Cedar Grove, NJ 07009 201-239-6200
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
Del Elctrns. Corp., Mt. Vernon, NY 10550 914-699-2000
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
EG&G, Inc., Electronics Components Div., Salem, MA 01970 508-745-3200
§† Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188 617-335-5200
Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
§ Gunther, W., GmbH, D 8500 Numberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
† Janco Corp., Burbank, CA 91504 818-846-1800
† Kilovac Corp., Santa Barbara, CA 93140-4422 805-684-4560
Landis & Gyr, Inc., Pleasantville, NY 10570 914-747-3540
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
J. R. Merritt Controls, Inc., Stamford, CT 06902 203-359-2113
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Ohmite Manufacturing Co., Skokie, IL 60076 312-675-2600
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
† Physics International Co., Olin Defense Systems Grp., San Leandro, CA 94577 415-577-7236
† Precision Mechanisms, Westbury, NY 11590 ..... 516-ED3-5955
† Radio Switch Corp., Marlboro, NJ 07746 201-462-6100
§ Square D Co., Palatine, IL 60067 312-397-2600
§ Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507 312-844-4300
§† Syracuse Electronics, Pass & Seymour, Inc., Syracuse, NY 13221 315-468-6211
† Tech Laboratories Inc., Palisades Pk, NJ 07650 201-944-2221
Teledyne Kinetics, Div. of Teledyne, Inc., Solana Beach, CA 92075 619-755-1181
§ Wabash Magnetics, Wabash, IN 46992 219-563-2191

Switches, Interlock-5100

§ Burgess Switch Co., American Electronic Components, Elkhart, IN 46515, 219-262-8608 ..... B•1690-1691
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1701
§ Dreefs Switch, Inc., Waukegan, IL 60087, 312-662-7667;800-323-9605 ... B•1722
Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116 ..... B•1724-1725
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... B•1732
§ Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1735
† EnTech Corporation, Simsbury, CT 06070, 203-658-2740;203-651-9557 .. B•1739
§ ITT Schadow, Eden Prairie, MN 55344, 612-934-4400 ..... B•1760
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
† Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ..... B•1784
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1808-1809,1811-1812
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1833
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... B•1845
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ..... B•1847,1849
§ Altech Corp., Somerville, NJ 08876 201-359-4454
American Switch Corp., Wakefield, MA 01880 617-246-1007
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
§† C.P. Clare Corp., Chicago, IL 60645 312-262-7700
Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
† Cole Instrument Corp., Santa Ana, CA 92704 714-556-3100
§ CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501 .. 515-573-1300
DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011 212-691-9050
§† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
§† Electro-Mech Components, Inc., South El Monte, CA 91733-3689 818-442-7180
† Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
§ Hamlin, Lake Mills, WI 53551 414-648-2361
† Kilovac Corp., Santa Barbara, CA 93140-4422 805-684-4560
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
§ Noble U.S.A., Inc., Rolling Meadows, IL 60008 312-364-6038
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173 312-843-7900
† Otto Controls, Otto Engineering, Carpentersville, IL 60110 312-428-7171
Signal Systems International, Lavalette, NJ 08735 201-741-1120
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076 312-964-2330

Switches, Keyboard-5150

§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1701
Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... B•1720
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... B•1732
§ Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1733-1734
Grimes Company, Brea, CA 92621, 714-671-3931 ..... B•1750
§ ITT Schadow, Eden Prairie, MN 55344, 612-934-4400 ..... B•1758-1759
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... B•1868
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448 ..... B•1872
§ Mechanical Enterprises, Herndon, VA 22070, 703-435-9496 .. B•1801,1876-1877
MOLEX, Inc., Lisle, IL 60532, 312-969-4550 ..... B•1815, C•1450-1451,1881
NMB Technologies, Chatsworth, CA 91311, 818-341-3355 ..... B•1879
§ Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1830
Texas Instruments, Connector System, Attleboro, MA 02703, 508-699-5269;508-699-3450 ..... B•1885
Veetronix, Inc., Lexington, NE 68850, 308-324-4600 ..... B•1852-1853
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 214-851-4005
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
§ Corby Industries, Inc., Allentown, PA 18103 215-433-1412
§ CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501 .. 515-573-1300
DOW SWITCH, Wilmington, MA 01887 617-935-6395
DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011 212-691-9050
† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
§ EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
§ Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
§ Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
§ Fujitsu of America, Santa Clara, CA 95054 408-562-1000
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
Ghielmetti, Inc., Los Angeles, CA 90028-8770 213-463-5111
§ Grayhill Inc., La Grange, IL 60525 708-354-1040
§ Gunther, W., GmbH, D 8500 Numberg 82, WEST GERMANY ..... (0)911/65521 or 65520
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
International Mircoelectronics, Arlington, TX 76003 817-561-2244
ITW Cortron, Illinois Tool Works, Elmhurst, IL 60126 312-279-9110
JAE Electronics Inc., Santa Ana, CA 92705-5504 714-250-8770
Korry Electronics Co., Criton Technologies, Seattle, WA 98109 206-281-1300
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
§ Marsh Products, Inc., Batavia, IL 60510 312-879-8008
§ Maxi-Switch Co., Sub. of EECO, Minneapolis, MN 55433 612-755-7660
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
Mouser Electronics, Mansfield, TX 76063 800-346-6873
† Risk, George, Inds., Kimball, NE 69145 308-235-4645
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
Spectra Lux Corp., Kirkland, WA 98034 206-747-0560
§ Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507 312-844-4300
Standard Grigsby Inc., W. Gunther GMBH, D 8500 Numberg 82, WEST GERMANY 0911-65521
Technical Panels, Inc., Temple City, CA 91780 800-343-1170
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800
Thermotech Div. of Menasha Corp., Hopkins, MN 55343 612-933-9400
§ Toko America, Inc., Mt. Prospect, IL 60056 312-297-0070
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300

Switches, Key Lock-5100

§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050, 804-974-5100 ..... B•1684
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845, 508-685-4371 ..... B•1686-1687
Burgess Switch Co., American Electronic Components, Elkhart, IN 46515, 219-262-8608 ..... B•1690
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... B•1693
§ Carlingswitch, Inc., Plainville, CT 06062-1156, 203-793-9281 ..... B•1697
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1701
† Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 ..... B•1702
CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501, 515-573-1300 ..... B•1704
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... B•1732
Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 ..... B•1736
§ Electroswitch, Southern Div., Electro Switch Corp., Raleigh, NC 27604, 919-833-0707 ..... B•1737
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... B•1738
EnTech Corporation, Simsbury, CT 06070, 203-658-2740;203-651-9557 .. B•1739
IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1755
§ Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 312-537-1800 ..... B•1756-1757
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475 ..... A•1085
ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
† Janco Corp., Burbank, CA 91504, 818-846-1800 ..... B•1779
Lamb Industries, Inc., Portland, OR 97225, 503-297-8878 ..... B•1164
† Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ..... B•1667,1784
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1811-1812
§† Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1825
§ Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794 ..... B•1827
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1833
§ Alarm Controls Corporation, Deer Park, NY 11729 516-586-4220
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
Allied Control, Plantsville, CT 06479 203-621-6771
§ Altech Corp., Somerville, NJ 08876 201-359-4454
Ark-Les, Watertown, MA 02172 617-924-2330
Augat Inc., Attleboro, MA 02703 617-222-2202
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
§† Brim Electronics, Fair Lawn, NJ 07410 201-796-2886
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Chicago Lock Co., Chicago, IL 60641 312-282-7177
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
§ COMCAB, Wakefield National, Inc., Nashport, OH 43830 614-828-2468
§ Corby Industries, Inc., Allentown, PA 18103 215-433-1412
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
§ DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011 212-691-9050
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
Entrelec, Alsthom International, Spring Valley, NY 10977 914-425-7460
§ Furnas Elec., Batavia, IL 60510 312-879-6000
Ghielmetti, Inc., Los Angeles, CA 90028-8770 213-463-5111
§ Grayhill Inc., La Grange, IL 60525 708-354-1040
International Mircoelectronics, Arlington, TX 76003 817-561-2244
JAE Electronics Inc., Santa Ana, CA 92705-5504 714-250-8770
Judco Mfg. Inc., Harbor City, CA 90710 213-534-0959
J. R. Merritt Controls, Inc., Stamford, CT 06902 203-359-2113
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Palatine, IL 60067 312-397-2600
§† Syracuse Electronics, Pass & Seymour, Inc., Syracuse, NY 13221 315-468-6211
Tansitor Electronics, Bennington, VT 05201 802-442-5473
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 312-364-7277
§ Toko America, Inc., Mt. Prospect, IL 60056 312-297-0070

Switches, Leaf, Single/Multiple-5100

Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1841
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
Capitol Switch Inc., Danbury, CT 06810 203-744-3300
† EnTech Corporation, Simsbury, CT 06070 ..... 203-658-2740;203-651-9557
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076 312-964-2330

Switches, Lever-5100

§ Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... B•1677
§ American Switch Corp., Wakefield, MA 01880, 617-246-1007 ..... B•1681
Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... B•1683
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050, 804-974-5100 ..... B•1684
Burgess Switch Co., American Electronic Components, Elkhart, IN 46515, 219-262-8608 ..... B•1688-1689
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ... B•1692-1693
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1698-1701,1859
CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501, 515-573-1300 ..... B•1704
§† Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... B•1720
§ DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011, 212-691-9050 ..... B•1723
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... B•1732
† EnTech Corporation, Simsbury, CT 06070, 203-658-2740;203-651-9557 .. B•1739
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200 ..... B•1799-1800
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1808-1809,1812
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1816-1821
§† Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1823
§† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 312-428-7171 ..... B•1828
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1833
Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1841
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ..... B•1847
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§ Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
† Cole Instrument Corp., Santa Ana, CA 92704 714-556-3100
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
§ Furnas Elec., Batavia, IL 60510 312-879-6000
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
§† J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., New Haven, CT 06509 203-772-2220
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
J. R. Merritt Controls, Inc., Stamford, CT 06902 203-359-2113
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
§† Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
Noble U.S.A., Inc., Rolling Meadows, IL 60008 312-364-6038
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173 312-843-7900
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 312-438-4000
† Radio Switch Corp., Marlboro, NJ 07746 201-462-6100
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Signal Systems International, Lavalette, NJ 08735 201-741-1120
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§† Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507 312-844-4300
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 312-364-7277

Switches, Limit-5100

§ Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... B•1677
§ Burgess Switch Co., American Electronic Components, Elkhart, IN 46515, 219-262-8608 ..... B•1690-1691
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1699
† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 .... D•1159
CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501, 515-573-1300 ..... B•1704
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1808-1809
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1823
§† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 312-428-7171 ..... B•1829
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§ American Switch Corp., Wakefield, MA 01880 617-246-1007
Aromat Corp., New Providence, NJ 07974 201-464-3550
Astrosystems, Lake Success, NY 11042 516-328-1600
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
§† Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200

Data Instruments, Inc., Acton, MA 01720 508-264-9550
§ Dillon, W. C., Weigh-Tronix, Inc., Fairmont, MN 56031 507-238-4461
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
§ Furnas Elec., Batavia, IL 60510 312-879-6000
† Giannini Institute, Indio, CA 92201 619-347-2833
§ Gordon Products, Brookfield, CT 06804 203-775-4501
§ Grayhill Inc., La Grange, IL 60525 708-354-1040
Hamlin, Lake Mills, WI 53551 414-648-2361
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
† Janco Corp., Burbank, CA 91504 818-846-1800
KAYCEE INDUSTRIES LTD., Bombay-38, INDIA 263521/22/23
† Machine Components Corp., Plainview, NY 11803 516-694-7222
Magnetoelastic Devices, Pittsfield, MA 01202 413-445-5608
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
§ 3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
§† Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173 312-843-7900
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
Parker Hannifin Corp., Cleveland, OH 44112-1290 216-531-3000
† Precision Mechanisms, Westbury, NY 11590 ..... 516-ED3-5955
§† Pres-Air-Trol Corp., Mamaroneck, NY 10543 ..... 914-698-2026;800-431-2625 (outside NY)
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† Saint Switch, Inc., St. Charles, IL 60174 312-377-3779
§ Scientific Technologies, Optical Sensor Div. Inc., Hayward, CA 94544 ... 415-471-9717
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
Signal Systems International, Lavalette, NJ 08735 201-741-1120
Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Palatine, IL 60067 312-397-2600
† Sterling Instruments, New Hyde Pk., NY 11040 516-328-3300
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
† Techno, A DSG Company, New Hyde Park, NY 11040 516-328-3970
§ Temposonics, MTS Sys. Corp., Plainview, NY 11803 516-349-1950
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800
§ United Electric Controls, Watertown, MA 02172 617-926-1000
§ Veeder-Root, Hartford, CT 06102 203-527-7201

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§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1699
§ CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501, 515-573-1300 ..... B•1704
† EnTech Corporation, Simsbury, CT 06070, 203-658-2740;203-651-9557 .. B•1739
Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 ..... B•1878
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1816-1821
Veetronix, Inc., Lexington, NE 68850, 308-324-4600 ..... B•1852
§ Altech Corp., Somerville, NJ 08876 201-359-4454
§ Annulus Technical Industries, Inc., Ancaster, Ontario, CAN L9G 4G4 416-648-8100
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
§† CW Industries, Southhampton, PA 18966 215-355-7080
§ Dreefs Switch, Inc., Waukegan, IL 60087 ..... 312-662-7667;800-323-9605
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602 203-382-2000
Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
ITT Schadow, Eden Prairie, MN 55344 612-934-4400
JAE Electronics Inc., Santa Ana, CA 92705-5504 714-250-8770
Lamb Industries, Inc., Portland, OR 97225 503-297-8878
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173 312-843-7900

Switches, Matrix-5100

Crosspoint, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... B•1709
CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117 ..... D•1241
§ Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1735
Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1409
Information Transfer Indl. Inc., Holcomb, NY 14469, 716-657-7074 .. D•1187-1188
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
† MarLee Switch Co., Upland, CA 91786, 714-982-8988 ..... B•1789
Matrix Systems Corp., Calabasas, CA 91302, 818-992-6776 ..... B•1579
§ T-Bar Incorporated, a Data Switch Co., Shelton, CT 06484, 203-926-1801 ..... B•1850
A.D. Data, Inc.:Photographic Sciences Corp.(PSC), Webster, NY 14580 .. 716-265-1600
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
Amber Inds., Inc., Dallas, TX 75379 214-490-9801
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
Bytex Corp., Southborough, MA 01772 617-480-0840
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
Communication Devices, Inc., Scarborough, Ont., CAN M1H3A4 416-439-6320
† Daico Industries, Inc., Compton, CA 90224 213-631-1143
§† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ..... 214-470-2106/2107
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
Ghielmetti, Inc., Los Angeles, CA 90028-8770 213-463-5111
§ Giltronix, Menlo Park, CA 94025 415-493-1300
§ Glasgal Communications, Inc., Northvale, NJ 07647 201-768-8082
† Grim Corporation, Medford, NJ 08055-0968 609-267-7950
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
Keithley Instrs., Cleveland, OH 44139 216-248-0400
L-Com Inc., N. Andover, MA 01845 508-682-6936
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
Low Key Corporation, Strong Group, Gloucester, MA 01930 508-281-0448
† LSI Jennings, San Jose, CA 95122-2696 408-292-4025
Mantex Corp., Oxford, MI 48051 313-628-8200
§ McCurdy Radio Industries Limited, Toronto, Ont., CAN M4A 2L4 416-751-6262
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Mitel Semiconductor, Mitel Corporation, Kanata, Ont., CANADA K2K 1X5 613-592-5630
§† Oxley, Inc., Branford, CT 06405 203-488-1033
Precision Filters, Ithaca, NY 14850 607-277-3550
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Racal-Milgo, Sunrise, FL 33323-2899 ..... 305-475-1601;800-327-4440
Sanders Associates, Inc., ECBD, A Lockheed Company, Manchester, NH 03108-8500 603-645-5548
† Sanders/A Lockheed Co. Div. Microwave Technlg. Ctr., Manchester, NH 03108 ..... 603-645-6000 X 5548
Stoelting Co., Chicago, IL 60623 312-522-4500
Technical Panels, Inc., Temple City, CA 91780 800-343-1170
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
§† Vicon Industries, Inc., Melville, NY 11747 516-293-2200

Switches, Membrane-5150

Bergquist, Minneapolis, MN 55435, 800-328-3882 ..... B•1858
Bonar Kard-O-Lite, Inc., King of Prussia, PA 19406, 215-277-2910 ..... B•1132
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... B•1692
EECO Incorporated, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1726
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119, 206-284-5475 ..... B•1866
§ ITT Schadow, Eden Prairie, MN 55344, 612-934-4400 ..... B•1759
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... B•1868
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448 ..... B•1870-1871
§ Lucas Duralith Corporation, Millville, NJ 08332, 609-825-6900 ..... B•1873
Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 ..... B•1878
MOLEX, Inc., Lisle, IL 60532, 312-969-4550 ..... B•1815, C•1450,1881
§ Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822,1880
PacTec, LaFrance Corp., Philadelphia, PA 19153, 215-365-8400 ..... C•1068
§ Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507, 312-844-4300 ..... B•1842
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 214-851-4005
† Barrington Plastics, Mt. Laurel, NJ 08054 609-235-5151
† Basic Electronics, Inc., Stanton, CA 90680 714-530-2400
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
† C.A.M. Graphics Co., Inc., Amityville, NY 11701 516-842-3400
C.P. Clare Corp., Chicago, IL 60645 312-262-7700
§ CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501 .. 515-573-1300
† DOW SWITCH, Wilmington, MA 01887 617-935-6395
§ Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
Endicott Research Group, Endicott, NY 13760 607-754-9187
Ghielmetti, Inc., Los Angeles, CA 90028-8770 213-463-5111
† GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
§ Gunther, W., GmbH, D 8500 Numberg 82, WEST GERMANY ..... (0)911/65521 or 65520
The Hall Company, Urbana, OH 43078 513-652-1376
† Hallmark Nameplate, Inc., Farmingdale, NY 11735 800-645-9502
JAE Electronics Inc., Santa Ana, CA 92705-5504 714-250-8770
LaFrance Corp., Philadelphia, PA 19153-3893 215-365-8000
Mantex Corp., Oxford, MI 48051 313-628-8200
§ Marsh Products, Inc., Batavia, IL 60510 312-879-8008
† Membronics Division, Chicago Decal Company, Chicago, IL 60618 312-463-4007
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§† Miller Dial Corp., El Monte, CA 91731 818-444-4555
Moxness Products, Inc., Versa Technologies, Racine, WI 53405 ..... 414-554-5050; 800-558-5706
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
† Sheldahl, Inc., Northfield, MN 55057 507-663-8000
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
† Square D Co., Palatine, IL 60067 312-397-2600
Technical Panels, Inc., Temple City, CA 91780 800-343-1170
§ Toko America, Inc., Mt. Prospect, IL 60056 312-297-0070
§ Topflight, York, PA 17404 ..... 717-843-9901;800-233-9386

Switches, Mercury Displacement-5100

§ **Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116** ..... **B•1724-1725**
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... **B•1474,1740-1741**
Hamlin, Lake Mills, WI 53551, 414-648-2361 ..... **B•1751**
§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600** ..... **B•1811**
Risk, George, Inds., Kimball, NE 69145, 308-235-4645 ..... **B•1883**
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... **B•1844**
C.P. Clare Corp., Chicago, IL 60645 312-262-7700
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
International Mircoelectronics, Arlington, TX 76003 817-561-2244
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Signal Systems International, Lavalette, NJ 08735 201-741-1120
§ Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121

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§ **Altech Corp., Somerville, NJ 08876, 201-359-4454** ..... **B•1677**
§ **American Switch Corp., Wakefield, MA 01880, 617-246-1007** ..... **B•1681**
§ **Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933** ..... **B•1682**
§ **Augat Alcoswitch, Augat Inc., N. Andover, MA 01845, 508-685-4371** ..... **B•1687**
§ **Burgess Switch Co., American Electronic Components, Elkhart, IN 46515, 219-262-8608** ..... **B•1690-1691**
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500** ..... **B•1699**
§ **CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501, 515-573-1300** ..... **B•1704**
§† **CW Industries, Southhampton, PA 18966, 215-355-7080** ..... **B•1718-1719**
§ **Dreefs Switch, Inc., Waukegan, IL 60087, 312-662-7667;800-323-9605** ... **B•1722**
§ **DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011, 212-691-9050** ..... **B•1723**
§ **EAO Switch Corp., Milford, CT 06460, 203-877-4577** ..... **B•1732**
§† **Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180** ..... **B•1728-1729**
§ **Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-826-8719** ..... **B•1733-1735**
Electroswitch, Southern Div., Electro Switch Corp., Raleigh, NC 27604, 919-833-0707 ..... **B•1737**
† **EnTech Corporation, Simsbury, CT 06070, 203-658-2740;203-651-9557** .. **B•1739**
§ **Grayhill Inc., La Grange, IL 60525, 708-354-1040** ..... **B•1745**
Grimes Company, Brea, CA 92621, 714-671-3931 ..... **B•1750**
§ **IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550** ..... **B•1754-1755**
§ **Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 312-537-1800** .... **B•1757**
§ **ITT Schadow, Eden Prairie, MN 55344, 612-934-4400** ..... **B•1758-1759,1761**
§ **ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040** ..... **B•1762**
† **Janco Corp., Burbank, CA 91504, 818-846-1800** ..... **B•1778**
Lamb Industries, Inc., Portland, OR 97225, 503-297-8878 ..... **B•1780-1781**
† **Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621** ..... **B•1784**
Manufacturers Components, Inc., Hialeah, FL 33016, 305-556-4481;800-367-0377 ..... **B•1788**
§ **McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200** ..... **B•1800**
§ **Mechanical Enterprises, Herndon, VA 22070, 703-435-9496** ..... **B•1801**
§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600** ..... **B•1808-1809,1812**
§ **NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942** ..... **B•1816-1821**
§† **Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000** ..... **B•1822**
§ **Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900** ..... **B•1825**
§ **Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794** ..... **B•1827**
† **Otto Controls, Otto Engineering, Carpentersville, IL 60110, 312-428-7171** ..... **B•1828-1829**
Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... **B•1831**
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 .. **B•1832-1833**
§ **Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850** ..... **B•1122**
§ **Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700** ..... **B•1847-1849**
§ **T-Bar Incorporated, a Data Switch Co., Shelton, CT 06484, 203-926-1801** ..... **B•1850**
Veetronix, Inc., Lexington, NE 68850, 308-324-4600 ..... **B•1852**
Aerospace Optics, Inc., Fort Worth, TX 76112 817-451-1141
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§ Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 214-851-4005
Augat Inc., Attleboro, MA 02703 617-222-2202
† Basic Electronics, Inc., Stanton, CA 90680 714-530-2400
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820 603-742-1120,800-872-0042
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
Components Unlimited, Inc., Portland, OR 97223 503-620-3522
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
§† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§† EECO Incorporated, Santa Ana, CA 92702-0659 714-835-6000
§† Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188 617-335-5200
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
§† Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
§ FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
§ Gaynor Electric Co., Thomaston, CT 06787-0316 203-283-4388
Ghielmetti, Inc., Los Angeles, CA 90028-8770 213-463-5111
§ Hirose Electric U.S.A., Inc. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), Simi Valley, CA 93065 805-522-7958
† Hoffman Engineering Corp., Stamford, CT 06902 203-325-8933
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
International Mircoelectronics, Arlington, TX 76003 817-561-2244
JAE Electronics Inc., Santa Ana, CA 92705-5504 714-250-8770
Jayco Plastics of California, Inc., Orange, CA 92665 714-974-1701
§† J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., New Haven, CT 06509 203-772-2220
Judco Mfg. Inc., Harbor City, CA 90710 213-534-0959
§ Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016 312-824-1188
Low Key Corporation, Strong Group, Gloucester, MA 01930 508-281-0448
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
J. R. Merritt Controls, Inc., Stamford, CT 06902 203-359-2113
Microavionics Corp., Costa Mesa, CA 92626 714-957-6904
Micro Pneumatic Logic, inc., Fort Lauderdale, FL 33309-1786 305-973-6166
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Noble U.S.A., Inc., Rolling Meadows, IL 60008 312-364-6038
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 312-390-6680;800-323-6693
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 312-438-4000
Relay Service Co., Chicago, IL 60651 312-252-2700
§† Risk, George, Inds., Kimball, NE 69145 308-235-4645
§ Schurter, Inc., Petaluma, CA 94952 707-778-6311
§ Seacor, Inc., Westwood, NJ 07675 201-666-5600
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
Shogyo International Corp., Great Neck, NY 11021 516-466-0911
§ Sorenson Lighted Controls, Hartford, CT 06114 ..... 203-527-3092;1-800-243-0240
† Square D Co., Palatine, IL 60067 312-397-2600
† Stacoswitch, Costa Mesa, CA 92626 714-549-3041
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ Toko America, Inc., Mt. Prospect, IL 60056 312-297-0070
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076 312-964-2330
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

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Airflyte Elctrns. Co., Bayonne, NJ 07002, 201-436-2230 ..... **B•1233**
§ **Altech Corp., Somerville, NJ 08876, 201-359-4454** ..... **B•1677**
§† **ASM Corporation, Smithfield, NC 27577, 919-934-3104** ..... **B•1685**
§ **Augat Alcoswitch, Augat Inc., N. Andover, MA 01845, 508-685-4371** .... **B•1687**
Barber Colman Co. (A Siebe Co.), Motor Division, Rockford, IL 61125-7040, 815-397-7400 ..... **B•1235**
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400** ... **B•1692-1693**
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500** ..... **B•1699**
† **Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100** ..... **B•1702**
§ **CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501, 515-573-1300** ..... **B•1704**
Crosspoint, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... **B•1709**
§† **CW Industries, Southhampton, PA 18966, 215-355-7080** ..... **B•1718**
§† **Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600** ..... **B•1720**
† **Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260** .... **B•1721**
§ **Dreefs Switch, Inc., Waukegan, IL 60087, 312-662-7667;800-323-9605** ... **B•1722**
§† **EECO Incorporated, Santa Ana, CA 92702-0659, 714-835-6000** .... **B•1726-1727**
§ **Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-826-8719** ..... **B•1734-1735**
§† **Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200** ..... **B•1736**
§ **Electroswitch, Southern Div., Electro Switch Corp., Raleigh, NC 27604, 919-833-0707** ..... **B•1737**
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... **B•1738**
† **EnTech Corporation, Simsbury, CT 06070, 203-658-2740;203-651-9557** .. **B•1739**
§ **Grayhill Inc., La Grange, IL 60525, 708-354-1040** ..... **B•1746**
IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... **B•1755**
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010, 415-347-8217 .... **B•1867**
§ **ITT Schadow, Eden Prairie, MN 55344, 612-934-4400** ..... **B•1760**
ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... **B•1762**
§ **IVO Industries, Inc., Eatontown, NJ 07724, 201-542-5151;800-932-0489** .. **B•1775**
JAE Electronics Inc., Santa Ana, CA 92705-5504, 714-250-8770 .... **B•1776-1777**
† **Janco Corp., Burbank, CA 91504, 818-846-1800** ..... **B•1778**
Lamb Industries, Inc., Portland, OR 97225, 503-297-8878 ..... **B•1780-1781**
† **Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621** ..... **B•1667,1784**
Manufacturers Components, Inc., Hialeah, FL 33016, 305-556-4481;800-367-0377 ..... **B•1788**

§† **Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000** ..... **B•1822**
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... **B•1823**
Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... **B•1825**
† **Otto Controls, Otto Engineering, Carpentersville, IL 60110, 312-428-7171** ..... **B•1829**
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 ..... **B•1833**
§ **Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700** ..... **B•1848-1849**
† **Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221** ..... **B•1851**
Wilcoxon Research, Rockville, MD 20850, 301-330-8811 ..... **B•2000**
Allied Control, Plantsville, CT 06479 203-621-6771
§ Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
American Control Technology, Inc., West Dundee, IL 60118 312-426-6780
§ American Switch Corp., Wakefield, MA 01880 617-246-1007
§ AMP, Harrisburg, PA 17105 717-564-0100
Arcolectric Corp., Canoga Park, CA 91304 818-700-1933
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
Augat Inc., Attleboro, MA 02703 617-222-2202
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
Chicago Lock Co., Chicago, IL 60641 312-282-7177
Components Unlimited, Inc., Portland, OR 97223 503-620-3522
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
§ EDL, Inc., Hauppauge, NY 11788 ..... 516-435-2808;1-800-DIAL EDL
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
§† Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Judco Mfg. Inc., Harbor City, CA 90710 213-534-0959
† Kilovac Corp., Santa Barbara, CA 93140-4422 805-684-4560
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
Mallory Timers, Emhart Elec./Elctrn. Grp., Indianapolis, IN 46201 317-636-5353
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
† Microavionics Corp., Costa Mesa, CA 92626 714-957-6904
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
Noble U.S.A., Inc., Rolling Meadows, IL 60008 312-364-6038
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 312-438-4000
Radio Switch Corp., Marlboro, NJ 07746 201-462-6100
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621
§ Seacor, Inc., Westwood, NJ 07675 201-666-5600
§ Shallco, Inc., Smithfield, NC 27577 919-934-3135
Signal Systems International, Lavalette, NJ 08735 201-741-1120
Spectrol Electronics, City of Industry, CA 91745 818-964-6565
§ Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507 312-844-4300
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† Transco Products, Inc., Camarillo, CA 93011-6003 805-987-8007
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Switches, Optical-3700

§ **Clairex Electronics, Clairex Corporation, Mt. Vernon, NY 10550, 914-664-6602** ..... **B•1320**
HEI, Inc., Optoelectronics Div., Victoria, MN 55386, 612-443-2500 ... **B•1322-1323**
§ **Marktech International Corp., Menands, NY 12204, 518-436-5865** ... **B•1172-1173**
§† **Optek Technology Inc., McKinney, TX 75069, 214-542-9461** ..... **B•1333**
Opto Diode Corp., Newbury Park, CA 91320, 805-499-0335 ..... **B•1334**
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 ..... **B•1347**
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386 612-443-2500
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§ 3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173 312-843-7900
§ Opto Technology, Inc., Wheeling, IL 60090 312-537-4277
§ Photoswitch Div., Allen Bradley Co., Waltham, MA 02154 617-466-8000
§ SC Technology, Inc., Livermore, CA 94550 415-373-9230
Sprague Electric Company, The Semiconductor Group, Worcester, MA 01613-2036 617-853-5000
† UCE, Inc., Norwalk, CT 06854 203-838-7509

Switches, Paddle Handle-5100

§ **Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933** ..... **B•1682-1683**
§ **Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050, 804-974-5100** ..... **B•1684**
§ **Augat Alcoswitch, Augat Inc., N. Andover, MA 01845, 508-685-4371** ..... **B•1686-1687**
§† **Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600** ..... **B•1720**
§ **DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011, 212-691-9050** ..... **B•1723**
EnTech Corporation, Simsbury, CT 06070, 203-658-2740;203-651-9557 .. **B•1739**
§ **ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040** ..... **B•1762**
§ **Lamb Industries, Inc., Portland, OR 97225, 503-297-8878** ..... **B•1780-1781**
§ **McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200** ..... **B•1798**
§ **Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600** ..... **B•1812**
§ **NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942** ..... **B•1816-1817**
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 ..... **B•1833**
Airpax Co., Cambridge Division, Cambridge, MD 21613 301-228-4600
§ Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ American Switch Corp., Wakefield, MA 01880 617-246-1007
Augat Inc., Attleboro, MA 02703 617-222-2202
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
Communication Devices, Inc., Scarborough, Ont., CAN M1H3A4 416-439-6320
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
§ CTS Corporation, Switch Div., Paso Robles, Paso Robles, CA 93446 805-238-0350
§ Dreefs Switch, Inc., Waukegan, IL 60087 ..... 312-662-7667;800-323-9605
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
§ J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., New Haven, CT 06509 203-772-2220
† Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
§ Seacor, Inc., Westwood, NJ 07675 201-666-5600
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630 312-792-2700
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ Syracuse Electronics, Pass & Seymour, Inc., Syracuse, NY 13221 315-468-6211

Switches, Peripheral-5100

MarLee Switch Co., Upland, CA 91786, 714-982-8988 ..... **B•1789**
† Advanced Systems Concepts, Altadena, CA 91001 818-791-0983
American Control Technology, Inc., West Dundee, IL 60118 312-426-6780
§ Dataprobe, Englewood, NJ 07631 201-569-6464
§ Electro Standards Lab., Inc., Providence, RI 02940 401-943-1164
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
§ Glasgal Communications, Inc., Northvale, NJ 07647 201-768-8082
§ T-Bar Incorporated, a Data Switch Co., Shelton, CT 06484 203-926-1801
† Terminal Data Corp., Rockville, MD 20855 301-921-8282
§ Via West Interface, Inc., Tucson, AZ 85705 602-623-5716

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Clairex Electronics, Clairex Corporation, Mt. Vernon, NY 10550, 914-664-6602 ..... **B•1320**
§ **EG & G Vactec, St. Louis, MO 63132, 314-423-4900** ..... **B•1321**
HEI, Inc., Optoelectronics Div., Victoria, MN 55386, 612-443-2500 ... **B•1322-1323**
§ **Optek Technology Inc., McKinney, TX 75069, 214-542-9461** ..... **B•1333**
Opto Diode Corp., Newbury Park, CA 91320, 805-499-0335 ..... **B•1334**
Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 ..... **B•1347**
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Somerville, NJ 08876 201-359-4454
§ Banner Engineering Corp., Minneapolis, MN 55441 612-544-3164
Burgess Switch Co., American Electronic Components, Elkhart, IN 46515 219-262-8608
§ Efector, Inc., Exton, PA 19341 ..... 215-524-2000;800-441-8246
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 312-882-5757
§ Furnas Elec., Batavia, IL 60510 312-879-6000
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Ramsey, NJ 07446 201-825-9696
HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386 612-443-2500
§ IDEC Corporation, Sunnyvale, CA 94089-2211 408-747-0550
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
Opto Technology, Inc., Wheeling, IL 60090 312-537-4277
§ Photoswitch Div., Allen Bradley Co., Waltham, MA 02154 617-466-8000
§ Redington Counters, Windsor, CT 06095 203-688-6205
Rehlander Assocs., Beverly, MA 01915 617-922-5961
Scanning Devices, Inc., Waltham, MA 02154 617-891-8991
† Square D Co., Palatine, IL 60067 312-397-2600
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487

Switches, Port Sharing-5100

† Advanced Systems Concepts, Altadena, CA 91001 818-791-0983
§ Annulus Technical Industries, Inc., Ancaster, Ontario, CAN L9G 4G4 416-648-8100
Capitol Switch Inc., Danbury, CT 06810 203-744-3300
Capulum Cable Technology, Ltd., Nepean, Ontario, CANADA K2H 9C1 .. 613-726-1966
§ Dataprobe, Englewood, NJ 07631 201-569-6464
§ Electro Standards Lab., Inc., Providence, RI 02940 401-943-1164
§ Glasgal Communications, Inc., Northvale, NJ 07647 201-768-8082
Information Transfer Indl. Inc., Holcomb, NY 14469 716-657-7074
L-Com Inc., N. Andover, MA 01845 508-682-6936
§ T-Bar Incorporated, a Data Switch Co., Shelton, CT 06484 203-926-1801
§ Telebyte Technology, Inc., Greenlawn, NY 11740 ..... 516-423-3232;800-835-3298
§ Terminal Data Corp., Rockville, MD 20855 301-921-8282
§ Via West Interface, Inc., Tucson, AZ 85705 602-623-5716

Switches, Power-5100

§ **Altech Corp., Somerville, NJ 08876, 201-359-4454** ..... **B•1677**
Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... **B•1683**

§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050, 804-974-5100 ..... B•1684
§† ASM Corporation, Smithfield, NC 27577, 919-934-3104 ..... B•1685
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... B•1693
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1700
† Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 ..... B•1702
CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501, 515-573-1300 ..... B•1704
§† CW Industries, Southhampton, PA 18966, 215-355-7080 ..... B•1718-1719
§ Dreefs Switch, Inc., Waukegan, IL 60087, 312-662-7667;800-323-9605 ... B•1722
§ DSA, Inc.(Dai-ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011, 212-691-9050 ..... B•1723
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116 ..... B•1724-1725
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... B•1732
§† Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 ..... B•1729
§ Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1734
§† Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 ..... B•1736
Electroswitch, Southern Div., Electro Switch Corp., Raleigh, NC 27604, 919-833-0707 ..... B•1737
† EnTech Corporation, Simsbury, CT 06070, 203-658-2740;203-651-9557 .. B•1739
§† Heinemann Electric Co., Lawrenceville, NJ 08648-0800, 609-882-4800 ... B•1371
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 ..... B•1753
Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 312-537-1800 ..... B•1756-1757
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
† Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560 ..... B•1552,1554
§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8878 ..... B•1780-1781
Manufacturers Components, Inc., Hialeah, FL 33016, 305-556-4481;800-367-0377 ..... B•1788
§ Marquardt Switches Inc., Cazenovia, NY 13035, 315-655-8050 ..... B•1791,1797
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ..... D•2214
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200 ..... B•1798-1800
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1812
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1820-1821
§† Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1824-1825
Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794 ..... B•1827
Otto Controls, Otto Engineering, Carpentersville, IL 60110, 312-428-7171 ..... B•1829
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1830
† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... B•1615
§ Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... C•1521-1522
Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1841
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... B•1844-1845
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ..... B•1848-1849
Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1851
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ American Switch Corp., Wakefield, MA 01880 617-246-1007
Aromat Corp., New Providence, NJ 07974 201-464-3550
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Burgess Switch Co., American Electronic Components, Elkhart, IN 46515 219-262-8608
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
Components Unlimited, Inc., Portland, OR 97223 503-620-3522
§ CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
§ CTS Corporation, Switch Div., Paso Robles, Paso Robles, CA 93446 805-238-0350
Delta Products Corporation, Fremont, CA 94538 415-770-0660
† Dow-Key Microwave Corporation, Ventura, CA 93003 805-650-0260
§† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
§ Furnas Elec., Batavia, IL 60510 312-879-6000
§ Grayhill Inc., La Grange, IL 60525 708-354-1040
§ Gunther, W., GmbH, D 8500 Numberg 82, WEST GERMANY ..... (0)911/65521 or 65520
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
† Janco Corp., Burbank, CA 91504 818-846-1800
§ Landis & Gyr, Inc., Pleasantville, NY 10570 914-747-3540
† LSI Jennings, San Jose, CA 95122-2696 408-292-4025
Lucas Ledex Inc., Vandalia, OH 45377-0427 513-898-3621
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
J. R. Merritt Controls, Inc., Stamford, CT 06902 203-359-2113
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
Noble U.S.A., Inc., Rolling Meadows, IL 60008 312-364-6038
§ Ohmite Manufacturing Co., Skokie, IL 60076 312-675-2600
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
§ Payne Engineering, Scott Depot, WV 25560 304-757-7353
Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
† Radio Switch Corp., Marlboro, NJ 07746 201-462-6100
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
Schaffner EMC, Inc., Instr. Div., Union, NJ 07083 ..... 201-851-0644;800-367-5566
Shallco, Inc., Smithfield, NC 27577 919-934-3135
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
† Square D Co., Palatine, IL 60067 312-397-2600
§ Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507 312-844-4300
§ Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532 803-393-5421
§† Syracuse Electronics, Pass & Seymour, Inc., Syracuse, NY 13221 315-468-6211
Tansitor Electronics, Bennington, VT 05201 802-442-5473
Teledyne Kinetics, Div. of Teledyne, Inc., Solana Beach, CA 92075 619-755-1181
§ USD Products, Cooper Industries, Chicago, IL 60656 312-867-4600

Switches, Pressure-5100

Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1823
† Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1831
§ Automatic Switch Co., Florham Park, NJ 07932 1-201-966-2000
§† Barksdale Controls Div., Imc Delaval Inc., Los Angeles, CA 90058 213-589-6181
Cambridge Aeroflo, Inc., Shirley, MA 01464 508-45-2346
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
† Edcliff Div., Systron Donner, Monrovia, CA 91016 818-358-4571
† Electro National, Canton, MS 39046 601-859-5511
† Gulton Industries, Inc., Servonic Div., Costa Mesa, CA 92627 ..... 714-642-2400; 800-854-4066
§ IC Sensors, Inc., Milpitas, CA 95035 408-432-1800
Micro Pneumatic Logic, inc., Fort Lauderdale, FL 33309-1786 305-973-6166
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Norgren, Littleton, CO 80120-1663 303-794-2611
† Pressure Controls, Inc., Belleville, NJ 07109 201-751-5002
§ Reliance Electric Co., Marketing Info Center, Cleveland, OH 44199 800-245-4501
Signal Systems International, Lavalette, NJ 08735 201-741-1120
† Square D Co., Palatine, IL 60067 312-397-2600
§ Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312
§ United Electric Controls, Watertown, MA 02172 617-926-1000

Switches, Program-5100

American Control Technology, Inc., West Dundee, IL 60118, 312-426-6780 ..... B•1679
§† American Research & Engineering, Elgin, IL 60123, 312-888-7245 ..... B•1680
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1700
Crosspoint, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... B•1709
§† Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... B•1720
§† EECO Incorporated, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1726
§ Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010, 415-347-8217 .... B•1867
§ IVO Industries, Inc., Eatontown, NJ 07724, 201-542-5151;800-932-0489 .. B•1775
§ Joio Industries, Inc., Garden Grove, CA 92643, 714-554-6840 ..... C•1396
† Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ..... B•1667
Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822
§† Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507, 312-844-4300 ..... B•1842
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1851
Airflyte Elctrns. Co., Bayonne, NJ 07002 201-436-2230
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Altech Corp., Somerville, NJ 08876 201-359-4454
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
§ American Control Products, Div. of Precision Timer Co., Inc., Westbrook, CT 06498 203-399-6253
§ AMP, Harrisburg, PA 17105 717-564-0100
Augat Inc., Attleboro, MA 02703 617-222-2202
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Automatic Timing & Controls Co., King of Prussia, PA 19406 ..... 215-337-5500; 800-441-8245
CDS - Colorado Data Sys., Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
† Cole Instrument Corp., Santa Ana, CA 92704 714-556-3100
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
§ Cramer Co., Old Saybrook, CT 06475 800-247-6784
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ..... 214-470-2106/2107
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Ramsey, NJ 07446 201-825-9696
Grayhill Inc., La Grange, IL 60525 708-354-1040
§ Gunther, W., GmbH, D 8500 Numberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
Inter-Market, Glenview, IL 60025 312-729-5330
§ ITT Sealectro, Trumbull, CT 06611 203-372-4118
JAE Electronics Inc., Santa Ana, CA 92705-5504 714-250-8770
† Lorch Electronics:Div. of Vernitron Corp., Englewood, NJ 07631 201-569-8282
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600

§ NKK Switches of America, Inc., Scottsdale, AZ 85260 602-991-0942
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
† Precision Mechanisms, Westbury, NY 11590 ..... 516-ED3-5955
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Shallco, Inc., Smithfield, NC 27577 919-934-3135
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
Standard Grigsby Inc., W. Gunther GMBH, D 8500 Nurnberg 82, WEST GERMANY 0911-65521
Techniques, Inc., Englewood, NJ 07631 201-569-5900
§ Tenor Company, New Berlin, WI 53151 414-782-3800

Switches, Proximity-5100

§ Burgess Switch Co., American Electronic Components, Elkhart, IN 46515, 219-262-8608 ..... B•1689
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1465
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116 ..... B•1724-1725
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 ..... B•1753
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1804-1806
§† Risk, George, Inds., Kimball, NE 69145, 308-235-4645 ..... B•1883
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... B•1844-1845
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§ Altech Corp., Somerville, NJ 08876 201-359-4454
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
† Computer Components, Inc., Pelham, NY 10803 914-738-1611
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Efector, Inc., Exton, PA 19341 ..... 215-524-2000;800-441-8246
† Eldec Corporation, Sensing Systems Div., Bothell, WA 98041-3002 206-487-4000
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 312-882-5757
† Electro National, Canton, MS 39046 601-859-5511
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
FSI/Fork Standards, Inc., Lombard, IL 60148 ..... 312-231-3511;312-932-9380
§ Furnas Elec., Batavia, IL 60510 312-879-6000
† Giannini Institute, Indio, CA 92201 619-347-2833
§ Gordon Products, Brookfield, CT 06804 203-775-4501
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
§ Hamlin, Lake Mills, WI 53551 414-648-2361
INRESCO, Inc., Pt. Pleasant, NJ 08742 201-892-5881
§ IVO Industries, Inc., Eatontown, NJ 07724 ..... 201-542-5151;800-932-0489
KAYCEE INDUSTRIES LTD., Bombay-38, INDIA 263521/22/23
Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
§ Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
§ Norgren, Littleton, CO 80120-1663 303-794-2611
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
Philips Electronics Ltd, Philips Comps., Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§ Photoswitch Div., Allen Bradley Co., Waltham, MA 02154 617-466-8000
§ Redington Counters, Windsor, CT 06095 203-688-6205
Rehlander Assocs., Beverly, MA 01915 617-922-5961
§ Scientific Technologies, Optical Sensor Div. Inc., Hayward, CA 94544 ... 415-471-9717
Sensor Corp., Scottdale, PA 15683 412-887-4080
Signal Systems International, Lavalette, NJ 08735 201-741-1120
§ Skan-A-Matic, Electro Corporation, Sarasota, FL 34230-3049 813-355-8411
§ Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
† Square D Co., Palatine, IL 60067 312-397-2600
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Tane Alarm Products, Floral Park, NY 11001 516-328-3351
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
Transducer Systems, Inc., Kulpsville, PA 19443 215-256-4611
§ Veeder-Root, Hartford, CT 06102 203-527-7201

Switches, Pushbutton, Illuminated-5100

American Control Technology, Inc., West Dundee, IL 60118, 312-426-6780 ..... B•1679
§ American Switch Corp., Wakefield, MA 01880, 617-246-1007 ..... B•1681
§ Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... B•1682
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050, 804-974-5100 ..... B•1684
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845, 508-685-4371 ..... B•1686-1687
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... B•1693
§† C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492, 203-269-8701 ..... B•1694
Carlingswitch, Inc., Plainville, CT 06062-1156, 203-793-9281 ..... B•1696
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1701,1859
§ CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501, 515-573-1300 ..... B•1704
CW Industries, Southhampton, PA 18966, 215-355-7080 ..... B•1719
§† Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... B•1720
§ Dreefs Switch, Inc., Waukegan, IL 60087, 312-662-7667;800-323-9605 ... B•1722
§ DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011, 212-691-9050 ..... B•1723
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... B•1732
§† Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 ..... B•1728-1729
† EnTech Corporation, Simsbury, CT 06070, 203-658-2740;203-651-9557 .. B•1739
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1754
§ ITT Schadow, Eden Prairie, MN 55344, 612-934-4400 ..... B•1760
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
IVO Industries, Inc., Eatontown, NJ 07724, 201-542-5151;800-932-0489 .. B•1775
§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8878 ... B•1164,1780-1781
† Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ..... B•1784
Manufacturers Components, Inc., Hialeah, FL 33016, 305-556-4481;800-367-0377 ..... B•1788
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200 ..... B•1798
§ Mechanical Enterprises, Herndon, VA 22070, 703-435-9496 ..... B•1801
§† Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1812
§ MOLEX, Inc., Lisle, IL 60532, 312-969-4550 ..... B•1815, C•1450-1451,1881
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1816-1821
§† Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1825
Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794 ..... B•1827
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1830
§† Risk, George, Inds., Kimball, NE 69145, 308-235-4645 ..... B•1883
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 .. B•1832-1833
§ Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... B•1835, C•1521-1522
§ Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122
† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1841
§ Sorenson Lighted Controls, Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1198
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ..... B•1847-1849
Veetronix, Inc., Lexington, NE 68850, 308-324-4600 ..... B•1852-1853
§ Adalet-PLM Div. Div. Scott & Fetzer Co., Cleveland, OH 44135 216-267-9000
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
† Aerospace Optics, Inc., Fort Worth, TX 76112 817-451-1141
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
Allied Control, Plantsville, CT 06479 203-621-6771
§ Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Altech Corp., Somerville, NJ 08876 201-359-4454
§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 214-851-4005
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
Components Unlimited, Inc., Portland, OR 97223 503-620-3522
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
§ CTS Corporation, Switch Div., Paso Robles, Paso Robles, CA 93446 805-238-0350
§† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
§ Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403 ..... 612-375-9639;800-826-8719
† Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
§ Entrelec, Alsthom International, Spring Valley, NY 10977 914-425-7460
§ Furnas Elec., Batavia, IL 60510 312-879-6000
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
Ghielmetti, Inc., Los Angeles, CA 90028-8770 213-463-5111
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
§ Grayhill Inc., La Grange, IL 60525 708-354-1040
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
§ IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
International Mircoelectronics, Arlington, TX 76003 817-561-2244
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
JAE Electronics Inc., Santa Ana, CA 92705-5504 714-250-8770
§† Janco Corp., Burbank, CA 91504 818-846-1800
§ J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., New Haven, CT 06509 203-772-2220
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 312-949-8505
† Korry Electronics Co., Criton Technologies, Seattle, WA 98109 206-281-1300
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016 312-824-1188
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
§ Maxi-Switch Co., Sub. of EECO, Minneapolis, MN 55433 612-755-7660
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
Methode Electronics, Inc., Chicago, IL 60656 312-867-9600
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
† Microavionics Corp., Costa Mesa, CA 92626 714-957-6904
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
§ Pres-Air-Trol Corp., Mamaroneck, NY 10543 ..... 914-698-2026;800-431-2625 (outside NY)
§ Qualtek Electronics Corp., Mentor, OH 44060 216-951-3300
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Saint Switch, Inc., St. Charles, IL 60174 312-377-3779
§ Seacor, Inc., Westwood, NJ 07675 201-666-5600
Shin-Etsu Polymer America, Inc., Union City, CA 94587 415-475-9000
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
† Square D Co., Palatine, IL 60067 312-397-2600
† Stacoswitch, Costa Mesa, CA 92626 714-549-3041
§ Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507 312-844-4300

Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800
§ Toko America, Inc., Mt. Prospect, IL 60056 312-297-0070
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
§† Vicon Industries, Inc., Melville, NY 11747 516-293-2200

Switches, Pushbutton, Nonilluminated-5100

§ American Switch Corp., Wakefield, MA 01880, 617-246-1007 ..... B•1681
§ Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... B•1682-1683
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050, 804-974-5100 ..... B•1684
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845, 508-685-4371 ..... B•1686-1687
§ Burgess Switch Co., American Electronic Components, Elkhart, IN 46515, 219-262-8608 ..... B•1689
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ... B•1692-1693
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1700-1701,1859
† Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 ..... B•1702
§ CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501, 515-573-1300 ..... B•1704
§† Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... B•1720
§ Dreefs Switch, Inc., Waukegan, IL 60087, 312-662-7667;800-323-9605 ... B•1722
§ DSA, Inc.(Dai-ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011, 212-691-9050 ..... B•1723
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... B•1732
§† Electro-Mech Components, Inc., South El Monte, CA 91733-3689, 818-442-7180 ..... B•1729
§ Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1733-1735
† EnTech Corporation, Simsbury, CT 06070, 203-658-2740;203-651-9557 .. B•1739
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1745
Grimes Company, Brea, CA 92621, 714-671-3931 ..... B•1750
§ IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1754
§ Inter-Market, Glenview, IL 60025, 312-729-5330 ..... B•1178
§ ITT Schadow, Eden Prairie, MN 55344, 612-934-4400 ..... B•1760-1761
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
IVO Industries, Inc., Eatontown, NJ 07724, 201-542-5151;800-932-0489 .. B•1775
JAE Electronics Inc., Santa Ana, CA 92705-5504, 714-250-8770 ..... B•1777
§† Janco Corp., Burbank, CA 91504, 818-846-1800 ..... B•1779
§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8878 .... B•1164,1780-1781
† Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ..... B•1667,1784
Manufacturers Components, Inc., Hialeah, FL 33016, 305-556-4481;800-367-0377 ..... B•1788
§ Mechanical Enterprises, Herndon, VA 22070, 703-435-9496 ..... B•1801
§† Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1812
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1816-1821
§ Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1825
§ Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794 ..... B•1827
§† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 312-428-7171 ..... B•1828-1829
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1830
§ Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1831
§† Risk, George, Inds., Kimball, NE 69145, 308-235-4645 ..... B•1883
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 .. B•1832-1833
§ Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... B•1835, C•1521-1522
§ Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122
Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1841
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ..... B•1847,1849
§ T-Bar Incorporated, a Data Switch Co., Shelton, CT 06484, 203-926-1801 ..... B•1850
Veetronix, Inc., Lexington, NE 68850, 308-324-4600 ..... B•1852-1853
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
Allied Control, Plantsville, CT 06479 203-621-6771
§ Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Altech Corp., Somerville, NJ 08876 201-359-4454
§ Amptronix, Inc., Rowland Heights, CA 91748 213-666-1564
Ark-Les, Watertown, MA 02172 617-924-2330
§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 214-851-4005
Augat Inc., Attleboro, MA 02703 617-222-2202
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
Components Unlimited, Inc., Portland, OR 97223 503-620-3522
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
§ CTS Corporation, Switch Div., Paso Robles, Paso Robles, CA 93446 805-238-0350
§† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
§ Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
† Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
§ Entrelec, Alsthom International, Spring Valley, NY 10977 914-425-7460
§ FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
§ Gaynor Electric Co., Thomaston, CT 06787-0316 203-283-4388
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
Ghielmetti, Inc., Los Angeles, CA 90028-8770 213-463-5111
† Giannini Institute, Indio, CA 92201 619-347-2833
GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
§† Guardian Elec. Mfg. Co., Chicago, IL 60607 815-337-0050
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
International Mircoelectronics, Arlington, TX 76003 817-561-2244
International Resource Svcs., Miami, FL 33166 305-884-2924
ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
§ J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., New Haven, CT 06509 203-772-2220
Judco Mfg. Inc., Harbor City, CA 90710 213-534-0959
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 312-949-8505
† Korry Electronics Co., Criton Technologies, Seattle, WA 98109 206-281-1300
Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
§ Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016 312-824-1188
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
Maxi-Switch Co., Sub. of EECO, Minneapolis, MN 55433 612-755-7660
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
† Milross Controls, Inc., Southampton, PA 18966 215-355-0200
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 312-364-6038
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
§ Qualtek Electronics Corp., Mentor, OH 44060 216-951-3300
RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-2828
Saint Switch, Inc., St. Charles, IL 60174 312-377-3779
§ Seacor, Inc., Westwood, NJ 07675 201-666-5600
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
Shin-Etsu Polymer America, Inc., Union City, CA 94587 415-475-9000
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
Spectrol Electronics, City of Industry, CA 91745 818-964-6565
† Square D Co., Palatine, IL 60067 312-397-2600
§ Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507 312-844-4300
Standard Grigsby Inc., W. Gunther GMBH, D 8500 Nurnberg 82, WEST GERMANY 0911-65521
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312
§ Tektone Sound & Signal, Lake Park, FL 33403 407-844-2383
† Thermo Electric, Saddle Brook, NJ 07662 201-843-5800
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 312-364-7277
§ Toko America, Inc., Mt. Prospect, IL 60056 312-297-0070
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076 312-964-2330
§† Vicon Industries, Inc., Melville, NY 11747 516-293-2200
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Switches, Reed-5100

Coto Corporation, Providence, RI 02907, 401-943-2686 ..... B•1451
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1465
§† Hamlin, Lake Mills, WI 53551, 414-648-2361 ..... B•1751,1957
Hasco Components, Inc., Bellrose Village, NY 11001, 516-328-9292 ..... B•1752
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 ..... B•1753
MarLee Switch Co., Upland, CA 91786, 714-982-8988 ..... B•1789
Midwest Components, Inc., Muskegon, MI 49443, 616-777-2602 ..... B•1910
Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822
§† Risk, George, Inds., Kimball, NE 69145, 308-235-4645 ..... B•1883
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1298, B•1629,1844-1845
Veetronix, Inc., Lexington, NE 68850, 308-324-4600 ..... B•1852
A.D. Data, Inc.:Photographic Sciences Corp.(PSC), Webster, NY 14580 .. 716-265-1600
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
Electric Device, Canfield, OH 44406 216-533-1111
† Electro National, Canton, MS 39046 601-859-5511
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, Northlake, IL 60164 312-681-7100
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
INRESCO, Inc., Pt. Pleasant, NJ 08742 201-892-5881
International Mircoelectronics, Arlington, TX 76003 817-561-2244
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
§ Maxi-Switch Co., Sub. of EECO, Minneapolis, MN 55433 612-755-7660
Mouser Electronics, Mansfield, TX 76063 800-346-6873

§ Norgren, Littleton, CO 80120-1663 303-794-2611
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
Signal Systems International, Lavalette, NJ 08735 201-741-1120
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
Tane Alarm Products, Floral Park, NY 11001 516-328-3351
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
§ Wabash Magnetics, Wabash, IN 46992 219-563-2191

Switches, RF-5100

Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 213-537-5200 ..... A•1205
† Compac, Holbrook, NY 11741, 516-585-3400 ..... B•1703
§† CW Industries, Southhampton, PA 18966, 215-355-7080 ..... B•1719
CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117 ..... D•1241
§† Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260 .... B•1721
Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1409
† General Microwave Corporation, Amityville, NY 11701, 516-226-8900 .... A•1784
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 ..... B•1753
Information Transfer Indl. Inc., Holcomb, NY 14469, 716-657-7074 ..... D•1187
† Janco Corp., Burbank, CA 91504, 818-846-1800 ..... B•1779
Kay Elemetrics Corp., Pine Brook, NJ 07058-9798, 201-227-2000 ..... A•1785
Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560 ..... B•1552
† LSI Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1570,1573
† MarLee Switch Co., Upland, CA 91786, 714-982-8988 ..... B•1789
Matrix Systems Corp., Calabasas, CA 91302, 818-992-6776 ..... B•1579
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1787
Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822
§† Adams-Russell, Anzac Div., Burlington, MA 01803 671-273-3333
† Alan Industries Inc., Columbus, IN 47201 812-372-8869
† Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
§ Control Cable, Inc., Baltimore, MD 21207 301-298-4411
† Daico Industries, Inc., Compton, CA 90224 213-631-1143
§† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
DOW SWITCH, Wilmington, MA 01887 617-935-6395
Eaton Corporation, Microwave Products Division, Sunnyvale, CA 94086 408-773-3700
† Electronic Systems Div., Servo Corp. of America, Hicksville, NY 11802 .. 516-938-9700
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
§ Glasgal Communications, Inc., Northvale, NJ 07647 201-768-8082
Hirose Electric U.S.A., Inc. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), Simi Valley, CA 93065 805-522-7958
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
§ K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Lectronic Research Labs., Inc., Camden, NJ 08104 609-541-4200
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., Englewood, NJ 07631 201-569-8282
MACOM, Inc., Burlington, MA 01803 617-272-3000
§† M/A-COM Omni Spectra, Inc., Merrimack, NH 03054 603-424-4111
§† Micronetics, Norwood, NJ 07648 201-767-1320
§ Namco Controls, An Acme-Cleveland Co., Mentor, OH 44060 216-946-9900
† Narda Microwave Corp., Subsidiary of Loral Corp., Hauppauge, NY 11788 516-231-1700
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
Peca, Inc., Bensalem, PA 19020 215-245-1550
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Radio Switch Corp., Marlboro, NJ 07746 201-462-6100
Reeve Electronics, Mellish E. Murray, Chicago, IL 60612 312-670-0150
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621
Sanders Associates, Inc., ECBD, A Lockheed Company, Manchester, NH 03108-8500 603-645-5548
† Sanders/A Lockheed Co. Div. Microwave Technlg. Ctr., Manchester, NH 03108 ..... 603-645-6000 X 5548
† Sector Microwave Ind. Inc., Deer Park, NY 11729 516-242-2300
† Sivers IMA, Div. of Philips, Culver City, CA 90230 213-390-7477
§ Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507 312-844-4300
Support Systems Intl. Corp., Richmond, CA 94804 415-234-9090
† Tachonics Corporation, Grumman Corp., Plainsboro, NJ 08536 609-275-2550
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Til-Tek Limited, Kemptville, Ontario, CANADA K0G 1J0 613-258-5928
§ Toko America, Inc., Mt. Prospect, IL 60056 312-297-0070
† Transco Products, Inc., Camarillo, CA 93011-6003 805-987-8007
† Vectronics Microwave Corp., Middlesex, NJ 08846 201-356-2377
§ Wabash Magnetics, Wabash, IN 46992 219-563-2191
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
† Waveline, W. Caldwell, NJ 07006 201-226-9100
Western Multiplex Corp., San Carlos, CA 94070 415-592-8832
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570

Switches, Rocker-5100

§ American Switch Corp., Wakefield, MA 01880, 617-246-1007 ..... B•1681
§ Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... B•1682
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050, 804-974-5100 ..... B•1684
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845, 508-685-4371 ..... B•1686-1687
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ... B•1692-1693
§ Carlingswitch, Inc., Plainville, CT 06062-1156, 203-793-9281 ..... B•1695
§ CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501, 515-573-1300 ..... B•1704
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419, 312-843-2200 ..... B•1711
§† CW Industries, Southhampton, PA 18966, 215-355-7080 ..... B•1719
§ Dreefs Switch, Inc., Waukegan, IL 60087, 312-662-7667;800-323-9605 ... B•1722
§ DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011, 212-691-9050 ..... B•1723
EECO Incorporated, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1726
§ Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1733-1734
EnTech Corporation, Simsbury, CT 06070, 203-658-2740;203-651-9557 .. B•1739
Globtek, Inc., N. Bergen, NJ 07047, 201-861-0246 ..... C•1369
Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1743-1744
§† Heinemann Electric Co., Lawrenceville, NJ 08648-0800, 609-882-4800 ... B•1371
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475 ..... A•1085
§ ITT Schadow, Eden Prairie, MN 55344, 612-934-4400 ..... B•1760
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8878 ..... B•1780-1781
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-9440 ..... B•1786
Manufacturers Components, Inc., Hialeah, FL 33016, 305-556-4481;800-367-0377 ..... B•1788
§ Marquardt Switches Inc., Cazenovia, NY 13035, 315-655-8050 ..... B•1792-1797
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200 ..... B•1798-1800
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1812
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1816-1817,1820-1821
§ Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822
Oslo Controls, Cheshire, CT 06410-1511, 203-272-2794 ..... B•1827
Panel Components Corp., Santa Rosa, CA 95406, 707-523-0600 ..... C•1471
Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... B•1835
† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1841
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ..... B•1847-1848
Airpax Co., Cambridge Division, Cambridge, MD 21613 301-228-4600
§ Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ AMP, Harrisburg, PA 17105 717-564-0100
Ark-Les, Watertown, MA 02172 617-924-2330
§ Ark-les Special Products Corp., Raleigh, NC 27620 919-828-6201
Aromat Corp., New Providence, NJ 07974 201-464-3550
Augat Inc., Attleboro, MA 02703 617-222-2202
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
Communication Devices, Inc., Scarborough, Ont., CAN M1H3A4 416-439-6320
Components Unlimited, Inc., Portland, OR 97223 503-620-3522
CTS Corporation, Elkhart, IN 46514 219-293-7511
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
§ Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
§ FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602 203-382-2000
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
Illinois Lock Co., The Eastern Co., Wheeling, IL 60090 312-537-1800
† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
International Mircoelectronics, Arlington, TX 76003 817-561-2244
§ J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., New Haven, CT 06509 203-772-2220
Judco Mfg. Inc., Harbor City, CA 90710 213-534-0959
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 312-949-8505
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016 312-824-1188
† Measurement Systems, Inc., Norwalk, CT 06854 203-838-5561
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173 312-843-7900
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
Shin-Etsu Polymer America, Inc., Union City, CA 94587 415-475-9000
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ SL Waber, Inc., Mt. Laurel, NJ 08054 ..... 609-866-8888;800-257-8384
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§† Syracuse Electronics, Pass & Seymour, Inc., Syracuse, NY 13221 315-468-6211
Tane Alarm Products, Floral Park, NY 11001 516-328-3351
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 312-364-7277
§ Toko America, Inc., Mt. Prospect, IL 60056 312-297-0070

Switches, Rotary-5100

Airflyte Elctrns. Co., Bayonne, NJ 07002, 201-436-2230 ..... B•1233
§ Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... B•1677
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050, 804-974-5100 ..... B•1684
§† ASM Corporation, Smithfield, NC 27577, 919-934-3104 ..... B•1685
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845, 508-685-4371 ..... B•1686-1687
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ... B•1692-1693
† Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 ..... B•1702

§† CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501, 515-573-1300 ..... B•1704
§ CTS Corporation, Switch Div., Paso Robles, Paso Robles, CA 93446, 805-238-0350 ..... B•1716
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... B•1732
§ EECO Incorporated, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1726
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1734
§† Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 ..... B•1736
ELMA Electronic Inc., Fremont, CA 94538, 415-656-3400 ..... B•1738
† EnTech Corporation, Simsbury, CT 06070, 203-658-2740;203-651-9557 .. B•1739
§† Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1746-1749
IDEC Corporation, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1755
§ Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 312-537-1800 ..... B•1756-1757
Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010, 415-347-8217 .... B•1867
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475 ..... A•1085
§ ITT Schadow, Eden Prairie, MN 55344, 612-934-4400 ..... B•1761
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
JAE Electronics Inc., Santa Ana, CA 92705-5504, 714-250-8770 ..... B•1776
§† Janco Corp., Burbank, CA 91504, 818-846-1800 ..... B•1778-1779
† Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ... B•1667,1784-1785
McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200 ..... B•1799
§ Mepcopal Company, San Diego, CA 92121, 619-453-0332 .. A•2132-2133, B•1803
Motorola Semiconductor Prods. Sector, Phoenix, AZ 85018-6606, 602-244-6900 ..... A•2184
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1816,1818-1821
§† Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1824-1825
Otto Controls, Otto Engineering, Carpentersville, IL 60110, 312-428-7171 ..... B•1829
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 312-438-4000 ..... A•2142
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1833
§ Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... B•1835
§ Shallco, Inc., Smithfield, NC 27577, 919-934-3135 ..... B•1836-1840
§ Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850 ..... B•1122
Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1841
§† Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507, 312-844-4300 ..... B•1842-1843
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1851
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§ Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ AMP, Harrisburg, PA 17105 717-564-0100
Arcolectric Corp., Canoga Park, CA 91304 818-700-1933
Ark-Les, Watertown, MA 02172 617-924-2330
Astrosystems, Lake Success, NY 11042 516-328-1600
Augat Inc., Attleboro, MA 02703 617-222-2202
Bosch, Robert, Corp., Broadview, IL 60153 312-865-5200
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
Carson Manufacturing Co., Inc., Indianapolis, IN 46220 317-257-3191
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC, Dover, NH 03820 603-742-1120,800-872-0042
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
§ COMCAB, Wakefield National, Inc., Nashport, OH 43830 614-828-2468
§ CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), Elkhart, IN 46514 219-295-3575
CTS Corporation, Microelectronics Div., W. Lafayette, IN 47906 317-463-2565
§ Dreefs Switch, Inc., Waukegan, IL 60087 ..... 312-662-7667;800-323-9605
DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011 212-691-9050
Duncan Electronics, Inc., Costa Mesa, CA 92626 714-545-8261
§† Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
† Electro National, Canton, MS 39046 601-859-5511
§† Electroswitch, Southern Div., Electro Switch Corp., Raleigh, NC 27604 .. 919-833-0707
† E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
§ Entrelec, Alsthom International, Spring Valley, NY 10977 914-425-7460
§ Emi Components, Richmond, VA 23236 804-794-6367
§ FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602 203-382-2000
Ghielmetti, Inc., Los Angeles, CA 90028-8770 213-463-5111
† Giannini Institute, Indio, CA 92201 619-347-2833
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
† Interface Products, Inc., Oceanside, CA 92056 619-945-0230
International Mircoelectronics, Arlington, TX 76003 817-561-2244
K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 312-949-8505
KAYCEE INDUSTRIES LTD., Bombay-38, INDIA 263521/22/23
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
Lamb Industries, Inc., Portland, OR 97225 503-297-8878
§ Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016 312-824-1188
† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 703-953-4751
Mallory Timers, Emhart Elec./Elctrn. Grp., Indianapolis, IN 46201 317-636-5353
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
† Maurey Instrument Corp., Chicago, IL 60629 312-581-4555
J. R. Merritt Controls, Inc., Stamford, CT 06902 203-359-2113
Methode Electronics, Inc., Chicago, IL 60656 312-867-9600
† Microavionics Corp., Costa Mesa, CA 92626 714-957-6904
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§ Microwave Development Laboratories, Natick, MA 01760 617-655-0060
† Minelco Inc. - A Talley Ind., Thomaston, CT 06787-0459 203-283-8261
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 312-364-6038
§ Ohmite Manufacturing Co., Skokie, IL 60076 312-675-2600
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
§ Piher International Corp., Mt. Prospect, IL 60056 ..... 312-390-6680;800-323-6693
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
† Radio Switch Corp., Marlboro, NJ 07746 201-462-6100
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621
§ Seacor, Inc., Westwood, NJ 07675 201-666-5600
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ Spectrol Electronics, City of Industry, CA 91745 818-964-6565
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
Standard Grigsby Inc., W. Gunther GMBH, D 8500 Nurnberg 82, WEST GERMANY 0911-65521
Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
§ TELTEC, INC., Minneapolis, MN 55425 612-854-9632
Tettex Instruments, Inc., Fairview Village, PA 19409-0281 215-539-6050
† Thermo Electric, Saddle Brook, NJ 07662 201-843-5800
§ Toko America, Inc., Mt. Prospect, IL 60056 312-297-0070

Switches, Sealed-5100

AME Corporation, Towaco, NJ 07082-0195, 201-263-1700 ..... B•1678
§† American Research & Engineering, Elgin, IL 60123, 312-888-7245 ..... B•1680
§ Augat Alcoswitch, Augat inc., N. Andover, MA 01845, 508-685-4371 .... B•1687
§ Burgess Switch Co., American Electronic Components, Elkhart, IN 46515, 219-262-8608 ..... B•1689
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ... B•1692-1693
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1699,1701
† Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 ..... B•1702
§ CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501, 515-573-1300 ..... B•1704
CTS Corporation, Switch Div., Paso Robles, Paso Robles, CA 93446, 805-238-0350 ..... B•1712-1715
§ CW Industries, Southhampton, PA 18966, 215-355-7080 ..... B•1718
§† Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... B•1720
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1465
DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011, 212-691-9050 ..... B•1723
§ Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116 ..... B•1724-1725
§ EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... B•1732
§ EECO Incorporated, Santa Ana, CA 92702-0659, 714-835-6000 .... B•1726-1727
§ Electronic Components Groupe, Stein Industries, inc., Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1733-1734
Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 ..... B•1736
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1740-1741
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1745
Hamlin, Lake Mills, WI 53551, 414-648-2361 ..... B•1751
Inter-Market, Glenview, IL 60025, 312-729-5330 ..... B•1178
§ ITT Schadow, Eden Prairie, MN 55344, 612-934-4400 ..... B•1758-1760
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
† Janco Corp., Burbank, CA 91504, 818-846-1800 ..... B•1778
Kilovac Corp., Santa Barbara, CA 93140-4422, 805-684-4560 ..... B•1553
§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8878 ..... B•1780-1781
Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448 ..... B•1871-1872
† Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ..... B•1667,1785
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-9440 ..... B•1787
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200 ..... B•1799-1800
Mechanical Enterprises, Herndon, VA 22070, 703-435-9496 .. B•1801,1876-1877
Mepcopal Company, San Diego, CA 92121, 619-453-0332 ..... B•1803
§† Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1810,1812
MOLEX, Inc., Lisle, IL 60532, 312-969-4550 ..... C•1450-1451
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1816-1821
§† Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822
† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 312-428-7171 ..... B•1828-1829
§† Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1831
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1833
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... B•1844-1845
§ T-Bar Incorporated, a Data Switch Co., Shelton, CT 06484, 203-926-1801 ..... B•1850
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1851
Veetronix, Inc., Lexington, NE 68850, 308-324-4600 ..... B•1852
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
† Aerospace Optics, Inc., Fort Worth, TX 76112 817-451-1141
§ American Switch Corp., Wakefield, MA 01880 617-246-1007
AMP, Harrisburg, PA 17105 717-564-0100
Arcolectric Corp., Canoga Park, CA 91304 818-700-1933
§ Aromat Corp., New Providence, NJ 07974 201-464-3550

§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
Augat Inc., Attleboro, MA 02703 617-222-2202
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., Dover, NH 03820 603-742-1120,800-872-0042
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
§ COMCAB, Wakefield National, Inc., Nashport, OH 43830 614-828-2468
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 818-791-5600
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
§ Electroswitch, Southern Div., Electro Switch Corp., Raleigh, NC 27604 919-833-0707
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
§ FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
† Giannini Institute, Indio, CA 92201 619-347-2833
§ Gunther, W., GmbH, D 8500 Numberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
Hermetic Switch, Chickasha, OK 73018 405-224-4046
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
§ Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 415-347-8217
ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
JAE Electronics Inc., Santa Ana, CA 92705-5504 714-250-8770
§† J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., New Haven, CT 06509 203-772-2220
† K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100 703-953-4751
† LSI Jennings, San Jose, CA 95122-2696 408-292-4025
MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
Midwest Components, Inc., Muskegon, MI 49443 616-777-2602
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173 312-843-7900
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
§† Risk, George, Inds., Kimball, NE 69145 308-235-4645
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Saint Switch, Inc., St. Charles, IL 60174 312-377-3779
Schroff Incorporated, Schroff GMBH, Warwick, RI 02886 401-732-3770
§ Shallco, Inc., Smithfield, NC 27577 919-934-3135
Signal Systems International, Lavalette, NJ 08735 201-741-1120
§† Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507 312-844-4300
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312
† Transco Products, Inc., Camarillo, CA 93011-6003 805-987-8007

Switches, Slide-5100

§† American Research & Engineering, Elgin, IL 60123, 312-888-7245 ..... B•1680
Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933 ..... B•1683
§ Aries Electronics, Frenchtown, NJ 08825, 201-996-6841 ..... C•1272
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845, 508-685-4371 ..... B•1686-1687
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... B•1692-1693
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1700
§ CTS Corporation, Switch Div., Paso Robles, Paso Robles, CA 93446, 805-238-0350 ..... B•1713,1715
§† CW Industries, Southhampton, PA 18966, 215-355-7080 ..... B•1718-1719
§ Daburn Electronics & Cable Corp., Northvale, NJ 07647, 201-768-5400 ..... C•1848
§ DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011, 212-691-9050 ..... B•1723
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1733-1734
Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1743-1744
§ Illinois Lock Co., The Eastern Co., Wheeling, IL 60090, 312-537-1800 ..... B•1756-1757
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
JAE Electronics Inc., Santa Ana, CA 92705-5504, 714-250-8770 ..... B•1776
§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8878 ..... B•1164,1780-1781
§ Marquardt Switches Inc., Cazenovia, NY 13035, 315-655-8050 ..... B•1791
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1816-1817,1819-1821
Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1830
† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... B•1841
§ Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ..... B•1849
Airflyte Elctrns. Co., Bayonne, NJ 07002 201-436-2230
§ Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ AMP, Harrisburg, PA 17105 717-564-0100
§ Annulus Technical Industries, Inc., Ancaster, Ontario, CAN L9G 4G4 416-648-8100
APX-Arstan Products International Inc., Jericho, NY 11753 516-333-8100
§ Ark-Les, Watertown, MA 02172 617-924-2330
§ Ark-les Special Products Corp., Raleigh, NC 27620 919-828-6201
§ Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
Augat Inc., Attleboro, MA 02703 617-222-2202
§ Carlingswitch, Inc., Plainville, CT 06062-1156 203-793-9281
Components Unlimited, Inc., Portland, OR 97223 503-620-3522
CTS Corporation, Elkhart, IN 46514 219-293-7511
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
§ Gaynor Electric Co., Thomaston, CT 06787-0316 203-283-4388
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Guardian Elec. Mfg. Co., Chicago, IL 60607 815-337-0050
§ Gunther, W., GmbH, D 8500 Numberg 82, WEST GERMANY ..... (0)911/65521 or 65520
ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
International Resource Svcs., Miami, FL 33166 305-884-2924
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
ITT Schadow, Eden Prairie, MN 55344 612-934-4400
ITT Sealectro, Trumbull, CT 06611 203-372-4118
Judco Mfg. Inc., Harbor City, CA 90710 213-534-0959
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 312-949-8505
§ Leecraft Mfg., Long Island City, NY 11101 718-392-8800
§ Lutron Electronics Co., Coopersburg, PA 18036 215-282-3800
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
Noble U.S.A., Inc., Rolling Meadows, IL 60008 312-364-6038
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
RDI Elctrns., Inc., New Rochelle, NY 10801 914-632-2828
† Resistance Technology Inc., St. Paul, MN 55112 612-636-9770
† Roanwell, New York, NY 10014 212-989-1090
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Switches, Snap Action (All Types)-5100

Altech Corp., Somerville, NJ 08875, 201-359-4454 ..... B•1677
§ American Switch Corp., Wakefield, MA 01880, 617-246-1007 ..... B•1681
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845, 508-685-4371 ..... B•1687
§ Burgess Switch Co., American Electronic Components, Elkhart, IN 46515, 219-262-8608 ..... B•1690-1691
§ C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400 ..... B•1692
§† C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492, 203-269-8701 ..... B•1694
Carlingswitch, Inc., Plainville, CT 06062-1156, 203-793-9281 ..... B•1695
§ Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... B•1700
§ CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501, 515-573-1300 ..... B•1704
§† CW Industries, Southhampton, PA 18966, 215-355-7080 ..... B•1719
§ Dreefs Switch, Inc., Waukegan, IL 60087, 312-662-7667;800-323-9605 ..... B•1722
§ DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011, 212-691-9050 ..... B•1723
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1733-1735
§† Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 ..... B•1736
Electroswitch, Southern Div., Electro Switch Corp., Raleigh, NC 27604, 919-833-0707 ..... B•1737
EnTech Corporation, Simsbury, CT 06070, 203-658-2740;203-651-9557 ..... B•1739
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1745
† Heinemann Electric Co., Lawrenceville, NJ 08648-0800, 609-882-4800 ..... B•1371
ITT Schadow, Eden Prairie, MN 55344, 612-934-4400 ..... B•1760
§† ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... B•1868-1869
§ Lamb Industries, Inc., Portland, OR 97225, 503-297-8878 ..... B•1780-1781
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200 ..... B•1800
§† Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1808-1809,1812
Midwest Components, Inc., Muskegon, MI 49443, 616-777-2602 ..... B•1910
§ NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942 ..... B•1816-1821
Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822
§ Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1824
§† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 312-428-7171 ..... B•1828
§ Power Dynamics Inc., West Orange, NJ 07052, 201-736-5722 ..... C•1507
§ Schurter, Inc., Petaluma, CA 94952, 707-778-6311 ..... A•1670-1671
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
Airpax Co., Cambridge Division, Cambridge, MD 21613 301-228-4600
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000
§ Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Annulus Technical Industries, Inc., Ancaster, Ontario, CAN L9G 4G4 416-648-8100
§ Arcolectric Corp., Canoga Park, CA 91304 818-700-1933
Ark-Les, Watertown, MA 02172 617-924-2330
§ Aromat Corp., New Providence, NJ 07974 201-464-3550
§† Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100

§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 214-851-4005
Augat Inc., Attleboro, MA 02703 617-222-2202
§ Barksdale Controls Div., Imo Delaval Inc., Los Angeles, CA 90058 213-589-6181
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
Chicago Lock Co., Chicago, IL 60641 312-282-7177
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
§† Columbus Electric Mfg. Co., Switch Division, Piney Flats, TN 37686 ... 1-800-251-7828
Components Unlimited, Inc., Portland, OR 97223 503-620-3522
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
§† Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
CTS Corporation, Elkhart, IN 46514 219-293-7511
§ EAO Switch Corp., Milford, CT 06460 203-877-4577
§† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
ELMA Electronic Inc., Fremont, CA 94538 415-656-3400
† Elmwood Sensors, Pawtucket, RI 02861 401-727-1300
§ Entech Systems, Inc., Simsbury, CT 06070 203-651-9557
§ FENWAL INC., Ashland, MA 01721 508-881-2000
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
The Hall Company, Urbana, OH 43078 513-652-1376
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
International Mircoelectronics, Arlington, TX 76003 817-561-2244
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
§ J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., New Haven, CT 06509 203-772-2220
Kaut & Bux Manufacturing Co., Mundelein, IL 60060 312-949-8505
KAYCEE INDUSTRIES LTD., Bombay-38, INDIA 263521/22/23
§ Landis & Gyr, Inc., Pleasantville, NY 10570 914-747-3540
Leecraft Mfg., Long Island City, NY 11101 718-392-8800
Linemaster Switch, Woodstock, CT 06281 203-974-1000
§ Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016 312-824-1188
Low Key Corporation, Strong Group, Gloucester, MA 01930 508-281-0448
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
Mantex Corp., Oxford, MI 48051 313-628-8200
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
J. R. Merritt Controls, Inc., Stamford, CT 06902 203-359-2113
Milross Controls, Inc., Southampton, PA 18966 215-355-0200
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 312-364-6038
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
† Orbit Instrument of Cal., Cypress, CA 90630 714-527-0561
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† Roanwell, New York, NY 10014 212-989-1090
† Saint Switch, Inc., St. Charles, IL 60174 312-377-3779
Schroff Incorporated, Schroff GMBH, Warwick, RI 02886 401-732-3770
§ Seacor, Inc., Westwood, NJ 07675 201-666-5600
Shin-Etsu Polymer America, Inc., Union City, CA 94587 415-475-9000
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ SL Waber, Inc., Mt. Laurel, NJ 08054 ..... 609-866-8888;800-257-8384
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
† Square D Co., Palatine, IL 60067 312-397-2600
§ Stancor Products, Hamilton Standard Controls, Logansport, IN 46947 ... 219-722-2244
§ Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507 312-844-4300
† Sundstrand Data Control Inc., Sundstrand Corporation, Redmond, WA 98073-9701 206-885-3711
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§† Syracuse Electronics, Pass & Seymour, Inc., Syracuse, NY 13221 315-468-6211
Tech Laboratories Inc., Palisades Pk, NJ 07650 201-944-2221
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800
§ Toko America, Inc., Mt. Prospect, IL 60056 312-297-0070
§ Torq Corp., Bedford, OH 44146 216-232-4100
Tricon Industries, Inc., Electromechanical Division, Downers Grove, IL 60515-4076 312-964-2330
§ United Electric Controls, Watertown, MA 02172 617-926-1000

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§ Burgess Switch Co., American Electronic Components, Elkhart, IN 46515, 219-262-8608 ..... B•1690-1691
CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501, 515-573-1300 ..... B•1704
Crosspoint, Div. of Info-Lite, Fairview, NJ 07022, 201-941-4455 ..... B•1709
§ Crydom Company, Cerritos, CA 90701, 213-865-3536 ..... B•1456-1458,1460
§ Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... B•1466
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1409
Hi-G Company, A Subsidiary of Nytronics Inc., Hartford, CT 06114, 203-522-8600 ..... B•1537-1538
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
IVO Industries, Inc., Eatontown, NJ 07724, 201-542-5151;800-932-0489 .. B•1775
† MarLee Switch Co., Upland, CA 91786, 714-982-8988 ..... B•1789
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1804-1806
Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822
Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900 ..... B•1824
Philips ECG, American Philips Co., Waltham, MA 02254, 617-890-6107 ..... A•2196-2197
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 ..... B•1833
Wilcoxon Research, Rockville, MD 20850, 301-330-8811 ..... B•2000
§† Adams-Russell, Anzac Div., Burlington, MA 01803 671-273-3333
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
American Control Technology, Inc., West Dundee, IL 60118 312-426-6780
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Astro-Geo-Marine, Inc., Santa Barbara, CA 93101 805-965-7005
Astrosystems, Lake Success, NY 11042 516-328-1600
§ Barksdale Controls Div., Imo Delaval Inc., Los Angeles, CA 90058 213-589-6181
Cambridge Aerofio, Inc., Shirley, MA 01464 508-45-2346
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 514-739-3274
§ C & K Components, Inc., Newton, MA 02158-1082 617-964-6400
Coaxial Dynamics, Cleveland, OH 44135 ..... 1-800-COAXIAL
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
Cross Electronics, Warrendale, PA 15086 412-776-1591
† Daico Industries, Inc., Compton, CA 90224 213-631-1143
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
† Dionics, Westbury, NY 11590 516-997-7474
Dynage/Controls, Inc., Canistota, SD 57012 605-296-3487
§ EAO Switch Corp., Milford, CT 06460 203-877-4577
§† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Efector, Inc., Exton, PA 19341 ..... 215-524-2000;800-441-8246
Elec-Trol, Inc., Saugus, CA 91350 805-252-8330
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 312-882-5757
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ..... 214-470-2106/2107
Electroswitch, Southern Div., Electro Switch Corp., Raleigh, NC 27604 .. 919-833-0707
Enerco, Inc., Seattle, WA 98108 206-762-1422
General Magnetics, Bloomfield, NJ 07003 201-743-2700
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
† Genisco Technology Corp., La Mirada, CA 90638 714-523-7001
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
§ Halmar Electronics, Inc., Columbus, OH 43204 614-275-0530
HEI, Inc., Optoelectronics Div., Victoria, MN 55386 612-443-2500
§† Honeywell Optoelectronics, Richardson, TX 75081 214-470-4271
† Hughes Aircraft Co., Microelctrns. Sys. Div., Irvine, CA 92715 714-752-3800
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
§† Leach Control Products Div., Leach Corporation, Buena Pk., CA 90620 .. 714-739-0770
Linemaster Switch, Woodstock, CT 06281 203-974-1000
† Lorch Electronics:Div. of Vernitron Corp., Englewood, NJ 07631 201-569-8282
§ Lutron Electronics Co., Coopersburg, PA 18036 215-282-3800
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
MACOM, Inc., Burlington, MA 01803 617-272-3000
Matrix Systems Corp., Calabasas, CA 91302 818-992-6776
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
Microphase, Norwalk, CT 06856 203-866-8000
§† Micro Power Sys. Inc., Santa Clara, CA 95054 408-727-5350
† Norsal Industries, Central Islip, NY 11722 516-234-1200
Olektron Corp., Signal Technology Corp., Webster, MA 01570 508-943-7440
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
§ Payne Engineering, Scott Depot, WV 25560 304-757-7353
Phase Control Electronics, Glendale, NY 11385 718-441-4278
Power Functions Engineering, Garland, TX 75042 214-278-0996
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† PSG Inds., Perkasie, PA 18944 215-257-3621
Regent Controls, Inc., Shelton, CT 06484-0767 203-736-2924
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
Sanders Associates, Inc., ECBD, A Lockheed Company, Manchester, NH 03108-8500 603-645-5548
† Sanders/A Lockheed Co. Div. Microwave Technlg. Ctr., Manchester, NH 03108 ..... 603-645-6000 X 5548
§ Scientific Technologies, Optical Sensor Div. Inc., Hayward, CA 94544 ... 415-471-9717
Signal Systems International, Lavalette, NJ 08735 201-741-1120
§† Siliconix, Inc., Santa Clara, CA 95054 408-988-8000
Sprague Electric Company, The Semiconductor Group, Worcester, MA 01613-2036 617-853-5000
§ SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
§ Struthers-Dunn Military Relays, Sub. Of Nytronics, Inc., Pitman, NJ 08071-0901 609-589-7500
§ Struthers-Dunn Industrial & Commerical Relays, Sub. of Nytronics, Inc., Darlington, SC 29532 803-393-5421
§ Teccor Electronics, Inc., Irving, TX 75038 214-580-1515
§† Teledyne Crystalonics, Teledyne Industries, Inc., Cambridge, MA 02140 617-491-1670
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Tempo Instrument, Inc., Commack, NY 11725 516-864-3700
§ Toko America, Inc., Mt. Prospect, IL 60056 312-297-0070
Triac Electronic Systems, Inc., Glendale, NY 11385 718-441-4759
§ United Electric Controls, Watertown, MA 02172 617-926-1000
§† Vicon Industries, Inc., Melville, NY 11747 516-293-2200
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570

Switches, Step Type-5100

§† ASM Corporation, Smithfield, NC 27577, 919-934-3104 ..... B•1685
§ ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
† Janco Corp., Burbank, CA 91504, 818-846-1800 ..... B•1778-1779
† Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ..... B•1667,1785
Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822

† **Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY)** ..... **B•1831**
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 ..... **B•1833**
§ **Schurter, Inc., Petaluma, CA 94952, 707-778-6311** ..... **C•1521-1522**
† **Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221** ..... **B•1851**
Airflyte Elctrns. Co., Bayonne, NJ 07002 201-436-2230
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
† Cole Instrument Corp., Santa Ana, CA 92704 714-556-3100
§† Communications Instruments, Inc., Fairview, NC 28730 704-628-1711
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
† Electro National, Canton, MS 39046 601-859-5511
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, Northlake, IL 60164 312-681-7100
ITT Sealectro, Trumbull, CT 06611 203-372-4118
Litton Encoder Div., Chatsworth, CA 91311 818-341-6161
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
J. R. Merritt Controls, Inc., Stamford, CT 06902 203-359-2113
Noble U.S.A., Inc., Rolling Meadows, IL 60008 312-364-6038
§ Ohmite Manufacturing Co., Skokie, IL 60076 312-675-2600
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Shalico, Inc., Smithfield, NC 27577 919-934-3135
§ Tenor Company, New Berlin, WI 53151 414-782-3800

Switches, Surface Mount-5100

§ **American Research & Engineering, Elgin, IL 60123, 312-888-7245** ..... **B•1680**
Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050, 804-974-5100 ..... **B•1684**
§ **Augat Alcoswitch, Augat Inc., N. Andover, MA 01845, 508-685-4371** .... **B•1687**
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400** ..... **B•1692**
Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500 ..... **B•1699,1701**
Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 ..... **B•1702**
CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501, 515-573-1300 ..... **B•1704**
DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011, 212-691-9050 ..... **B•1723**
EAO Switch Corp., Milford, CT 06460, 203-877-4577 ..... **B•1732**
§ **EECO Incorporated, Santa Ana, CA 92702-0659, 714-835-6000** ..... **B•1726**
ITT Schadow, Eden Prairie, MN 55344, 612-934-4400 ..... **B•1761**
ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... **B•1762**
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-9440 ..... **B•1786-1787**
Manufacturers Components, Inc., Hialeah, FL 33016, 305-556-4481;800-367-0377 ..... **B•1788**
§ **Mepcopal Company, San Diego, CA 92121, 619-453-0332** ..... **B•1803**
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578, 312-438-4000 ..... **B•1830**
Rundel Prods., Allied Control, Plantsville, CT 06479, 203-621-6771 ..... **B•1833**
Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ..... **B•1847**
Burgess Switch Co., American Electronic Components, Elkhart, IN 46515 219-262-8608
§ Control Cable, Inc., Baltimore, MD 21207 301-298-4411
§ CTS Corporation, Switch Div., Paso Robles, Paso Robles, CA 93446 805-238-0350
† Daico Industries, Inc., Compton, CA 90224 213-631-1143
Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403 ..... 612-375-9639;800-826-8719
General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602 203-382-2000
Intaq Electrotouch Sys., GM Nameplate, Inc., Seattle, WA 98119 206-284-5475
K-Two Industries, Palo Alto, CA 94306 408-720-9316
MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
§ NKK Switches of America, Inc., Scottsdale, AZ 85260 602-991-0942
† Resistance Technology Inc., St. Paul, MN 55112 612-636-9770
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

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Airpax Co., Frederick Div., Frederick, MD 21701, 301-663-5141 ..... **B•1887**
Elmwood Sensors, Pawtucket, RI 02861, 401-727-1300 ..... **B•1894-1895**
Fenwal Electronics/APD, Kidde, Inc., Milford, MA 01757, 508-478-6000 .. **B•1896**
Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... **B•1898-1900**
Micro Devices Product Group, Therm-O-Disc, Inc., Mansfield, OH 44907, 419-525-8500 ..... **B•1402**
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... **B•1810**
§ **Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673** ..... **B•1917**
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907, 419-525-8500 ..... **B•1921**
§ Aqualarm, Marine Safety Systems, Inc., Chula Vista, CA 92011 619-575-4011
§ Automatic Switch Co., Florham Park, NJ 07932 1-201-966-2000
§ Barksdale Controls Div., Imo Delaval Inc., Los Angeles, CA 90058 213-589-6181
Burling Instruments, Chatham, NJ 07928 201-635-9481
Cambridge Aerofio, Inc., Shirley, MA 01464 508-45-2346
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 514-739-3274
§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
† Chatham Controls, Chatham, NJ 07928 201-635-8892
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ E-Squared Technology Corp., Ventura, CA 93003 805-644-9544
§ FENWAL INC., Ashland, MA 01721 508-881-2000
General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602 203-382-2000
Hold-Heet Products Corp., Chicago, IL 60640 ..... 312-728-4454;312-728-4455
Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
§ Midwest Components, Inc., Muskegon, MI 49443 616-777-2602
Princo Instruments, Inc., Southampton, PA 18966
† PSG Inds., Perkasie, PA 18944 215-257-3621
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ Stancor Products, Hamilton Standard Controls, Logansport, IN 46947 ... 219-722-2244
† Sundstrand Data Control Inc., Sundstrand Corporation, Redmond, WA 98073-9701 206-885-3711
Sylvania GTE Control Devices, Standish, ME 04084 207-642-4535
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
§ United Electric Controls, Watertown, MA 02172 617-926-1000
Warren G-V, Unit of Signal Co., Whippany, NJ 07981 201-386-1200
Western Elctrn. Comps. Corp., Camarillo, CA 93010 805-482-8002

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American Control Technology, Inc., West Dundee, IL 60118, 312-426-6780 ..... **B•1679**
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400** ..... **B•1692**
§ **Cherry Electrical Products, Cherry Corporation, Waukegan, IL 60087, 312-360-3500** ..... **B•1700,1859**
§† **Crouzet Controls, Inc., Schaumburg, IL 60173-5419, 312-843-2200** ..... **B•1711**
§† **Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600** ..... **B•1720**
§† **EECO Incorporated, Santa Ana, CA 92702-0659, 714-835-6000** .... **B•1726-1727**
§ **Inter-Market, Glenview, IL 60025, 312-729-5330** ..... **B•1178**
§ **Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010, 415-347-8217** .... **B•1867**
§ **IVO Industries, Inc., Eatontown, NJ 07724, 201-542-5151;800-932-0489** ..... **B•1089,1775**
JAE Electronics Inc., Santa Ana, CA 92705-5504, 714-250-8770 ..... **B•1777**
§ **Omron Electronics, Inc., Consumer & Commerical Div., Schaumburg, IL 60173, 312-843-7900** ..... **B•1825**
§ **Shelly Associates, Inc., Tustin, CA 92680, 714-669-9850** ..... **B•1122**
† **Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221** ..... **B•1851**
§ Augat Alcoswitch, Augat Inc., N. Andover, MA 01845 508-685-4371
§ Cincinnati Electrosystems, Loveland, OH 45140 513-831-6800
Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
§ Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
Electroswitch, Southern Div., Electro Switch Corp., Raleigh, NC 27604 .. 919-833-0707
§ Erni Components, Richmond, VA 23236 804-794-6367
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
Ghielmetti, Inc., Los Angeles, CA 90028-8770 213-463-5111
International Mircoelectronics, Arlington, TX 76003 817-561-2244
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 312-364-6038
§ Omron Elctrns., Inc., Control Comps. Div., Schaumburg, IL 60173 312-843-7900
§ Seacor, Inc., Westwood, NJ 07675 201-666-5600
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 312-364-7277

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Altech Corp., Somerville, NJ 08876, 201-359-4454 ..... **B•1677**
§ **American Switch Corp., Wakefield, MA 01880, 617-246-1007** ..... **B•1681**
§ **Arcolectric Corp., Canoga Park, CA 91304, 818-700-1933** ..... **B•1683**
§† **Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050, 804-974-5100** ..... **B•1684**
§ **Augat Alcoswitch, Augat Inc., N. Andover, MA 01845, 508-685-4371** ..... **B•1686-1687**
§ **C & K Components, Inc., Newton, MA 02158-1082, 617-964-6400** ... **B•1692-1693**
§ **Carlingswitch, Inc., Plainville, CT 06062-1156, 203-793-9281** ..... **B•1695-1696**
§ **CRL Comps., Inc., A Cambridge Elctrn. Inds. Co., Fort Dodge, IA 50501, 515-573-1300** ..... **B•1704**
§ **DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011, 212-691-9050** ..... **B•1723**
† **EnTech Corporation, Simsbury, CT 06070, 203-658-2740;203-651-9557** .. **B•1739**
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§ **Lamb Industries, Inc., Portland, OR 97225, 503-297-8878** .... **B•1164,1780-1781**
§ **McGill Manufacturing Co., Inc., Valparaiso, IN 46383, 219-465-2200** ..... **B•1798**
§† **Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600** ..... **B•1813**
§ **NKK Switches of America, Inc., Scottsdale, AZ 85260, 602-991-0942** ..... **B•1816-1821**
§† **Otto Controls, Otto Engineering, Carpentersville, IL 60110, 312-428-7171** ..... **B•1828-1829**
Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... **B•1841**
Switchcraft, Inc., A Raytheon Company, Chicago, IL 60630, 312-792-2700 ..... **B•1847**
§ **T-Bar Incorporated, a Data Switch Co., Shelton, CT 06484, 203-926-1801** ..... **B•1850**
† **Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221** ..... **B•1851**
Adams Rite Products, Inc., Glendale, CA 91204 818-241-5121
Advanced Systems Concepts, Altadena, CA 91001 818-791-0983
† Airpax Co., Cambridge Division, Cambridge, MD 21613 301-228-4600
§ Allen-Bradley Co., Industrial Control Div., Milwaukee, WI 53201 414-382-2000

§ Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
§ Amptronix, Inc., Rowland Heights, CA 91748 213-666-1564
Ark-Les, Watertown, MA 02172 617-924-2330
§ Aromat Corp., New Providence, NJ 07974 201-464-3550
§ Ash-Lan Comps., Ash-Lan, Inc., Dallas, TX 75244 214-851-4005
Augat Inc., Attleboro, MA 02703 617-222-2202
Bosch, Robert, Corp., Broadview, IL 60153 312-865-5200
§† Brim Electronics, Fair Lawn, NJ 07410 201-796-2886
§ C & K/Unimax, Inc., C & K Components, Inc., Wallingford, CT 06492 203-269-8701
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
Communication Devices, Inc., Scarborough, Ont., CAN M1H3A4 416-439-6320
Components Unlimited, Inc., Portland, OR 97223 503-620-3522
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
§† Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., Los Angeles, CA 90039 213-660-1310
§ Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403 ..... 612-375-9639;800-826-8719
§ FEME Electronics, Inc., Plymouth Meeting, PA 19462 215-941-0366
§ Gaynor Electric Co., Thomaston, CT 06787-0316 203-283-4388
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602 203-382-2000
Ghielmetti, Inc., Los Angeles, CA 90028-8770 213-463-5111
Hasco Components, Inc., Bellrose Village, NY 11001 516-328-9292
† Haydon Switch & Instrument, Waterbury, CT 06705 203-756-7441
ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
† Imtronics Industries, St. Petersburg, FL 33716 813-572-9010
International Mircoelectronics, Arlington, TX 76003 817-561-2244
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 516-937-3475
§ ITT Schadow, Eden Prairie, MN 55344 612-934-4400
§† J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., New Haven, CT 06509 203-772-2220
KAYCEE INDUSTRIES LTD., Bombay-38, INDIA 263521/22/23
Kay Elemetrics Corp., Pine Brook, NJ 07058-9798 201-227-2000
† Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
§ Littelfuse, Inc., Sub. of Tracor, Inc., Des Plaines, IL 60016 312-824-1188
§† Machine Components Corp., Plainview, NY 11803 516-694-7222
Manufacturers Components, Inc., Hialeah, FL 33016 ..... 305-556-4481;800-367-0377
§ Marquardt Switches Inc., Cazenovia, NY 13035 315-655-8050
§ MEC A/S, Ballerup, DENMARK DK-2750 011-4542973366
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Optrex/Satori, Torrance, CA 90505 213-378-9478
§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† Resistance Technology Inc., St. Paul, MN 55112 612-636-9770
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
Saint Switch, Inc., St. Charles, IL 60174 312-377-3779
§ Schroff UK Ltd., Hemel Hempstead, Herts, ENGLAND HP2 4SG 0442-40471/6
Senior Inds., Inc., Wood Dale, IL 60191 312-350-1600
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ SMK Electronics Corporation, U.S.A., Placentia, CA 92670 714-996-0960
§ Spemco Switches, St. Clair Shores, MI 48080 800-482-2828
Switches Unlimited, Inc., Woodside, NY 11377 ..... 718-478-5000;800-221-0487
§† Syracuse Electronics, Pass & Seymour, Inc., Syracuse, NY 13221 315-468-6211
Tane Alarm Products, Floral Park, NY 11001 516-328-3351
Texas Instruments, Connector System, Attleboro, MA 02703 ..... 508-699-5269; 508-699-3450
Texas Instrs., Matls. & Controls Grp., Attleboro, MA 02703 617-699-3800
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 312-364-7277

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§ Electronic Components Groupe, Stein Industries, Inc., Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1733-1734
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§ ITT Schadow, Eden Prairie, MN 55344, 612-934-4400 ..... B•1760
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Low Key Corporation, Strong Group, Gloucester, MA 01930, 508-281-0448 ..... B•1871
MOLEX, Inc., Lisle, IL 60532, 312-969-4550 ..... C•1450-1451
§ Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822
Adams Rite Products, Inc., Glendale, CA 91204 818-241-5121
Advanced Input Devices, Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., San Jose, CA 95134 408-432-6000
Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050 804-974-5100
§ Bowmar Instrument Corp., Data Entry Division, Clearwater, FL 34622-4796 813-573-2525
§ Brady, W. H., Co., Xymox Div., Milwaukee, WI 53201 414-355-8300
C.A.M. Graphics Co., Inc., Amityville, NY 11701 516-842-3400
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
§† Eaton Corp./MSC Products, Costa Mesa, CA 92627 714-642-2427
§ Efector, Inc., Exton, PA 19341 ..... 215-524-2000;800-441-8246
§ Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
Enerco, Inc., Seattle, WA 98108 206-762-1422
† GM Nameplate, Inc., Seattle, WA 98119 206-284-2200
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
The Hall Company, Urbana, OH 43078 513-652-1376
† Hallmark Nameplate, Inc., Farmingdale, NY 11735 800-645-9502
† Holt Inc., Irvine, CA 92718 714-859-8800
† IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
JAE Electronics Inc., Santa Ana, CA 92705-5504 714-250-8770
§ Lucas Duralith Corporation, Millville, NJ 08332 609-825-6900
§ Lutron Electronics Co., Coopersburg, PA 18036 215-282-3800
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
§† Miller Dial Corp., El Monte, CA 91731 818-444-4555
§† Pres-Air-Trol Corp., Mamaroneck, NY 10543 ..... 914-698-2026;800-431-2625 (outside NY)
Relay Service Co., Chicago, IL 60651 312-252-2700
§ Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507 312-844-4300
§ Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312
Technical Panels, Inc., Temple City, CA 91780 800-343-1170
§ Toko America, Inc., Mt. Prospect, IL 60056 312-297-0070
§ Topflight, York, PA 17404 ..... 717-843-9901;800-233-9386
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300

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§† Arrow Hart Components, Cooper Industries, Charlottesville, VA 22906-9050, 804-974-5100 ..... B•1684
ASM Corporation, Smithfield, NC 27577, 919-934-3104 ..... B•1685
§† Augat Alcoswitch, Augat Inc., N. Andover, MA 01845, 508-685-4371 .... B•1687
Cole Instrument Corp., Santa Ana, CA 92704, 714-556-3100 ..... B•1702
§ CTS Corporation, Switch Div., Paso Robles, Paso Robles, CA 93446, 805-238-0350 ..... B•1713
§† Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... B•1720
§† EECO Incorporated, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1727
† Electroswitch, Unit of Electro Switch Corp., Weymouth, MA 02188, 617-335-5200 ..... B•1736
Electroswitch, Southern Div., Electro Switch Corp., Raleigh, NC 27604, 919-833-0707 ..... B•1737
EnTech Corporation, Simsbury, CT 06070, 203-658-2740;203-651-9557 .. B•1739
Fifth Dimension, Inc., Trenton, NJ 08638, 609-393-8350 ..... B•1740-1741
§† Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1743-1744,1746-1748
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ITW Switches, Illinois Tool Works, Chicago, IL 60634, 312-282-4040 ..... B•1762
† Janco Corp., Burbank, CA 91504, 818-846-1800 ..... B•1778-1779
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† Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1822
† Orbit Instrument of Cal., Cypress, CA 90630, 714-527-0561 ..... D•1155
† Otto Controls, Otto Engineering, Carpentersville, IL 60110, 312-428-7171 ..... B•1828-1829
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Wilcoxon Research, Rockville, MD 20850, 301-330-8811 ..... B•2000
† Accudyne Corp., Janesville, WI 53547 608-752-9081
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† Advanced Systems Concepts, Altadena, CA 91001 818-791-0983
Aerospace Optics, Inc., Fort Worth, TX 76112 817-451-1141
† Capitol Switch Inc., Danbury, CT 06810 203-744-3300
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
† Control Products, Inc., E. Hanover, NJ 07936 201-887-9400
Durakool, Inc., American Electronic Components, Elkhart, IN 46514 219-264-1116
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ..... 214-470-2106/2107
† Elmwood Sensors, Pawtucket, RI 02861 401-727-1300
§† J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., New Haven, CT 06509 203-772-2220
† Kilovac Corp., Santa Barbara, CA 93140-4422 805-684-4560
† Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
† Machine Components Corp., Plainview, NY 11803 516-694-7222
§ McGill Manufacturing Co., Inc., Valparaiso, IN 46383 219-465-2200
Microavionics Corp., Costa Mesa, CA 92626 714-957-6904
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
† Saint Switch, Inc., St. Charles, IL 60174 312-377-3779
† Tapeswitch Corp. of America, Farmingdale, NY 11735 516-694-6312
§ T-Bar Incorporated, a Data Switch Co., Shelton, CT 06484 203-926-1801

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CTS Corporation, Switch Div., Paso Robles, Paso Robles, CA 93446, 805-238-0350 ..... B•1713
§† Digitran Division, Xcel Corporation, Pasadena, CA 91107, 818-791-5600 ..... B•1720
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† LSI Jennings, San Jose, CA 95122-2696, 408-292-4025 ..... B•1571
Wilcoxon Research, Rockville, MD 20850, 301-330-8811 ..... B•2000
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† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
Computron Display Systems, Xcel Corporation, Pasadena, CA 91107 ... 818-791-5600
Crosspoint, Div. of Info-Lite, Fairview, NJ 07022 201-941-4455

† Daico Industries, Inc., Compton, CA 90224 213-631-1143
† Dow-Key Microwave Corporation, Ventura, CA 93003 805-650-0260
† Electrospace Systems, Inc., Richardson, TX 75083-1359 ..... 214-470-2106/2107
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
§ K&L Microwave, Inc., Salisbury, MD 21801 301-749-2424
Line Electric Products, Hartford, CT 06141 ..... 203-659-3573;1-800-331-1137
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Machine Components Corp., Plainview, NY 11803 516-694-7222
† MACOM, Inc., Burlington, MA 01803 617-272-3000
† MarLee Switch Co., Upland, CA 91786 714-982-8988
† Norsal Industries, Central Islip, NY 11722 516-234-1200
† Premier Microwave, Port Chester, NY 10573 914-939-8900
§† Risk, George, Inds., Kimball, NE 69145 308-235-4645
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
Standard Grigsby, Inc., Flint Industries, Aurora, IL 60507 312-844-4300
§ Support Systems Intl. Corp., Richmond, CA 94804 415-234-9090
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† Transco Products, Inc., Camarillo, CA 93011-6003 805-987-8007

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Jayco Plastics of California, Inc., Orange, CA 92665, 714-974-1701 ..... B•1868
Mechanical Enterprises, Herndon, VA 22070, 703-435-9496 ..... B•1877
Memtron Technologies, Inc., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 ..... B•1878
Oak Switch Systems, Crystal Lake, IL 60014, 815-459-5000 ..... B•1880

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Sanders Associates, Inc., ECBD, A Lockheed Company, Manchester, NH 03108-8500 603-645-5548
† Sanders/A Lockheed Co. Div. Microwave Technlg. Ctr., Manchester, NH 03108 ..... 603-645-6000 X 5548
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

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† Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 .... D•1159
† Vernitron Controls, Vernitron Corporation, San Diego, CA 92073, 619-428-5581 ..... B•1313
† American Electronics, Fullerton, CA 92631 714-871-3020
† Astro Instrument Corp., Pompano Beach, FL 33064 305-973-8900
Astrosystems, Lake Success, NY 11042 516-328-1600
§† Harowe Servo Controls, Inc.:A Fasco Co., West Chester, PA 19380 215-692-2700
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
† Innovatek Microsystems, Inc., Millerton, NY 12546-9720 914-373-9003
† Natel Engineering Co., Inc., Simi Valley, CA 93063 805-581-3950
† Novatronics Inc., Stratford, Ontario, CANADA N5A 6V6 519-271-3880
† SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300

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Tapes, Magnetic, Digital Cassette-2000 — *See Vol. D*

Tapes, Numerical Control-2000 — *See Vol. D*

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Technical Books-4200 — *See Vol. C*

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Telephone Handsets — See Handsets, etc. (Vol. D)

Telephone Ringing Generators — See Generators, Signal (Vol. D)

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Telephone Systems, Telephones Sound Powered — See Communications Systems, Telephone (Vol. D)

Teleprinters, Auto Send/Receive-1900 — *See Vol. D*

Teleprinters, Keyboard Send/Receive-1900 — *See Vol. D*

Teleprinters, Receive Only-1900 — *See Vol. D*

Teletypewriters & Equipment-1900 — *See Vol. D*

Television Systems & Equipment, Cable (CATV) & Master Antenna (MATV) — See CATV Systems & Equipment (Vol. D)

Television Systems & Equipment Closed Circuit-1900 — *See Vol. D*

Temperature Compensators-5300

Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... B•1899-1900
† Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... B•1907
Quality Thermistor, Boise, ID 83709, 208-377-3373 ..... A•2199
Western Elctrn. Comps. Corp., Camarillo, CA 93010, 805-482-8002 .. B•1922-1925
§† Anritsu Meter Co. of America, Franklin Lakes, NJ 07417 201-848-0033
Betatherm Corp., Shrewsbury, MA 01545 508-842-0516
§ EDL, Inc., Hauppauge, NY 11788 ..... 516-435-2808;1-800-DIAL EDL
§ Jumo Process Control, Inc., Bergenfield, NJ 07621 201-501-0060
§ KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
Midwest Components, Inc., Muskegon, MI 49443 616-777-2602
Precision Resistor Co., Inc., Largo, FL 34647 813-541-5771
Richard-Lee Co., Cranford, NJ 07016 201-276-0710

Temperature Indicators — See Meters, Temperature (Vol. D), Labels, Temperature Indicating (Vol. B)

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Tensile Testers — See Testers, Material (Vol. D)

Terminal Blocks (Incl. Barrier Types)-2100 — *See Vol. C*

Terminal Blocks, DIN Rail Mounting-2100 — *See Vol. C*

Terminal Blocks, Panel Mounting-2100 — *See Vol. C*

Terminal Blocks, PC Board Mounting-2100 — *See Vol. C*

Terminal Boards-2100 — *See Vol. C*

Terminal Boards, Blocks, Strips (MIL)-2440

Beau Products Div., Vernitron Corp., Laconia, NH 03247, 603-524-5101 ..... C•1290,1293
Oxley, Inc., Branford, CT 06405, 203-488-1033 ..... B•1025
WECO Electrical Connectors, Inc., Mooers, NY 12958, 518-298-4810 ..... C•1564-1565
§ WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4, 514-694-9136 ..... C•1564-1565
Andon Elctrns. Corp., Lincoln, RI 02865 401-333-0388

Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
Doran Manufacturing Co., Cincinnati, OH 45225 513-681-5424
Entrelec, Alsthom International, Spring Valley, NY 10977 914-425-7460
FIC Corp., Rockville, MD 20852 ..... 301-881-8124;800-638-6594
† Flight Connector, TransTechnology Electronics, Peoria, IL 61615-1584 .. 309-693-3300
Jan Hardware Mfg. Co., Long Island City, NY 11101 718-361-0800
§ Jolo Industries, Inc., Garden Grove, CA 92643 714-554-6840
§ Reliance Comm/Tec, Reliance Electric, Cleveland, OH 44199 800-245-4501
§† Syracuse Electronics, Pass & Seymour, Inc., Syracuse, NY 13221 315-468-6211

Terminal Equipment, Digital-2000 — *See Vol. D*

Terminal Strips (Incl. Barrier Types)-2100 — *See Vol. C*

Terminals, Communications-2000 — *See Vol. D*

Terminals, Credit Authorization-2000 — *See Vol. D*

Terminals, Crimp-2100 — *See Vol. C*

Terminals, Data Display (Incl. Alphanumeric & Graphic)-2000 — *See Vol. D*

Terminals, Data Entry, Multimedia-2000 — *See Vol. D*

Terminals, Disconnecting-2100 — *See Vol. C*

Terminals, Display-2000 — *See Vol. D*

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Terminals, Intelligent/Programmable, Transaction Processing-2000 — *See Vol. D*

Terminals, LED/Lamp Indicators-2100 — *See Vol. C*

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Terminals, Turret-2100 — *See Vol. C*

Terminals, Wirewrap-2100 — *See Vol. C*

Terminals (MIL), Ground Data-2440

U.S. Terminals, Cincinnati, OH 45243, 513-561-8145 ..... C•1557
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
† Aydin Corp., Horsham, PA 19044 215-657-7510
† Miltope Corp., Melville, NY 11747 516-420-0200
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
† Stanford Telecommunications, Inc., Santa Clara, CA 95054 408-748-1010

Terminations, Antenna-Also See Dummy Loads-2500 — *See Vol. C*

Terminations, Cable-2100 — *See Vol. C*

Terminations, Fiber Optic-2475

† **Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727 ..... B•1214**
§† **MERET, Inc., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1215**
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430, 201-529-8757 ..... B•1219
Augat, Inc., Interconnection Products Group, Attleboro, MA 02703 508-222-2202
Cinch Connector Division, Labinal Components & Systems Inc., Elk Grove Village, IL 60007 312-981-6000
§ Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
Dubbeldee Harris Diamond Corp.:D. Drukker & Zn. N.V., Mt. Arlington, NJ 07856 201-770-1420
Fibronics International Inc., Communications Way, Hyannis, MA 02601-1892 508-778-0700
† Foundation Instruments Inc., Nepean, ON, CANADA K2E 7J6 613-226-4000
† Light Control Systems Inc., Tyngsboro, MA 01879 617-649-9870
† Math Assocs., Westbury, NY 11590 516-334-6800
† Optelecom, Inc., Gaithersburg, MD 20877 301-840-2121
§ Phoenix Contact, Harrisburg, PA 17111 717-944-1300
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
§ Thomas & Betts Corporation, Bridgewater, NJ 08807 201-685-1600
U.S. Instr. Rentals, San Mateo, CA 94403 800-824-2873

Terminations, Microwave-3450 — *See Vol. A*

Terminations, VHF, Video, Pulse-1900 — *See Vol. D*

Termination Systems, Wire-2100 — *See Vol. C*.

Test Assemblies (MIL)-2440

Qualitec Technologies, Inc., Palo Alto, CA 94303-1706, 408-984-1763 ... D•1336
† Cardinal Control Co., Kensington, CT 06037 203-828-6379
Computer Doctors, College Park, MD 20740 ..... 1-800-RAM-STAR;301-474-3095
Grim Corporation, Medford, NJ 08055-0968 609-267-7950
SPS Inc. (Muirhead Vactric), Springfield, NJ 07081 201-376-1222
§ Sunshine Scientific Instruments, Philadelphia, PA 19115 215-673-5600
U.S. Instr. Rentals, San Mateo, CA 94403 800-824-2873

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Test Equipment, Closed Circuit TV-Also See Television Systems & Equipment, Closed-Circuit-2900 — *See Vol. D*

Test Equipment, Color TV-2900 — *See Vol. D*

Test Equipment, Data Communications, Monitors & Recorders-2900 — *See Vol. D*

Test Equipment, Fiber Optic-2475

† **Advantest America, Inc., Lincolnshire, IL 60069, 312-634-2552 ..... D•1215-1217**
Berkeley Nucleonics Corp., Richmond, CA 94804, 415-234-1100 ..... D•1230
Dymec Silicon Transistor Corp., Winchester, MA 01890, 617-729-7870 ..... B•1206-1207
Genstar Rental Electronics, Inc., Woodland Hills, CA 91367, 800-331-3440 (in CA);800-227-8409 ..... D•1277
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1208
Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... B•1217
Advantest Corporation, Tokyo 163, JAPAN 03-342-7500
Ametek Controls Div., Ametek Fiber Optic Products, Feasterville, PA 19047 215-355-6900
† Anritsu, Oakland, NJ 07436 ..... 201-337-1111;800-255-7234
Biddle Instruments, Blue Bell, PA 19422 215-646-9200
Contact East, N. Andover, MA 01845 508-682-2000
DSA, Inc.(Dai-Ichi Shoji of America), Div. of Leader Instruments, New York, NY 10011 212-691-9050
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
§ EXFO E.O. Engineering, Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
§ Feedback, Berkeley Hghts., NJ 07922 201-464-5181
† Force, Inc., Christiansburg, VA 24073 703-382-0462
GTE Fiberoptic Products, Williamsport, PA 17701 ... 717-326-6591;1-800-FBR-OPTICS
§ Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
† INTELCO, Acton, MA 01720 508-264-4485
† Math Assocs., Westbury, NY 11590 516-334-6800
3 M Photodyne Inc., Camarillo, CA 93010 805-388-8378
† Power Technology, Inc., Little Rock, AR 72219 501-568-1995
§ Siecor Electro-Optic Products, Siecor Corporation, Research Triangle Park, NC 27709 ..... 1-800-888-LAN1;919-481-5100
Sumitronics, Inc., Sumitomo Corporation, Sunnyvale, CA 94086 408-737-7683
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
U.S. Instr. Rentals, San Mateo, CA 94403 800-824-2873
Velmex, Inc., East Bloomfield, NY 14443 ..... 716-657-6151;800-642-6446
† York Technology, Inc., Burbank, CA 91502 818-955-8927

Test Equipment, Mechanical Impedance-2900 — *See Vol. D*

Test Equipment, Memory Systems, Disk-2900 — *See Vol. D*

Test Equipment, Motor-2900 — *See Vol. D*

Test Equipment, Rental & Lease - Also See Services, Electrical Measurement & Test-2900 — *See Vol. D*

Test Equipment, RFI Susceptibility-2900 — *See Vol. D*

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Ball Corp., Efratom Division, Irvine, CA 92718-1605, 714-770-5000 ..... A•1349
Blue M, A Unit of General Signal, Blue Island, IL 60406, 312-385-9000 ... D•1206
Cirris Systems, Salt Lake City, UT 84115, 801-466-6600;800-424-7747 ... D•1233
IET Labs, Inc., Westbury, NY 11590, 516-334-5959 ..... D•1286-1293
North Atlantic Industries, Hauppauge, NY 11788, 516-582-6500 ..... D•1328
† **Sunrise Electronics; Inc., Glendora, CA 91740, 818-914-1926 ..... D•1348**
American Electronic Laboratories, Inc., Lansdale, PA 19446 215-822-2929
Astrosystems, Lake Success, NY 11042 516-328-1600

† Atec, Inc., Houston, TX 77055 713-468-7971
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
Cincinnati Sub-Zero Prods., Cincinnati, OH 45241 513-772-8810
† Collins Avionics Divisions, Rockwell Intl., Cedar Rapids, IA 52498 319-395-1000
§† Colorado Data Systems, Inc., Englewood, CO 80110 303-762-1640
Custom Sci. Instrs., Cedar Knolls, NJ 07927 201-538-8500
§ EDL, Inc., Hauppauge, NY 11788 ..... 516-435-2808;1-800-DIAL EDL
† Electro-Optical Industries, Santa Barbara, CA 93130 ..... 805-964-6701 (ext. 280)
Elgar/Intepro Systems, San Diego, CA 92121 ..... 619-458-0261;1-800-854-2213
† Everett/Charles Test Equipment, Inc., Pomona, CA 91767 714-621-9511
† Hafstrom Technical Products, Inc., San Diego, CA 92109 619-274-8822
† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
Julie Research Labs., New York, NY 10001 212-633-6625
† Kay Elemetrics Corp., Pine Brook, NJ 07058-9798 201-227-2000
LTX, Westwood, MA 02090 617-461-1000
† Natel Engineering Co., Inc., Simi Valley, CA 93063 805-581-3950
† NH Research, Incorporated, Instrumentation Products Division, Irvine, CA 92714 714-474-3900
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
† Photo Research:Kollmorgen, Chatsworth, CA 91313-2192 818-341-5151
Plessey Electronic Systems Corp., Wayne, NJ 07470 201-633-6000
† Production Automation, Inc., Santa Clara, CA 95054 408-980-9880
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
Schenck Pegasus Corp., Troy, MI 48083 313-689-9000
† Tektronix, Inc., Beaverton, OR 97077 800-835-9433
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6102
† Trio-Tech International, San Fernando, CA 91340 818-365-9200
Varo Electron Devices:An Imo Inds. Co., Garland, TX 75046 214-487-4129
Veeco Instruments Inc., Plainview, NY 11803 516-349-8300
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
† Zehntel, Inc., Walnut Creek, CA 94598 415-932-6900

Test Fixtures, ATE-2900 — *See Vol. D*

Test Methods (MIL)-2440

Instrument Specialties Co., Delaware Water Gap, PA 18327, 717-424-8510 ..... **D•1298**
Product Technology, Inc., Irvine, CA 92714, 714-474-8998 ..... **C•1719**
Qualitec Technologies, Inc., Palo Alto, CA 94303-1706, 408-984-1763 ... **D•1336**
LTX, Westwood, MA 02090 617-461-1000
RTS Systems, Inc., Burbank, CA 91506 818-566-6700
† Zehntel, Inc., Walnut Creek, CA 94598 415-932-6900

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Test Sets (MIL)-2440

Instrument Specialties Co., Delaware Water Gap, PA 18327, 717-424-8510 ..... **D•1298**
Qualitec Technologies, Inc., Palo Alto, CA 94303-1706, 408-984-1763 ... **D•1336**
† Atec, Inc., Houston, TX 77055 713-468-7971
† Boeing Electronics, Seattle, WA 98124-6269 206-657-7474
† Cabletest Products Co., Melrose, MA 02176 617-665-2932
CDS - Colorado Data Sys., Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
† Comtech Microwave Corp., Comtech Corp., Hauppauge, NY 11788 516-435-4646
† Electro-Optical Industries, Santa Barbara, CA 93130 ..... 805-964-6701 (ext. 280)
† ETM Electromatic Inc, Newark, CA 94560 415-797-1100
† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
† Natel Engineering Co., Inc., Simi Valley, CA 93063 805-581-3950
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
† Production Automation, Inc., Santa Clara, CA 95054 408-980-9880
† Sunrise Electronics, Inc., Glendora, CA 91740 818-914-1926
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
Varo Electron Devices:An Imo Inds. Co., Garland, TX 75046 214-487-4129
Wavetek San Diego, Inc., San Diego, CA 92123 619-279-2200

Test Systems, Automatic DC-2900 — *See Vol. D*

Test Systems, Board-2900 — *See Vol. D*

Test Systems, Component-2900 — *See Vol. D*

Test Systems, Computer Controlled (Automatic)-2900 — *See Vol. D*

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Testers, Capacitor-2900 — *See Vol. D*

Testers, Circuit — See Testers, Signal Tracing (Vol. D)

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Testers, Corona-2900 — *See Vol. D*

Testers, CRT-2900 — *See Vol. D*

Testers, Diode-2900 — *See Vol. D*

Testers, Electron Beam-2900 — *See Vol. D*

Testers, Electrical Parameter-2900 — *See Vol. D*

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Testers, Encoder-2900 — *See Vol. D*

Testers, Fiber Optic-2900 — *See Vol. D*

Testers, Ground Resistance — See Meters, Ohm (Vol. D)

Testers, Heat, Manual-2550 — *See Vol. D*

Testers, Hipot — See Testers, Insulation Breakdown (Vol. D)

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Testers, Insulation Resistance-2900 — *See Vol. D*

Testers, Integrated Circuit (Automatic)-2900 — *See Vol. D*

Testers, Integrated Circuit (Manual)-2900 — *See Vol. D*

Testers, Interface-2900 — *See Vol. D*

Testers, LED & LED Arrays-2900 — *See Vol. D*

Testers, Life, Component-2550 — *See Vol. D*

Testers, Logic Card-2900 — *See Vol. D*

Testers, Loopback-2900 — *See Vol. D*

Testers, Magnetic Core-2900 — *See Vol. D*

Testers, Magnetic Head Media-2900 — *See Vol. D*

Testers, Magnetic Medium-2900 — *See Vol. D*

Testers, Magnetron-2900 — *See Vol. D*

Testers, Material-2550 — *See Vol. D*

Testers, Memory Board-2900 — *See Vol. D*

Testers, Meter-2900 — *See Vol. D*

Testers, Microwave-2900 — *See Vol. D*

Testers, Modem-2900 — *See Vol. D*

Testers, Motor-2900 — *See Vol. D*

Testers, Multibus-2025 — *See Vol. D*

Testers, PIND-2900 — *See Vol. D*

Testers, Potentiometer-2900 — *See Vol. D*

Testers, Power Supply-2900 — *See Vol. D*

Testers, Pulse Jitter-2900 — *See Vol. D*

Testers, Relay-2900 — *See Vol. D*

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Testers, Shock-2550 — *See Vol. D*

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Testers, Solderability-4100 — *See Vol. D*

Testers, Synchro/Resolver-2900 — *See Vol. D*

Testers, Thickness (all types)-2900 — *See Vol. D*

Testers, Thyristor-2900 — *See Vol. D*

Testers, Tracking & Erosion Resistance (Insulation)-2900 — *See Vol. D*

Testers, Transistor-2900 — *See Vol. D*

Testers, Transmission & Delay-2900 — *See Vol. D*

Testers, Tube-2900 — *See Vol. D*

Testers, Vibration-Also See Services, Environmental Test-2900 — *See Vol. D*

Testers, Voltage-2900 — *See Vol. D*

Testers, Voltage Breakdown-2900 — *See Vol. D*

Testers, (MIL)-2440

Qualitec Technologies, Inc., Palo Alto, CA 94303-1706, 408-984-1763 ... D•1336
† Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
† Production Automation, Inc., Santa Clara, CA 95054 408-980-9880
† Trio-Tech International, San Fernando, CA 91340 818-365-9200

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Thermal Converters — See Converters, Thermal (Vol. B)

Thermal Imagers — See Imagers, Thermal (Vol. D)

Thermal Platforms-2900 — *See Vol. D*

Thermistors-5300

Betatherm Corp., Shrewsbury, MA 01545, 508-842-0516 ..... B•1889
Cambridge Aerofio, Inc., Shirley, MA 01464, 508-45-2346 ..... C•1641
§ Dale Electronics, Inc., El Paso Div., El Paso, TX 79926-6728, 915-592-3253 ..... B•1890-1893
Elmwood Sensors, Pawtucket, RI 02861, 401-727-1300 ..... B•1895
§† Fenwal Electronics/APD, Kidde, Inc., Milford, MA 01757, 508-478-6000 .. B•1896
§† Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... B•1898-1900
§ Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ..... B•1901-1903
Mepco/Centralab, North American Philips Corporation, Mineral Wells, TX 76067, 817-325-7871 ..... A•1981
§ Midwest Components, Inc., Muskegon, MI 49443, 616-777-2602 .... B•1910-1911
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1999
NES, Inc. (Nationwide Electronic Systems), Carpentersville, IL 60110, 312-426-5900 ..... D•1407
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... C•1907
† Quality Thermistor, Boise, ID 83709, 208-377-3373 ..... A•2198-2199, B•1915
Western Elctrn. Comps. Corp., Camarillo, CA 93010, 805-482-8002 .. B•1922-1925
Advanced Thermal Products, Inc., St. Marys, PA 15857 814-772-0278
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300; 800-999-3711
Alpha Thermistor, Inc., San Diego, CA 92121 619-549-4660
Altech Corp., Somerville, NJ 08876 201-359-4454
§ Atkins Technical Inc., Gainesville, FL 32608 904-378-5555
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 514-739-3274
† The Carborundum Company, Electronic Ceramics, Niagara Falls, NY 14302 716-278-2000
§ Colber Corp., Irvington, NJ 07111 201-371-9500
§ Dale Electronics, Techno Division, Van Nuys, CA 91405-1139 818-781-1642
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
Digitec, Marion, OH 43302 614-387-3444
§ Dowty Electronics Co., Thermocontrol Div., Brandon, VT 05733 802-247-6811
§ EDL, Inc., Hauppauge, NY 11788 ..... 516-435-2808;1-800-DIAL EDL
Electronic Component Assembly, Inc., San Diego, CA 92121 619-549-0808
† EMCA/ROHM & HAAS, Montgomeryville, PA 18936 215-855-1000
Extech Instruments Corp., Waltham, MA 02154 617-890-7440
§ FENWAL INC., Ashland, MA 01721 508-881-2000
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§† Gordon Co.:Watlow, Richmond, IL 60071 815-678-2211
Hughes Aircraft Co., Microelctrns. Sys. Div., Irvine, CA 92715 714-752-3800
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
Interelectronics Corp., Congers, NY 10920 ..... 914-EL8-8000
International Mircoelectronics, Arlington, TX 76003 817-561-2244
International Resistive Company, Boone, NC 28607 704-264-8861
§ Law, R. E. Instrument, Inc., Palos Hills, IL 60465 312-974-4000
§ Love Controls Corp., Wheeling, IL 60090 312-541-3232
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, Riviera Beach, FL 33404 407-881-3200
Micro Devices Product Group, Therm-O-Disc, Inc., Mansfield, OH 44907 419-525-8500
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., West Lafayette, IN 47906 317-463-2536
Philips Electronics Ltd, Philips Comps., Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
† Piezo Electric Products, Inc., Metuchen, NJ 08840 201-548-2800
Raychem Corp., Elctrns. Grp., Menlo Park, CA 94025 415-361-3860
§ RFL Inds., Inc., (DBA) Dowty Elctrns. Co., Brandon, VT 05733 802-247-6811
§ Science/Electronics, Dayton, OH 45401-0986 513-859-5555
† Sensor Scientific, Inc., Fairfield, NJ 07006 ..... 201-227-7790;800-524-1610
§† Sfernice, Inc., Grand Junction, CO 81502 303-242-0810
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Sunshine Scientific Instruments, Philadelphia, PA 19115 215-673-5600
Sylvania GTE Control Devices, Standish, ME 04084 207-642-4535
§ TDK Corporation, Electronic Components & Material, Tokyo, JAPAN 103 ..... (03) 278-5111
Techno, Inc., Van Nuys, CA 91405 818-781-1642
§ Tegam, Inc., Madison, OH 44057 216-428-7505
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907 419-525-8500
† Thermometrics, Inc., Edison, NJ 08817-4695 201-287-2870
§ United Electric Controls, Watertown, MA 02172 617-926-1000
§† Unitrode Corp., Watertown, MA 02172 617-926-0404
§† Victory Engineering Corp., Springfield, NJ 07081 201-379-5900
§† Weed Instrument Co., Inc., Round Rock, TX 78664-0300 512-255-7043
§† Yellow Springs Instrument Co., Yellow Springs, OH 45387 513-767-7241

Thermistors, Surface Mount-5300

Betatherm Corp., Shrewsbury, MA 01545, 508-842-0516 ..... B•1889
§ Dale Electronics, Inc., El Paso Div., El Paso, TX 79926-6728, 915-592-3253 ..... B•1890-1893
Fenwal Electronics/APD, Kidde, Inc., Milford, MA 01757, 508-478-6000 .. B•1896
§ Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... B•1900
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 .. B•1902
Midwest Components, Inc., Muskegon, MI 49443, 616-777-2602 ..... B•1908-1909,1911
Quality Thermistor, Boise, ID 83709, 208-377-3373 ..... A•2198-2199
† Sensor Scientific, Inc., Fairfield, NJ 07006, 201-227-7790;800-524-1610 ..... B•1918-1919
Western Elctrn. Comps. Corp., Camarillo, CA 93010, 805-482-8002 .. B•1922-1925
Alpha Thermistor, Inc., San Diego, CA 92121 619-549-4660
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 514-739-3274
§ Dale Electronics, Techno Division, Van Nuys, CA 91405-1139 818-781-1642
Electronic Component Assembly, Inc., San Diego, CA 92121 619-549-0808
§ FENWAL INC., Ashland, MA 01721 508-881-2000
Instrulab, Dayton, OH 45404 513-223-2241
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Sfernice, Inc., Grand Junction, CO 81502 303-242-0810
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
† Thermometrics, Inc., Edison, NJ 08817-4695 201-287-2870

Thermocouple Devices & Materials — See Cooling/Heating Modules, Thermoelectric (Vol. B)

Thermocouple Interfaces for Personal Computers-2000 — *See Vol. D*

Thermocouples, Elements & Accessories-5300

Best Technology Inc., Seattle, WA 98109, 206-382-1300 ..... B•1888
Calex Mfg. Co., Inc., Pleasant Hill, CA 94523, 415-932-3911 ..... D•1008
Melcor/Materials Elctrn. Prods., Trenton, NJ 08648, 609-393-4178 .. B•1904-1905
NES, Inc. (Nationwide Electronic Systems), Carpentersville, IL 60110, 312-426-5900 ..... D•1407
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... C•1907, D•1015
PPM, Inc., Cleveland, OH 44139, 216-349-2300 ..... D•1334
Quality Thermistor, Boise, ID 83709, 208-377-3373 ..... B•1914
Acme Elec. Heating Corp., Hialeah, FL 33013 305-685-8326
† Alberox Corporation, New Bedford, MA 02745 508-995-1725
Alpha-M Corp., Dallas, TX 75229 214-406-0424
§ Alpha Wire Corp., Elizabeth, NJ 07207-0711 201-925-8000
§ Anritsu Meter Co. of America, Franklin Lakes, NJ 07417 201-848-0033
§ Athena Controls, Inc., Plymouth Meeting, PA 19462 215-828-2490
§ Atkins Technical Inc., Gainesville, FL 32608 904-378-5555
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
§† Bailey Controls Co., Div. of Babcox & Wilcox, Wickliffe, OH 44092 216-585-8500
Ballantine Laboratories, Inc., Sub. of E.S.I. Inc., Boonton, NJ 07005 201-335-0900
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
§ Bartlett Instrument Co., Ft. Madison, IA 52627 319-372-8366
§ Beckman Industrial Corp., Emerson Electric Co., San Diego, CA 92123 .. 619-495-3200
Burling Instruments, Chatham, NJ 07928 201-635-9481
Ceramaseal, New Lebanon, NY 12125 518-794-7800
C.G. Instruments, Dayton, OH 45459 513-434-7643
§ Colber Corp., Irvington, NJ 07111 201-371-9500
† DELTA M Corporation, Oak Ridge, TN 37830 615-483-1569
§ Digitec, Marion, OH 43302 614-387-3444
§ Dowty Electronics Co., Thermocontrol Div., Brandon, VT 05733 802-247-6811
§ EDL, Inc., Hauppauge, NY 11788 ..... 516-435-2808;1-800-DIAL EDL
Electro Physics Co., Inc., Waukegan, IL 60085 312-249-5801
Elmwood Sensors, Pawtucket, RI 02861 401-727-1300
† Engine Systems Division, Simmonds Precision, Norwich, NY 13815 607-335-5000
§ E-Squared Technology Corp., Ventura, CA 93003 805-644-9544
§ FENWAL INC., Ashland, MA 01721 508-881-2000
† FTS Systems, Inc., Stone Ridge, NY 12484 914-687-0071
General Resistance, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
† GIC Thermodynamics, Royal Oak, MI 48073 313-280-1648
§† Gordon Co.:Watlow, Richmond, IL 60071 815-678-2211
Hades Manufacturing Corp., Farmingdale, NY 11735 516-249-4244

§† Heraeus Inc., Temp. Measurement Group, S. Plainfield, NJ 07080 201-755-4800
Highland Technology, Inc., San Francisco, CA 94122 415-753-5814
Hy-Cal Engineering, El Monte, CA 91731 818-444-4000
Julie Research Labs., New York, NY 10001 212-633-6625
§ Jumo Process Control, Inc., Bergenfield, NJ 07621 201-501-0060
† Lake Shore Cryotronics, Inc., Westerville, OH 43081 614-891-2243
§ Law, R. E. Instrument, Inc., Palos Hills, IL 60465 312-974-4000
Leeds & Northrup, General Signal, North Wales, PA 19454 215-699-2000
§ Love Controls Corp., Wheeling, IL 60090 312-541-3232
Minco Products, Minneapolis, MN 55432 612-571-3121
§ Modutec, Manchester, NH 03103 603-669-5121
† Narda Microwave Corp., Subsidiary of Loral Corp., Hauppauge, NY 11788 516-231-1700
§ Pyrocom Co., Seattle, WA 98133 206-365-3535
§† Revere Corporation of America, Wallingford, CT 06492 203-269-7701
§ RFL Inds., Inc., (DBA) Dowty Elctrns. Co., Brandon, VT 05733 802-247-6811
Richards, Arklay S., Co., Inc., Newton Highlands, MA 02161-1793 617-527-4385
§ Science/Electronics, Dayton, OH 45401-0986 513-859-5555
§ S. F. Products Corporation, Southport, CT 06490 203-929-6180
Solder Absorbing Technology (SAT), A Spirig Co., Springfield, MA 01108 800-628-8862
§ Sunshine Scientific Instruments, Philadelphia, PA 19115 215-673-5600
† Syscon Intl, Inc., So. Bend, IN 46618-1096 219-232-3900
Teledyne Semiconductor, Mountain View, CA 94039-7267 415-968-9241
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6102
§ Temptronic Corporation, Newton, MA 02158 617-969-2501
† Thermo Electric, Saddle Brook, NJ 07662 201-843-5800
† Thermometrics, Inc., Edison, NJ 08817-4695 201-287-2870
§ United Electric Controls, Watertown, MA 02172 617-926-1000
Veeco Instruments Inc., Plainview, NY 11803 516-349-8300
§† Weed Instrument Co., Inc., Round Rock, TX 78664-0300 512-255-7043
§ WestCon, Marion, OH 43302 614-382-5771
§ West Instrument, A Mark IV Company, Schiller Park, IL 60176 312-678-6400
§ Yellow Springs Instrument Co., Yellow Springs, OH 45387 513-767-7241

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Thermometers, Electronic (All Types) — See Meters, Temperature (Vol. D)

Thermometers, Microscopic, Infrared-2900 — *See Vol. D*

Thermometers, Resistance-2900 — *See Vol. D*

Thermostats-Also See Switches, Thermally Actuated; Controls, Temperature-5300

† Airpax Co., Frederick Div., Frederick, MD 21701, 301-663-5141 ..... B•1887
† Elmwood Sensors, Pawtucket, RI 02861, 401-727-1300 ..... B•1894
Fenwal Electronics/APD, Kidde, Inc., Milford, MA 01757, 508-478-6000 .. B•1896
Micro Devices Product Group, Therm-O-Disc, Inc., Mansfield, OH 44907, 419-525-8500 ..... B•1402
§ Selco Products Co., SEL Sales, Inc., Buena Park, CA 90621, 714-521-8673 ..... B•1917
Advanced Thermal Products, Inc., St. Marys, PA 15857 814-772-0278
§† Amperite Co., Inc., Union City, NJ 07087 201-864-9503
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
§ Barksdale Controls Div., Imo Delaval Inc., Los Angeles, CA 90058 213-589-6181
§† Bud Industries, Inc., Willoughby, OH 44094-0431 216-946-3200
Burling Instruments, Chatham, NJ 07928 201-635-9481
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 514-739-3274
† Chatham Controls, Chatham, NJ 07928 201-635-8892
Dreefs Switch, Inc., Waukegan, IL 60087 ..... 312-662-7667;800-323-9605
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., Milwaukee, WI 53216 414-449-7487
§ E-Squared Technology Corp., Ventura, CA 93003 805-644-9544
§ FENWAL INC., Ashland, MA 01721 508-881-2000
§ Grasslin Controls Corp.:Grasslin Gmbh & Co., K.G., Ramsey, NJ 07446 201-825-9696
† Honeywell Inc., Commercial Bldgs. Grp., MN 27-4231, Minneapolis, MN 55408 612-870-2294
§ Jumo Process Control, Inc., Bergenfield, NJ 07621 201-501-0060
§ Love Controls Corp., Wheeling, IL 60090 312-541-3232
§ Midwest Components, Inc., Muskegon, MI 49443 616-777-2602
Phase Control Electronics, Glendale, NY 11385 718-441-4278
Princo Instruments, Inc., Southampton, PA 18966
† PSG Inds., Perkasie, PA 18944 215-257-3621
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ Texas Instrs., Inc., Dallas, TX 75380 ..... 800-232-3200 (ext 700)
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907 419-525-8500
Triac Electronic Systems, Inc., Glendale, NY 11385 718-441-4759
§ United Electric Controls, Watertown, MA 02172 617-926-1000
§ Vermont Automation Co., Inc., Essex Junction, VT 05452 802-879-7571
Warren G-V, Unit of Signal Co., Whippany, NJ 07981 201-386-1200

Thermowells-5300

§ DELTA M Corporation, Oak Ridge, TN 37830 615-483-1569
§ GIC Thermodynamics, Royal Oak, MI 48073 313-280-1648
§† Gordon Co.:Watlow, Richmond, IL 60071 815-678-2211
Hy-Cal Engineering, El Monte, CA 91731 818-444-4000
Minco Products, Minneapolis, MN 55432 612-571-3121
Omega Engineering, Stamford, CT 06907 800-826-6342
Princo Instruments, Inc., Southampton, PA 18966
§ Pyrocom Co., Seattle, WA 98133 206-365-3535
† Thermo Electric, Saddle Brook, NJ 07662 201-843-5800

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Thyristors and SCRs, Surface Mount-4800 — *See Vol. A*

Thyristors (Incl. Silicon Controlled Rectifiers) - Also see DIACs; TRIACs, SIDACs-4800 — *See Vol. A*

Thyristors (MIL)-2440

§† Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
† NWL Transformers, Bordentown, NJ 08505 609-298-7300

Ties, Wire & Cable — See Wire & Cable Ties (Vol. C)

Time Delays, Precision-2900 — *See Vol. D*

Time Dispenser, Microprocessor based-2200 — *See Vol. D*

Time Management Systems-2200 — *See Vol. D*

Timers, Counting-2200 — *See Vol. D*

Timers, Cycle & Reset-2200 — *See Vol. D*

Timers, Delay-2200 — *See Vol. D*

Timers, Electrolytic Cell-2200 — *See Vol. D*

Timers, Interval-2200 — *See Vol. D*

Timers, Programmed-2200 — *See Vol. D*

Timers, Sequence-2200 — *See Vol. D*

Timers, Solid State-2200 — *See Vol. D*

Tool Kits & Sets-5400 — *See Vol. C*

Tools & Kits, Contact Insertion/Removal-5400 — *See Vol. C*

Tools, Alignment & Tuning-5400 — *See Vol. C*

Tools, Cable Tie-5400 — *See Vol. C*

Tools, Connector-5400 — *See Vol. C*

Tools, Crimping & Swaging-5400 — *See Vol. C*

Tools, Heat Sealing-5400 — *See Vol. C*

Tools, Lead Bending & Insertion-5400 — *See Vol. C*

Tools, Magnetic Pickup-5400 — *See Vol. C*

Tools, Marking, Numbering, Engraving-5400 — *See Vol. C*

Tools, Parts Handling, Vacuum Operated-5400 — *See Vol. C*

Tools, Relay Servicing-5400 — *See Vol. C*

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Totalizers, Digital-2200 — *See Vol. D*

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Touch Panels-2000 — *See Vol. D*

Touch Terminals-2000 — *See Vol. D*

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Trackballs, XY Positioning-2200 — *See Vol. D*

Tracking Systems (MIL)-2440

Orbit Instrument of Cal., Cypress, CA 90630, 714-527-0561 ..... D•1155
† Accusonic Division, Ferranti O.R.E. Inc., Falmouth, MA 02541 617-548-5800
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† Anaren Microwave, E. Syracuse, NY 13057 315-432-8909
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
† Datron Systems, Inc., Simi Valley, CA 93065-1650 805-584-1717
† DBA Systems, Inc., Melbourne, FL 32902-0550 305-727-0660
† Electrac, Inc., Anaheim, CA 92801 714-879-6021

† Electro-Magentic Processes, Inc.:Member of ISC Defense & Space, Chatsworth, CA 91311-4858 818-882-6333
† Electronic Systems Div., Servo Corp. of America, Hicksville, NY 11802 .. 516-938-9700
Electrospace Systems, Inc., Richardson, TX 75083-1359 ..... 214-470-2106/2107
† E-Systems, Greenville Div., Greenville, TX 75401 214-455-3450
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
† MFG, Parabam Div., Carson, CA 90745 213-549-5044
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311 818-885-8223
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
Resdel Engrg. Corp, Resdel Inds., Arcadia, CA 91006 213-684-2600
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300

Training Systems (MIL)-2440

† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
† Data-Design Labs., Cucamonga, CA 91730 714-987-2511
† E M S Development Corp., Farmingdale, NY 11735 516-293-7900
† E-Systems, Greenville Div., Greenville, TX 75401 214-455-3450
† Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
† Matrox Electronic Systems, Ltd., Dorval, QU, CANADA H9P 2T4 514-685-2630
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
† Simulaser Corp., City of Industry, CA 91746 818-369-1355

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Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1208-1211
† Aydin Corp., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
† ILC Data Device Corp., Bohemia, NY 11716 516-567-5600

Transducer Elements-5500

Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1988
§ Atomergic Chemetals Corp., Farmingdale, NY 11735-1527 516-694-9000
† Channel Industries, Santa Barbara, CA 93111 805-967-0171
Entran Devices, Fairfield, NJ 07006 ..... 201-227-1002;800-635-0650
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000
§ HBM, Inc., Marlboro, MA 01752 508-624-4500
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
† Novotechnik U.S., Inc., Marlborough, MA 01752 617-485-2244
† Piezo Electric Products, Inc., Metuchen, NJ 08840 201-548-2800
† Piezo Kinetics Inc., Bellefonte, PA 16823 814-355-1593
§ Rye Industries, Inc., Mamaroneck, NY 10543 914-698-0080
† Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000
Spectrol Electronics, City of Industry, CA 91745 818-964-6565
U.S. Instr. Rentals, San Mateo, CA 94403 800-824-2873
Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778 508-358-2777

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Transducers, Audio-5500

Bell, Floyd, Inc., Columbus, OH 43212, 614-294-4000 ..... D•1026
† Blatek, Inc., Bellefonte, PA 16823, 814-355-4910 ..... B•1936
§ Golden Pacific Electronics, Inc, Placentia, CA 92670, 714-993-6970 ..... D•1027
§ International Components Corp., Melville, NY 11747, 516-293-1500 ..... D•1030
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-9440 ..... D•1033
§ Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., Indianapolis, IN 46241, 317-856-3731 ..... D•1038-1041
§ MG Electronics, Hauppauge, NY 11788, 516-582-3400 ..... D•1043
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... B•1967
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., Springfield, NJ 07081, 201-376-6070 ..... A•1711
† Shogyo International Corp., Great Neck, NY 11021, 516-466-0911 ..... D•1054
Sonicall, Inc., Trumbull, CT 06611, 203-452-9555 ..... D•1057
§ Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 201-572-9512 ..... D•1058-1062
TDK Corporation, Electronic Components & Material, Tokyo, JAPAN 103, (03) 278-5111 ..... D•1064
§ AKG Acoustics, Inc., Stamford, CT 06902 203-348-2121
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
† Piezo Electric Products, Inc., Metuchen, NJ 08840 201-548-2800
§† Projects Unlimited, Dayton, OH 45414 513-890-1918
Radio Materials Corp., Attica, IN 47918 ..... 317-762-2491;1-800-356-9956
§ Rye Industries, Inc., Mamaroneck, NY 10543 914-698-0080
§ Shure Brothers Inc., Evanston, IL 60202-3696 312-866-2200
Stanton Magnetics, Inc., Plainview, NY 11803 516-349-0235
Tauber Elctrns. Inc., San Diego, CA 92117 619-274-7242
U.S. Instr. Rentals, San Mateo, CA 94403 800-824-2873
§ Wheelock, Inc., Long Branch, NJ 07740 201-222-6880

Transducers, Ceramic-5500

Blatek, Inc., Bellefonte, PA 16823, 814-355-4910 ..... B•1936
LZR Electronics, Inc., Gaithersburg, MD 20879, 301-921-9440 ..... D•1033
§ MG Electronics, Hauppauge, NY 11788, 516-582-3400 ..... D•1043
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., Springfield, NJ 07081, 201-376-6070 ..... A•1711
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
† Channel Industries, Santa Barbara, CA 93111 805-967-0171
† International Transducer Corp., Channel Technologies, Inc., Santa Barbara, CA 93111 805-683-2575
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
Motorola Inc., Auto. & Indl. Elctrns. Grp., Schaumburg, IL 60196 312-576-4850
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Piezo Electric Products, Inc., Metuchen, NJ 08840 201-548-2800
† Piezo Kinetics Inc., Bellefonte, PA 16823 814-355-1593
§ Stetco, Inc., Franklin Pk, IL 60131 312-671-4208

Transducers, Displacement-5500

† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... B•1224
Blatek, Inc., Bellefonte, PA 16823, 814-355-4910 ..... B•1936
HBM, Inc., Marlboro, MA 01752, 508-624-4500 ..... B•1958-1959
† Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 ..... A•2121-2123
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1804-1806
Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1831
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... A•2147
† AEMC Corporation, Boston, MA 02111 ..... 617-451-0227;800-343-1391
Astrosystems, Lake Success, NY 11042 516-328-1600
§ Automatic Timing & Controls Co., King of Prussia, PA 19406 ..... 215-337-5500; 800-441-8245
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
Burleigh Instruments, Fishers, NY 14453 716-924-9355
† Celesco Transducer Prods., Inc., Canoga Pk, CA 91304-5005 818-884-6860
§ Ceramic Magnetics, Inc., Fairfield, NJ 07006 201-227-4222
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018 215-622-1000
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
Computer Instruments Div., Hempstead, NY 11550 516-483-8200
Contaq Technologies Corp., Bristol, VT 05443 802-453-3332
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
Disc Instruments, Honeywell, Costa Mesa, CA 92626 714-433-0343
† Farrand Controls, Div. of Farrand Industries, Inc., Valhalla, NY 10595 914-761-2600
Genisco Technology Corp., Transducers Products Div., Simi Valley, CA 93065 805-581-3985
Giddings & Lewis Electronics, A Unit of AMCA International, Fond du Lac, WI 54935 414-921-7100
Gould Inc., Recording Systems Division, Cleveland, OH 44114 216-361-3315
† Gulton Industries, Inc., Servonic Div., Costa Mesa, CA 92627 ..... 714-642-2400; 800-854-4066
§ Gunther, W., GmbH, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
§† Kavlico Corp., Moorpark, CA 93021 805-523-2000
LEL Co., Cresskill, NJ 07626 201-569-8641
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
Magnetoelastic Devices, Pittsfield, MA 01202 413-445-5608
3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
MTS Systems, Minneapolis, MN 55424 612-937-4000
Northern Precision Labs., Fairfield, NJ 07006 201-227-4800
† Novotechnik U.S., Inc., Marlborough, MA 01752 617-485-2244
Omutec, Odetics, Inc., Anaheim, CA 92802 714-758-0200
Piezo Electric Products, Inc., Metuchen, NJ 08840 201-548-2800
§† Robinson-Halpern Products, Transicoil, Inc., Plymouth Meeting, PA 19462-0248 215-825-9200
† Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000
Sensotec, Inc., Columbus, OH 43212 614-486-7723
§ Spectral Dynamics Division, Scientific-Atlanta, Inc., San Diego, CA 92123-0575 619-496-3400
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200
Stoelting Co., Chicago, IL 60623 312-522-4500
Teledyne/Geotech, Garland, TX 75041 214-271-2561
† Teledyne Gurley, Troy, NY 12181 518-272-6300
§ Temposonics, MTS Sys. Corp., Plainview, NY 11803 516-349-1950
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
Transducer Systems, Inc., Kulpsville, PA 19443 215-256-4611
Trans-Tek, Ellington, CT 06029 203-872-8351
TRW Technar, Inc., TRW, Inc., Irwindale, CA 91706 818-334-0250
Unimeasure, Inc., Corvallis, OR 97330 503-757-3158
§ Veeder-Root, Hartford, CT 06102 203-527-7201
Vibrac, Amherst, NH 03031 603-882-6777
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778 508-358-2777

Transducers, Flow-5500

Blatek, Inc., Bellefonte, PA 16823, 814-355-4910 ..... B•1936
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1989
§† Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1831
Accusonic Division, Ferranti O.R.E. Inc., Falmouth, MA 02541 617-548-5800
§† Bailey Controls Co., Div. of Babcox & Wilcox, Wickliffe, OH 44092 216-585-8500
† Bristol Babcock Inc., Watertown, CT 06795 ..... 203-575-3000;800-243-3576
Cambridge Aeroflo, Inc., Shirley, MA 01464 508-45-2346
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
Computer Instruments Div., Hempstead, NY 11550 516-483-8200
Controls Division, Ametek, Inc., Feasterville, PA 19047 215-355-6900
† EG & G Flow Technology, Inc., Phoenix, AZ 85072 602-437-1315
§† Fenwal Electronics/APD, Kidde, Inc., Milford, MA 01757 508-478-6000
§ IC Sensors, Inc., Milpitas, CA 95035 408-432-1800
† Kurz Instruments Inc., Monterey, CA 93940 800-424-7356
Micronel U.S., Vista, CA 92083 619-727-7400
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600

Midwest Components, Inc., Muskegon, MI 49443 616-777-2602
§† MKS Instruments, Inc., Andover, MA 01810 508-975-2350
Motion Sensors, Inc., Cranford, NJ 07701 201-925-3553
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
Motorola Inc., Auto. & Indl. Elctrns. Grp., Schaumburg, IL 60196 312-576-4850
Panametrics, Waltham, MA 02254 617-899-2740
Robinson-Halpern Products, Transicoil, Inc., Plymouth Meeting, PA 19462-0248 215-825-9200
Sensym, Inc., Sunnyvale, CA 94089 408-744-1500
Validyne Engineering Corporation, Northridge, CA 91324 818-886-2057
Yokogawa Corp. of America, Newnan, GA 30265 404-253-7000

Transducers, Force-5500

HBM, Inc., Marlboro, MA 01752, 508-624-4500 ..... B•1958
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1988
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... B•1996
† A. L. Design, Inc., Amherst, NY 14226 716-833-6272
BLH Electronics, Inc., Canton, MA 02021-9111 617-821-2000
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
Cambridge Technology, Inc., Watertown, MA 02172 617-923-1181
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
§ Data Instruments, Inc., Acton, MA 01720 508-264-9550
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
§ Dillon, W. C., Weigh-Tronix, Inc., Fairmont, MN 56031 507-238-4461
† Entran Devices, Fairfield, NJ 07006 ..... 201-227-1002;800-635-0650
† Genisco Technology Corp., Transducers Products Div., Simi Valley, CA 93065 805-581-3985
§ GSE, Core Inds., Farmington Hills, MI 48024 313-476-7875
§ Helm Instrument Co., Inc., Maumee, OH 43537 419-893-4356
§ IC Sensors, Inc., Milpitas, CA 95035 408-432-1800
§† Interface, Inc., Scottsdale, AZ 85260 602-948-5555
§ Kavlico Corp., Moorpark, CA 93021 805-523-2000
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
Lebow Products, Eaton Corp., Troy, MI 48084 313-643-0220
Magnetoelastic Devices, Pittsfield, MA 01202 413-445-5608
† PCB Piezotronics, Depew, NY 14043-2495 716-684-0001
§† Revere Corporation of America, Wallingford, CT 06492 203-269-7701
† Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000
Sensotec, Inc., Columbus, OH 43212 614-486-7723
Stoelting Co., Chicago, IL 60623 312-522-4500
Unimeasure, Inc., Corvallis, OR 97330 503-757-3158
Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100
Vibrac, Amherst, NH 03031 603-882-6777
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322
Wilcoxon Research, Rockville, MD 20850 301-330-8811

Transducers, Frequency – See Transducers, Volt, Watt, Current, etc. (Vol. B)

Transducers, Humidity-5500

† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
§† Hy-Cal Engineering, El Monte, CA 91731 818-444-4000
§ Jumo Process Control, Inc., Bergenfield, NJ 07621 201-501-0060
§ Marcon America Corp., Vernon Hills, IL 60061 312-913-9980
† Thunder Scientific Corp., Albuquerque, NM 87123 ..... 505-265-8701;800-872-7728

Transducers, Incremental Digital Position, Rotary – See Encoders, Shaft Angle (Vol. B)

Transducers, Liquid Level-5500

Blatek, Inc., Bellefonte, PA 16823, 814-355-4910 ..... B•1936
Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116 ..... B•1724
American Magnetics, Oak Ridge, TN 37831-2509 615-482-1056
Contaq Technologies Corp., Bristol, VT 05443 802-453-3332
MTS Systems, Minneapolis, MN 55424 612-937-4000
Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000

Transducers, Magnetic Pickup-5500

† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... B•1224
Airpax Co., Cheshire Div., Cheshire, CT 06410, 203-271-6000 ..... B•1931
Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 ..... D•1229
Hamlin, Lake Mills, WI 53551, 414-648-2361 ..... B•1751,1957
† International Electro Magnetics, Inc., Palatine, IL 60067, 312-358-4622 ... D•1032
† Magnetic Shield Corporation, Perfection Mica Co., Bensenville, IL 60106, 312-766-7800 ..... C•1743
§† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1966
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1804-1806
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561 .... B•1983, D•1330
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... B•1845
Airpax Co., Sensor Div., A Division of North American Philips Corp., Cheshire, CT 06410 203-272-0301
§ AKG Acoustics, Inc., Stamford, CT 06902 203-348-2121
§ ALTEK Corporation, Silver Springs, MD 20904-7802 301-572-2555
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
Crompton Instruments, Inc., Glendale Heights, IL 60139 312-351-9888
§ C-Tek Inc., Wakefield, MA 01880 617-246-1720
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
Dixson, Inc., Grand Junction, CO 81503 ..... 303-242-8863 (ext 223)
§ Dynapar, Gurnee, IL 60031 312-662-2666
§† Electro Corporation, Sub. of Fasco Industries Inc., Sarasota, FL 34230-3049 813-355-8411
General Vibrations Mfg. Co., Manchester, CT 06040 203-646-0090
Giddings & Lewis Electronics, A Unit of AMCA International, Fond du Lac, WI 54935 414-921-7100
§ Grado Laboratories, Brooklyn, NY 11220 718-435-5340
Motion Sensors, Inc., Cranford, NJ 07701 201-925-3553
§ Richard-Lee Co., Cranford, NJ 07016 201-276-0710
§ Rye Industries, Inc., Mamaroneck, NY 10543 914-698-0080
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430 201-529-8757
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ Spectral Dynamics Division, Scientific-Atlanta, Inc., San Diego, CA 92123-0575 619-496-3400
Transducer Systems, Inc., Kulpsville, PA 19443 215-256-4611
§ Veeder-Root, Hartford, CT 06102 203-527-7201
Wabash Magnetics, Kearney-National Inc., Huntington, IN 46750 219-356-8300

Transducers, Magnetostrictive-5500

Amperex Electronic Company, A Div. of North American Philips Corporation, Slatersville, RI 02876 401-762-3800
Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000

Transducers, Piezoelectric-5500

Bell, Floyd, Inc., Columbus, OH 43212, 614-294-4000 ..... D•1026
§ Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., Indianapolis, IN 46241, 317-856-3731 ..... D•1038-1041
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1807
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... B•1967
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., Springfield, NJ 07081, 201-376-6070 ..... A•1711
§ Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 201-572-9512 ..... D•1058,1060,1062
TDK Corporation, Electronic Components & Material, Tokyo, JAPAN 103, (03) 278-5111 ..... D•1064
Vernitron Piezoelectric Div., Bedford, OH 44146-5478, 216-232-8600 .... A•1499
§ Atlas/Soundolier, Fenton, MO 63026 314-349-3110
§ Atomergic Chemetals Corp., Farmingdale, NY 11735-1527 516-694-9000
† Blatek, Inc., Bellefonte, PA 16823 814-355-4910
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
Burleigh Instruments, Fishers, NY 14453 716-924-9355
† Channel Industries, Santa Barbara, CA 93111 805-967-0171
Endevco, San Juan Capistrano, CA 92675 714-493-8181
Entran Devices, Fairfield, NJ 07006 ..... 201-227-1002;800-635-0650
§ Ercona, Patchogue, NY 11772 516-758-0700
General Vibrations Mfg. Co., Manchester, CT 06040 203-646-0090
† Gulton Industries, Inc., Servonic Div., Costa Mesa, CA 92627 ..... 714-642-2400; 800-854-4066
§ IC Sensors, Inc., Milpitas, CA 95035 408-432-1800
† International Transducer Corp., Channel Technologies, Inc., Santa Barbara, CA 93111 805-683-2575
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
† PCB Piezotronics, Depew, NY 14043-2495 716-684-0001
† Piezo Electric Products, Inc., Metuchen, NJ 08840 201-548-2800
† Piezo Kinetics Inc., Bellefonte, PA 16823 814-355-1593
† Pind Testers Inc., Irvine, CA 92718 714-380-1551
Primo Company Limited, Tokyo, JAPAN 181 0422-43-3121
§† Projects Unlimited, Dayton, OH 45414 513-890-1918
§ Stetco, Inc., Franklin Pk., IL 60131 312-671-4208
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
Taiyo Yuden (USA) Inc., Arlington Heights, IL 60005-4493 312-364-6104
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322

Transducers, Position, Linear-5500

† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910, 818-882-0424 ..... B•1942
Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116 ..... B•1724-1725
Enprotech Corp., Kalamazoo, MI 49007, 616-381-0665 ..... B•1953
HBM, Inc., Marlboro, MA 01752, 508-624-4500 ..... B•1958
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1804-1806
Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1831
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 ..... A•2147
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2152
† AEMC Corporation, Boston, MA 02111 ..... 617-451-0227;800-343-1391
§ APEC Fiber Optics Corp., College Station, TX 77840 409-693-5397
Astrosystems, Lake Success, NY 11042 516-328-1600
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
Burleigh Instruments, Fishers, NY 14453 716-924-9355
† Celesco Transducer Prods., Inc., Canoga Pk., CA 91304-5005 818-884-6860
† Component Specialties Corp., Temple City, CA 91780 213-283-0015
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
Contaq Technologies Corp., Bristol, VT 05443 802-453-3332
† Control Sciences, Inc., Chatsworth, CA 91311 818-709-5510
C-Tek Inc., Wakefield, MA 01880 617-246-1720
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
§ Dova Controls, Redmond, WA 98052 206-881-7414
§ Electro Corporation, Sub. of Fasco Industries Inc., Sarasota, FL 34230-3049 813-355-8411
† Farrand Controls, Div. of Farrand Industries, Inc., Valhalla, NY 10595 914-761-2600
† Force, Inc., Christiansburg, VA 24073 703-382-0462
† Genisco Technology Corp., Transducers Products Div., Simi Valley, CA 93065 805-581-3985

† Gulton Industries, Inc., Servonic Div., Costa Mesa, CA 92627 ..... 714-642-2400; 800-854-4066
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
† JDK Controls, Inc., Newbury Park, CA 91320-1593 805-499-7779
§† Kavlico Corp., Moorpark, CA 93021 805-523-2000
Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
Magnetoelastic Devices, Pittsfield, MA 01202 413-445-5608
Motion Sensors, Inc., Cranford, NJ 07701 201-925-3553
† Novotechnik U.S., Inc., Marlborough, MA 01752 617-485-2244
Omutec, Odetics, Inc., Anaheim, CA 92802 714-758-0200
† Penny & Giles, Santa Monica, CA 90401 213-393-1497
Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000
Sensotec, Inc., Columbus, OH 43212 614-486-7723
Spectrol Electronics, City of Industry, CA 91745 818-964-6565
† Teledyne Gurley, Troy, NY 12181 518-272-6300
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 312-364-7277
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
Transducer Systems, Inc., Kulpsville, PA 19443 215-256-4611
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
Trans-Tek, Ellington, CT 06029 203-872-8351
TRW Technar, Inc., TRW, Inc., Irwindale, CA 91706 818-334-0250
Unimeasure, Inc., Corvallis, OR 97330 503-757-3158
Validyne Engineering Corporation, Northridge, CA 91324 818-886-2057
Vibrac, Amherst, NH 03031 603-882-6777

Transducers, Position, Rotary-5500

BEI Motion Systems Co., Digital Products Div., Little Rock, AR 72203, 501-851-4000 ..... B•1934
BEI Motion Systems Co., Position Controls Div., Carlsbad, CA 92008, 619-931-0200 ..... B•1934
Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116 ..... B•1724-1725
Enprotech Corp., Kalamazoo, MI 49007, 616-381-0665 ..... B•1953
† Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1966
Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ..... D•1202
§ APEC Fiber Optics Corp., College Station, TX 77840 409-693-5397
Astrosystems, Lake Success, NY 11042 516-328-1600
BEI Motion Systems Co., Computer Products Div., San Marcos, CA 92069 619-471-2600
BEI Motion Systems Co., Industrial Encoder Div., Goleta, CA 93117 805-968-0782
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
† Clifton Precision, Litton Systems, Inc., Clifton Hgts., PA 19018 215-622-1000
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
† Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910 818-882-0424
† Control Sciences, Inc., Chatsworth, CA 91311 818-709-5510
C-Tek Inc., Wakefield, MA 01880 617-246-1720
§ Dova Controls, Redmond, WA 98052 206-881-7414
§ Dynapar, Gurnee, IL 60031 312-662-2666
† Farrand Controls, Div. of Farrand Industries, Inc., Valhalla, NY 10595 914-761-2600
Hathaway Corporation:Motion Control Div., Tulsa, OK 74116 918-438-7800
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
† JDK Controls, Inc., Newbury Park, CA 91320-1593 805-499-7779
† Kavlico Corp., Moorpark, CA 93021 805-523-2000
Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
Motion Sensors, Inc., Cranford, NJ 07701 201-925-3553
† Novotechnik U.S., Inc., Marlborough, MA 01752 617-485-2244
Omutec, Odetics, Inc., Anaheim, CA 92802 714-758-0200
† Penny & Giles, Santa Monica, CA 90401 213-393-1497
† Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000
Sharp Electronics Corp., Microelectronics Div., Mahwah, NJ 07430 201-529-8757
§ Spectral Dynamics Division, Scientific-Atlanta, Inc., San Diego, CA 92123-0575 619-496-3400
Spectrol Electronics, City of Industry, CA 91745 818-964-6565
† Teledyne Gurley, Troy, NY 12181 518-272-6300
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Arlington Heights, IL 60005-3904 312-364-7277
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
Transducer Systems, Inc., Kulpsville, PA 19443 215-256-4611
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
Trans-Tek, Ellington, CT 06029 203-872-8351
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100
† Vernitron Controls, Vernitron Corporation, San Diego, CA 92073 619-428-5581
Vibrac, Amherst, NH 03031 603-882-6777
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778 508-358-2777

Transducers, Power – See Transducers, Volt, Watt, Currents, etc. (Vol. B)

Transducers, Pressure-5500

§ Data Instruments, Inc., Acton, MA 01720, 508-264-9550 ..... B•1943
† Entran Devices, Fairfield, NJ 07006, 201-227-1002;800-635-0650 ..... B•1954
HBM, Inc., Marlboro, MA 01752, 508-624-4500 ..... B•1958
§ Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1807
§ Motorola Semiconductor Prods. Sector, Phoenix, AZ 85018-6606, 602-244-6900 ..... A•2190
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1988-1989
§† Pres-Air-Trol Corp., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1831
Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA ..... B•1990-1992
† Vernitech:Vernitron Corp., Deer Pk., NY 11729, 516-586-5100 .. A•2147, B•1037
† A. L. Design, Inc., Amherst, NY 14226 716-833-6272
Amperex Electronic Company, A Div. of North American Philips Corporation, Slatersville, RI 02876 401-762-3800
§ APEC Fiber Optics Corp., College Station, TX 77840 409-693-5397
§† Bailey Controls Co., Div. of Babcox & Wilcox, Wickliffe, OH 44092 216-585-8500
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
§ Barksdale Controls Div., Imo Delaval Inc., Los Angeles, CA 90058 213-589-6181
§ Bellofram Corporation, Pelham, NH 03076 ..... 603-635-2103;800-343-0039
Bosch, Robert, Corp., Broadview, IL 60153 312-865-5200
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† Bristol Babcock Inc., Watertown, CT 06795 ..... 203-575-3000;800-243-3576
Cambridge Aeroflo, Inc., Shirley, MA 01464 508-45-2346
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773 714-394-4481
† Celesco Transducer Prods., Inc., Canoga Pk., CA 91304-5005 818-884-6860
† Channel Industries, Santa Barbara, CA 93111 805-967-0171
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
† Computer Instruments Div., Hempstead, NY 11550 516-483-8200
Controls Division, Ametek, Inc., Feasterville, PA 19047 215-355-6900
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
§ Dynisco, Norwood, MA 02062 617-769-6600
† Edcliff Div., Systron Donner, Monrovia, CA 91016 818-358-4571
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 312-882-5757
§ Endevco, San Juan Capistrano, CA 92675 714-493-8181
§ Extech Instruments Corp., Waltham, MA 02154 617-890-7440
† Faria, Thomas G., Corp., Uncasville, CT 06382-0983 203-848-9271
† Genisco Technology Corp., Transducers Products Div., Simi Valley, CA 93065 805-581-3985
† Giannini Institute, Indio, CA 92201 619-347-2833
Gould Inc., Recording Systems Division, Cleveland, OH 44114 216-361-3315
§ GSE, Core Inds., Farmington Hills, MI 48024 313-476-7875
† Gulton Industries, Inc., Servonic Div., Costa Mesa, CA 92627 ..... 714-642-2400; 800-854-4066
Harrel, Inc., E. Norwalk, CT 06855 203-866-2573
Honeywell Inc., Aerospace & Defense Grp., Minneapolis, MN 55408 612-870-5186
§ IC Sensors, Inc., Milpitas, CA 95035 408-432-1800
§ Jumo Process Control, Inc., Bergenfield, NJ 07621 201-501-0060
§ Kavlico Corp., Moorpark, CA 93021 805-523-2000
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
Lebow Products, Eaton Corp., Troy, MI 48084 313-643-0220
LEL Co., Cresskill, NJ 07626 201-569-8641
Leybold Inficon Inc., E. Syracuse, NY 13057 315-434-1100
† Litton Potentiometer Div., Mt. Vernon, NY 10551 914-664-7733
3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
Midwest Components, Inc., Muskegon, MI 49443 616-777-2602
§† MKS Instruments, Inc., Andover, MA 01810 508-975-2350
Motorola Inc., Auto. & Indl. Elctrns. Grp., Schaumburg, IL 60196 312-576-4850
§ Norgren, Littleton, CO 80120-1663 303-794-2611
Optimum Applied Systems, Dobbs Ferry, NY 10522-1696 914-693-9001
† Paine Corporation, Seattle, WA 98144 ..... 206-329-8600;800-426-0366
† PCB Piezotronics, Depew, NY 14043-2495 716-684-0001
† Penny & Giles, Santa Monica, CA 90401 213-393-1497
Philips Electronics Ltd, Philips Comps., Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§ Phoenix Contact, Harrisburg, PA 17111 717-944-1300
† Piezo Electric Products, Inc., Metuchen, NJ 08840 201-548-2800
† Piezo Kinetics Inc., Bellefonte, PA 16823 814-355-1593
Pressure Systems, Inc., Hampton, VA 23666 804-865-1243
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§† Robinson-Halpern Products, Transicoil, Inc., Plymouth Meeting, PA 19462-0248 215-825-9200
† Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000
Sensotec, Inc., Columbus, OH 43212 614-486-7723
† Sensym, Inc., Sunnyvale, CA 94089 408-744-1500
§ Spectral Dynamics Division, Scientific-Atlanta, Inc., San Diego, CA 92123-0575 619-496-3400
Stoelting Co., Chicago, IL 60623 312-522-4500
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
§† Trans Metrics, Inc., Solon, OH 44139 216-248-2229
Unimeasure, Inc., Corvallis, OR 97330 503-757-3158
Validyne Engineering Corporation, Northridge, CA 91324 818-886-2057
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322
§ Yellow Springs Instrument Co., Yellow Springs, OH 45387 513-767-7241
Yokogawa Corp. of America, Newnan, GA 30265 404-253-7000

Transducers, Proximity-5500

Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... B•1224
Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116 ..... B•1724-1725
§ Hamlin, Lake Mills, WI 53551, 414-648-2361 ..... B•1751,1957
Hermetic Switch, Chickasha, OK 73018, 405-224-4046 ..... B•1753
§† Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 .. B•1804-1806
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... B•1845
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
Contaq Technologies Corp., Bristol, VT 05443 802-453-3332
§ Dale Electronics, Inc., El Paso Div., El Paso, TX 79926-6728 915-592-3253
§ Eaton Corp, Durant Products, Watertown, WI 53094 414-261-4070

§ Electro Corporation, Sub. of Fasco Industries Inc., Sarasota, FL 34230-3049 813-355-8411
Epsilon-Lambda Elctrns. Corp., Geneva, IL 60134 312-232-9611
FSI/Fork Standards, Inc., Lombard, IL 60148 ..... 312-231-3511;312-932-9380
General Numeric Corporation, Elk Grove Village, IL 60007 312-640-1595
† GIC Thermodynamics, Royal Oak, MI 48073 313-280-1648
§ Gordon Products, Brookfield, CT 06804 203-775-4501
§ HBM, Inc., Marlboro, MA 01752 508-624-4500
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
Instrumentation & Control Sys., ICS.Inc., Addison, IL 60101 312-543-6200
Kessler-Ellis Prods., Atlantic Highlands, NJ 07716 ..... 201-291-0500;800-631-2165
3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
Metrix Instrument Co., Houston, TX 77043 713-461-2131
Motion Sensors, Inc., Cranford, NJ 07701 201-925-3553
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., Springfield, NJ 07081 201-376-6070
§ Redington Counters, Windsor, CT 06095 203-688-6205
Rehlander Assocs., Beverly, MA 01915 617-922-5961
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000
§ Spectral Dynamics Division, Scientific-Atlanta, Inc., San Diego, CA 92123-0575 619-496-3400
§ Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600
§ Tenor Company, New Berlin, WI 53151 414-782-3800
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322
Wabash Magnetics, Kearney-National Inc., Huntington, IN 46750 219-356-8300

Transducers, Sonic-5500

Bell, Floyd, Inc., Columbus, OH 43212 614-294-4000
† Blatek, Inc., Bellefonte, PA 16823 814-355-4910
† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000
† International Transducer Corp., Channel Technologies, Inc., Santa Barbara, CA 93111 805-683-2575
Kistler-Morse, Redmond, WA 98073 206-881-8000
§† Kyocera Northwest, Electronic Components Group, Vancouver, WA 98661 206-696-2840
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., Springfield, NJ 07081 201-376-6070
† Piezo Kinetics Inc., Bellefonte, PA 16823 814-355-1593
§ Stetco, Inc., Franklin Pk., IL 60131 312-671-4208

Transducers, Strain Gauge-5500

HBM, Inc., Marlboro, MA 01752, 508-624-4500 ..... B•1958-1959
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1988-1989
Acurex Corp./Autodata Div., Mountain View, CA 94039 415-967-9100
A. L. Design, Inc., Amherst, NY 14226 716-833-6272
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
BLH Electronics, Inc., Canton, MA 02021-9111 617-821-2000
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773 714-394-4481
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
§ Data Instruments, Inc., Acton, MA 01720 508-264-9550
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
§† Dillon, W. C., Weigh-Tronix, Inc., Fairmont, MN 56031 507-238-4461
§ Dynisco, Norwood, MA 02062 617-769-6600
† Edcliff Div., Systron Donner, Monrovia, CA 91016 818-358-4571
† Entran Devices, Fairfield, NJ 07006 ..... 201-227-1002;800-635-0650
† Genisco Technology Corp., Transducers Products Div., Simi Valley, CA 93065 805-581-3985
§ GSE, Core Inds., Farmington Hills, MI 48024 313-476-7875
† Gulton Industries, Inc., Servonic Div., Costa Mesa, CA 92627 ..... 714-642-2400; 800-854-4066
§ Helm Instrument Co., Inc., Maumee, OH 43537 419-893-4356
§ Interface, Inc., Scottsdale, AZ 85260 602-948-5555
§† Kistler-Morse, Redmond, WA 98073 206-881-8000
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
Lebow Products, Eaton Corp., Troy, MI 48084 313-643-0220
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
† Paine Corporation, Seattle, WA 98144 ..... 206-329-8600;800-426-0366
Piezo Electric Products, Inc., Metuchen, NJ 08840 201-548-2800
§† Revere Corporation of America, Wallingford, CT 06492 203-269-7701
Robinson-Halpern Products, Transicoil, Inc., Plymouth Meeting, PA 19462-0248 215-825-9200
† Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000
Sensotec, Inc., Columbus, OH 43212 614-486-7723
§† Trans Metrics, Inc., Solon, OH 44139 216-248-2229
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322

Transducers, Temperature-5500

Amperex Electronic Company, A Div. of North American Philips Corporation, Slatersville, RI 02876, 401-762-3800 ..... B•1317-1318
§ Dale Electronics, Inc., El Paso Div., El Paso, TX 79926-6728, 915-592-3253 ..... B•1890-1893
HBM, Inc., Marlboro, MA 01752, 508-624-4500 ..... B•1959
Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... B•1899-1900
Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ..... B•1901-1903
Micro Switch, A Honeywell Div., Freeport, IL 61032, 815-235-6600 ..... B•1806-1807
§ Motorola Semiconductor Prods. Sector, Phoenix, AZ 85018-6606, 602-244-6900 ..... A•2190
Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1988-1989
§ Quality Thermistor, Boise, ID 83709, 208-377-3373 ..... A•2199, B•1914
Advanced Techn. Research Labs., Alexandria, VA 22312 703-750-2920
Advanced Thermal Products, Inc., St. Marys, PA 15857 814-772-0278
§ Alpha Wire Corp., Elizabeth, NJ 07207-0711 201-925-8000
§† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563 516-593-5600
† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
§ APEC Fiber Optics Corp., College Station, TX 77840 409-693-5397
§ Atkins Technical Inc., Gainesville, FL 32608 904-378-5555
§† Bailey Controls Co., Div. of Babcox & Wilcox, Wickliffe, OH 44092 216-585-8500
Barber-Colman Co., Indl. Instrs. Div., Rockford, IL 61125-7040 815-877-0241
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
Betatherm Corp., Shrewsbury, MA 01545 508-842-0516
Bosch, Robert, Corp., Broadview, IL 60153 312-865-5200
† Bristol Babcock Inc., Watertown, CT 06795 ..... 203-575-3000;800-243-3576
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
Burling Instruments, Chatham, NJ 07928 201-635-9481
Cambridge Aeroflo, Inc., Shirley, MA 01464 508-45-2346
§ Capintec Instruments, Ramsey, NJ 07446 201-825-9500
Controls Division, Ametek, Inc., Feasterville, PA 19047 215-355-6900
Crompton Instruments, Inc., Glendale Heights, IL 60139 312-351-9888
Crompton Instrs., Hawker Siddley, Elk Grove Village, IL 60007 312-593-1107
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
Degussa Corp., Temperature Sensing Products, So. Plainfield, NJ 07080 201-757-6500
Digital Dynamics, Inc., Scotts Valley, CA 95066 408-438-4444
§ Dowty Electronics Co., Thermocontrol Div., Brandon, VT 05733 802-247-6811
§ EDL, Inc., Hauppauge, NY 11788 ..... 516-435-2808;1-800-DIAL EDL
† Entran Devices, Fairfield, NJ 07006 ..... 201-227-1002;800-635-0650
§ E-Squared Technology Corp., Ventura, CA 93003 805-644-9544
§ Everest Interscience, Inc., Fullerton, CA 92634-3640 714-992-4461
† Faria, Thomas G., Corp., Uncasville, CT 06382-0983 203-848-9271
§ FENWAL INC., Ashland, MA 01721 508-881-2000
§† Fenwal Electronics/APD, Kidde, Inc., Milford, MA 01757 508-478-6000
General Resistance, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
§ Hades Manufacturing Corp., Farmingdale, NY 11735 516-249-4244
† Harrel, Inc., E. Norwalk, CT 06855 203-866-2573
† Hy-Cal Engineering, El Monte, CA 91731 818-444-4000
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
† Instrulab, Dayton, OH 45404 513-223-2241
International Resistive Company, Boone, NC 28607 704-264-8861
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
† Lake Shore Cryotronics, Inc., Westerville, OH 43081 614-891-2243
Larson Instrument, Orangeburg, NY 10962 914-359-3800
§ Love Controls Corp., Wheeling, IL 60090 312-541-3232
§ Martel Electronics, Windham, NH 03087 ..... 603-893-0886;800-821-0023
3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
Meissner Industries, Dover, NJ 07801 201-366-1700
§ Midwest Components, Inc., Muskegon, MI 49443 616-777-2602
§† Mikron Instr., Wyckoff, NJ 07481 201-891-7330
Minco Products, Minneapolis, MN 55432 612-571-3121
§ Newport Electronics, Santa Ana, CA 92704-4426 714-540-4914
Philips Electronics Ltd, Philips Comps., Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§ Phoenix Contact, Harrisburg, PA 17111 717-944-1300
† Piezo Electric Products, Inc., Metuchen, NJ 08840 201-548-2800
PPM, Inc., Cleveland, OH 44139 216-349-2300
Primo Company Limited, Tokyo, JAPAN 181 0422-43-3121
Princo Instruments, Inc., Southampton, PA 18966
† PSG Inds., Perkasie, PA 18944 215-257-3621
Radio Materials Corp., Attica, IN 47918 ..... 317-762-2491;1-800-356-9956
§† RCD Components, Inc., Manchester, NH 03103 603-669-0054
RCL-Shallcross, Manchester, NH 03102 603-627-3831
RCL-Shallcross, Inc., Smithfield, NC 27577 919-934-5181
† Relco Products, Denver, CO 80237 303-756-1143
§ RFL Inds., Inc., (DBA) Dowty Elctrns. Co., Brandon, VT 05733 802-247-6811
Rochester Instrument Systems, Rochester, NY 14605 716-263-7700
§ S. F. Products Corporation, Southport, CT 06490 203-929-6180
§ Spectral Dynamics Division, Scientific-Atlanta, Inc., San Diego, CA 92123-0575 619-496-3400
† Syscon Intl., Inc., So. Bend, IN 46618-1096 219-232-3900
§ TDK Corporation, Electronic Components & Material, Tokyo, JAPAN 103 ..... (03) 278-5111
Techno, Inc., Van Nuys, CA 91405 818-781-1642
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
† Thermo Electric, Saddle Brook, NJ 07662 201-843-5800
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
Wabash Magnetics, Kearney-National Inc., Huntington, IN 46750 219-356-8300
§† Weed Instrument Co., Inc., Round Rock, TX 78664-0300 512-255-7043
Western Elctrn. Comps. Corp., Camarillo, CA 93010 805-482-8002
§ Yellow Springs Instrument Co., Yellow Springs, OH 45387 513-767-7241

Transducers, Thermoelectric – See Transducers, Temperature (Vol. B)

Transducers, Tilt - Also see Inclinometers-5500

Durakool, Inc., American Electronic Components, Elkhart, IN 46514, 219-264-1116 ..... B•1724-1725
§† Dova Controls, Redmond, WA 98052 206-881-7414
International Machine & Tool Corp., Warwick, RI 02888 401-467-6905
† Penny & Giles, Santa Monica, CA 90401 213-393-1497
Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000
† Spectron Glass & Electronics, Inc., Hauppauge, NY 11788 516-582-5600

Transducers, Torque-5500

Computer Optical Products, Inc., Sub. of Hathaway Corp., Chatsworth, CA 91311-6910, 818-882-0424 ..... B•1942
HBM, Inc., Marlboro, MA 01752, 508-624-4500 ..... B•1958

Omega Engineering, Stamford, CT 06907, 800-826-6342 ..... B•1988
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2153
Acurex Corp./Autodata Div., Mountain View, CA 94039 415-967-9100
† A. L. Design, Inc., Amherst, NY 14226 716-833-6272
Androtek/dmi, Columbus, OH 43229 614-882-7821
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
Daytronic Corp., Hawker Siddeley, Miamisburg, OH 45342 513-866-3300
§ GSE, Core Inds., Farmington Hills, MI 48024 313-476-7875
§ Interface, Inc., Scottsdale, AZ 85260 602-948-5555
Lebow Products, Eaton Corp., Troy, MI 48084 313-643-0220
Magnetoelastic Devices, Pittsfield, MA 01202 413-445-5608
† Penny & Giles, Santa Monica, CA 90401 213-393-1497
Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000
Sensotec, Inc., Columbus, OH 43212 614-486-7723
Transducer Systems, Inc., Kulpsville, PA 19443 215-256-4611
Vibrac, Amherst, NH 03031 603-882-6777
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322

Transducers, Ultrasonic-5500

† Blatek, Inc., Bellefonte, PA 16823, 814-355-4910 ..... B•1936
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., Springfield, NJ 07081, 201-376-6070 ..... A•1711
Accusonic Division, Ferranti O.R.E. Inc., Falmouth, MA 02541 617-548-5800
§ Amerace Corporation, Hackettstown, NJ 07840 201-852-1122
Anders, Inc., Simsbury, CT 06070 203-658-7666
§ Atomergic Chemetals Corp., Farmingdale, NY 11735-1527 516-694-9000
† Channel Industries, Santa Barbara, CA 93111 805-967-0171
Contaq Technologies Corp., Bristol, VT 05443 802-453-3332
† Dukane Corp., Communications Sys. Div., St. Charles, IL 60174-9984 ... 312-584-2300
† EDO Western Corp., EDO Corp., Salt Lake City, UT 84115 801-486-7481
§ Electro Corporation, Sub. of Fasco Industries Inc., Sarasota, FL 34230-3049 813-355-8411
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
† Gulton Industries, Inc., Servonic Div., Costa Mesa, CA 92627 ..... 714-642-2400; 800-854-4066
International Mircoelectronics, Arlington, TX 76003 817-561-2244
† International Transducer Corp., Channel Technologies, Inc., Santa Barbara, CA 93111 805-683-2575
Kistler-Morse, Redmond, WA 98073 206-881-8000
Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Panametrics, Waltham, MA 02254 617-899-2740
† Piezo Kinetics Inc., Bellefonte, PA 16823 814-355-1593
Primo Company Limited, Tokyo, JAPAN 181 0422-43-3121
Radio Materials Corp., Attica, IN 47918 ..... 317-762-2491;1-800-356-9956
§† Sensall, Rosemount Corp., Hauppauge, NY 11788 516-273-6600
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§† Sonicor Instrument Corp., Copiague, NY 11726 516-842-3344
§ Sonobond Ultrasonics Inc., Inductotherm Industries, West Chester, PA 19380 ..... 215-696-4710;800-323-1269
Stetco, Inc., Franklin Pk., IL 60131 312-671-4208
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

Transducers, Velocity-5500

Blatek, Inc., Bellefonte, PA 16823, 814-355-4910 ..... B•1936
§ Vibra-Metrics, Inc., Hamden, CT 06514, 203-288-6158;1-800-352-2001 ... B•1999
Airpax Co., Sensor Div., A Division of North American Philips Corp., Cheshire, CT 06410 203-272-0301
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773 714-394-4481
† Celesco Transducer Prods., Inc., Canoga Pk., CA 91304-5005 818-884-6860
† Computer Instruments Div., Hempstead, NY 11550 516-483-8200
Disc Instruments, Honeywell, Costa Mesa, CA 92626 714-433-0343
Electro Physics Co., Inc., Waukegan, IL 60085 312-249-5801
§ Fenwal Electronics/APD, Kidde, Inc., Milford, MA 01757 508-478-6000
General Vibrations Mfg. Co., Manchester, CT 06040 203-646-0090
† Genisco Technology Corp., Transducers Products Div., Simi Valley, CA 93065 805-581-3985
§ HBM, Inc., Marlboro, MA 01752 508-624-4500
† Humphrey, Inc., San Diego, CA 92123 619-565-6631
§ IC Sensors, Inc., Milpitas, CA 95035 408-432-1800
§ Kavlico Corp., Moorpark, CA 93021 805-523-2000
Kinemetrics/Systems, Kinemetrics, Inc., Pasadena, CA 91107 818-795-2220
† Kurz Instruments Inc., Monterey, CA 93940 800-424-7356
Metrix Instrument Co., Houston, TX 77043 713-461-2131
§† Micro Mo Electronics, Inc., St. Petersburg, FL 33701 813-822-2529
Motion Sensors, Inc., Cranford, NJ 07701 201-925-3553
§† Robinson-Halpern Products, Transicoil, Inc., Plymouth Meeting, PA 19462-0248 215-825-9200
† Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000
Sensotec, Inc., Columbus, OH 43212 614-486-7723
§† Systron-Donner Inertial Div., Concord, CA 94518 415-671-6400
Teledyne/Geotech, Garland, TX 75041 214-271-2561
† Teledyne Gurley, Troy, NY 12181 518-272-6300
§ Temposonics, MTS Sys. Corp., Plainview, NY 11803 516-349-1950
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
Transducer Systems, Inc., Kulpsville, PA 19443 215-256-4611
† Transicoil, Inc., Worcester, PA 19490-9990 215-277-1300
Trans-Tek, Ellington, CT 06029 203-872-8351
Vibrac, Amherst, NH 03031 603-882-6777
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322

Transducers, Vibration-5500

Chatsworth Data Corporation, Chatsworth, CA 91311, 818-341-9200 .... D•1232
Entran Devices, Fairfield, NJ 07006, 201-227-1002;800-635-0650 ..... B•1955
HBM, Inc., Marlboro, MA 01752, 508-624-4500 ..... B•1958-1959
§ Vibra-Metrics, Inc., Hamden, CT 06514, 203-288-6158;1-800-352-2001 ... B•1999
Alpha-M Corp., Dallas, TX 75229 214-406-0424
Bently Nevada Corp., Minden, NV 89423 ..... 800-227-5514;702-782-3611
† Bruel & Kjaer Instrs. Inc., Marlboro, MA 01752-3093 508-481-7000
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773 714-394-4481
† Channel Industries, Santa Barbara, CA 93111 805-967-0171
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3900
§ Dova Controls, Redmond, WA 98052 206-881-7414
Electro Physics Co., Inc., Waukegan, IL 60085 312-249-5801
§ Endevco, San Juan Capistrano, CA 92675 714-493-8181
General Vibrations Mfg. Co., Manchester, CT 06040 203-646-0090
† Gulton Industries, Inc., Servonic Div., Costa Mesa, CA 92627 ..... 714-642-2400; 800-854-4066
§ Helm Instrument Co., Inc., Maumee, OH 43537 419-893-4356
† HH Controls Co., Inc., Arlington, MA 02174 617-646-2626
§ IC Sensors, Inc., Milpitas, CA 95035 408-432-1800
Kelmet, Inc., San Dimas, CA 91773 714-599-0954
Kinemetrics/Systems, Kinemetrics, Inc., Pasadena, CA 91107 818-795-2220
† Knowles Electronics, Inc., Franklin Park, IL 60131 312-455-3600
Metrix Instrument Co., Houston, TX 77043 713-461-2131
Motion Sensors, Inc., Cranford, NJ 07701 201-925-3553
† PCB Piezotronics, Depew, NY 14043-2495 716-684-0001
Primo Company Limited, Tokyo, JAPAN 181 0422-43-3121
§ Projects Unlimited, Dayton, OH 45414 513-890-1918
† Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000
Sensotec, Inc., Columbus, OH 43212 614-486-7723
§ Spectral Dynamics Division, Scientific-Atlanta, Inc., San Diego, CA 92123-0575 619-496-3400
§† Systron-Donner Inertial Div., Concord, CA 94518 415-671-6400
Teledyne/Geotech, Garland, TX 75041 214-271-2561
Trans-Tek, Ellington, CT 06029 203-872-8351
Unholtz-Dickie Corp., Wallingford, CT 06492 203-265-3929
§ Vibro-Meter Corp., Billerica, MA 01822-5058 508-663-7322
† Wilcoxon Research, Rockville, MD 20850 301-330-8811

Transducers, Volt, Watt, Current VAR, Power Factor, Frequency-5500

Active Control Instrumentation, Key Largo, FL 33037, 305-451-1000 ..... D•1134
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803, 516-694-6700 ..... B•1224
† American Aerospace Controls, Farmingdale, NY 11735, 516-694-5100 ..... B•1932-1933
Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 ..... D•1228
Dynapower Corporation, Farmington Hills, MI 48333, 313-553-4300 ..... D•1730-1732
Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235, 614-889-6152 ..... A•2299
LEM/Rekco, Germantown, WI 53022, 414-784-3430 ..... D•1151
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561 ..... B•1968-1981,1984-1986, D•1330
Wilcoxon Research, Rockville, MD 20850, 301-330-8811 ..... B•2000
† AEMC Corporation, Boston, MA 02111 ..... 617-451-0227;800-343-1391
§† Amprobe Instrument, Core Industries, Inc, Lynbrook, NY 11563 516-593-5600
Androtek/dmi, Columbus, OH 43229 614-882-7821
§ ARGA Controls, Pasadena, CA 91105 213-682-3314
Best Technology Inc., Seattle, WA 98109 206-382-1300
† C & C Jetronic, Inc., Princeton, NJ 08540 609-921-8540
Chauvin Arnoux, Chauvin Arnoux-France, Dover, NH 03820 603-749-6434
Crompton Instruments, Inc., Glendale Heights, IL 60139 312-351-9888
Crompton Instrs., Hawker Siddley, Elk Grove Village, IL 60007 312-593-1107
Cross Electronics, Warrendale, PA 15086 412-776-1591
§† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
Dowty RFL Inds. Inc./Communications Div., The Dowty Grp. PLC, Boonton, NJ 07005-0239 201-334-3100
Dowty RFL Inds. Inc./Instrumentation Div., The Dowty Grp. PLC, Boonton, NJ 07005-0239 201-334-3100
† Electro National, Canton, MS 39046 601-859-5511
EWC, Inc., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
§ Fenwal Electronics/APD, Kidde, Inc., Milford, MA 01757 508-478-6000
§ Halmar Electronics, Inc., Columbus, OH 43204 614-275-0530
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 815-235-6600
† Physics International Co., Olin Defense Systems Grp., San Leandro, CA 94577 415-577-7236
Rochester Instrument Systems, Rochester, NY 14605 716-263-7700
Rotek Instrument Corp., Waltham, MA 02254 617-899-4611
Scientific Columbus, Inc., Esterline Corporation, Columbus, OH 43223 .. 614-274-0400
† Sigma Electronics Inc., Houston, TX 77099 713-933-4700
Star Micronics, Inc., OEM Division, Piscataway, NJ 08854 201-572-9512
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
§ Time Mark Corp., Tulsa, OK 74116 918-438-1220
Tokin America, Inc., San Jose, CA 95134 408-432-8020
U.S. Instr. Rentals, San Mateo, CA 94403 800-824-2873
§ Yokogawa Corp. of America, Newnan, GA 30265 404-253-7000

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† **Abbott Technologies, Inc., Burbank Division, Transformers, Burbank, CA 91506, 818-841-3630** ..... **A•2219-2223,2225-2230**
Bey Electric, Inc., Lincoln Park, NJ 07035, 201-694-5000 ..... **A•2263**
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462/3487 ..... **A•2278-2279**
† **EWC, Inc., Kenilworth, NJ 07033, 201-245-3200;800-526-4048** ..... **A•2284,2297**
† **Hisonic, Inc., Olathe, KS 66061, 913-782-0012** ..... **A•2307**
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... **A•2324-2325**
Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... **A•2331**
§† **Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050** ..... **A•2346,2352-2353,2359**
† **North Hills Electronics, Glen Cove, NY 11542, 516-671-5700** ..... **A•2366,2368**
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•2387**
† **Polyphase Instrument, Ft. Washington, PA 19034, 215-643-6950** ... **A•2420-2421**
† **Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 201-826-4700** ..... **A•2419**
† **Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790** ..... **A•1673,2466,2469-2470, D•2079**
† **Technitrol, Philadelphia, PA 19134, 215-426-9105** ..... **B•1032-1035**
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314** ..... **A•2491-2492,2494-2496**
† **Torwico Elctrns. Inc., Lakewood, NJ 08701, 201-364-1800** ..... **A•2498-2499**
† **Trans American Transformer, E. Setauket, NY 11733, 516-928-0762** ..... **A•2489**
Voltampere Corp., Lynbrook, NY 11563, 516-887-9443 ..... **D•2127**
Wayne Transformers Co., Inc., A Marine Electric Systems Co., Clifton, NJ 07014-1135, 201-614-1100 ..... **A•2512**
† Adams-Maxwell Division, Coast Magnetics, Inglewood, CA 90302-1284 213-673-3245
§† Adams-Russell, Anzac Div., Burlington, MA 01803 671-273-3333
† Automatic Coil Corp., Sub. Designatronics, Inc., Miami, FL 33147 305-696-6660
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† DeYoung Manufacturing, Inc., Kirkland, WA 98034 206-823-4798
Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
† Elnetic Electronics, Inc., Los Angeles, CA 90009-8232 213-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
Genco Precision Corp., Deer Park, NY 11729 516-242-3006
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 213-234-9091
† Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetic Component Engineering, Inc., Culver City, CA 90230 213-398-4761
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
† Milwaukee Transformer Co., MTE Corporation, Milwaukee, WI 53223 414-358-5300
Mouser Electronics, Mansfield, TX 76063 800-346-6873
MTE Corp., Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Furlong, PA 18925 215-794-7411
† Onan Power/Electronics, Minneapolis, MN 55437 612-921-5600
† OPT Industries Inc., Phillipsburg, NJ 08865 201-454-2600
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
PC Transformer Corp., West Babylon, NY 11704 516-491-3300
† Perkin-Elmer Corp., Elctrn. Prods. Dept., Norwalk, CT 06859-0132 203-762-4786
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311 818-885-8223

† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
† Sigma Electronics Inc., Houston, TX 77099 713-933-4700
§† Skyway Magnetics, Warner Springs, CA 92086 619-782-3342
† Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Todd Systems, Inc., Yonkers, NY 10701 914-963-3400
§† Toko America, Inc., Mt. Prospect, IL 60056 312-297-0070
Torema U.S.A., Inc., Houston, TX 77063 713-977-2500
Ulveco, Inc., Foster City, CA 94404 415-574-1100
United Transformer Co.:Div. of Opt Industries Inc., Phillipsburg, NJ 08865 201-454-2600
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100

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Bey Electric, Inc., Lincoln Park, NJ 07035, 201-694-5000 ..... A•2263
† Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... A•2268
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•2282
† EWC, Inc., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2284,2297
Hisonic, Inc., Olathe, KS 66061, 913-782-0012 ..... A•2307
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2323
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† Microtran Co. Inc., Valley Stream, NY 11582, 516-561-6050 ..... A•2346,2352-2353,2359
† North Hills Electronics, Glen Cove, NY 11542, 516-671-5700 ..... A•2366,2368
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† Polyphase Instrument, Ft. Washington, PA 19034, 215-643-6950 ... A•2420-2421
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861, 201-826-4700 ..... A•2419
Tamura Corporation of America, Carson, CA 90746-3518, 213-638-1790 ..... A•1673,2466,2469-2470, D•2079
Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001 ..... A•2476
† Technitrol, Philadelphia, PA 19134, 215-426-9105 ..... B•1032-1035
† Trans American Transformer, E. Setauket, NY 11733, 516-928-0762 ..... A•2489
§† Vitec Electronic Corporation, Visalia, CA 93291, 209-739-1077 ..... A•2507
§† Aydin Radar & EW Division, Div. of Aydin Corporation, San Jose, CA 95119-1371 408-629-1100
Bel Fuse, Jersey City, NJ 07302 201-432-0463
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† BH Electronics, Inc., Burnsville, MN 55337 612-894-9590
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† DeYoung Manufacturing, Inc., Kirkland, WA 98034 206-823-4798
Epco Products Inc., WAllkill, NY 12589 914-895-2033
† Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Component Engineering, Inc., Culver City, CA 90230 213-398-4761
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
Neshaminy Transformer, Neshaminy Electronics Corp., Furlong, PA 18925 215-794-7411
† OPT Industries Inc., Phillipsburg, NJ 08865 201-454-2600
§ Pacific Coil Co., Inductor Supp., Inc., Bakersfield, CA 93305-5495 ..... 805-323-7714; 800-332-COIL
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311 818-885-8223
† Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† Texas Transformer Corp., Plano, TX 75086 214-424-1581
Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
§† Toko America, Inc., Mt. Prospect, IL 60056 312-297-0070
United Transformer Co.:Div. of Opt Industries Inc., Phillipsburg, NJ 08865 201-454-2600
† Vanguard Electronics Co., Gardena, CA 90248 213-323-4100
† Wirebenders, Inc., Phoenix, AZ 85021 602-861-1856

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§ Clairex Electronics, Clairex Corporation, Mt. Vernon, NY 10550, 914-664-6602 ..... B•1320
§ EG & G Vactec, St. Louis, MO 63132, 314-423-4900 ..... B•1321
NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1325-1326,1328-1331
§† Optek Technology Inc., McKinney, TX 75069, 214-542-9461 ..... B•1333
Opto Diode Corp., Newbury Park, CA 91320, 805-499-0335 ..... B•1334
Philips ECG, American Philips Co., Waltham, MA 02254, 617-890-6107 .. A•2197
† Silonex Inc., Plattsburgh, NY 12901, 518-561-3160 ..... B•1347
§ A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
A E G Corporation, Telefunken Semiconductors Div., Somerville, NJ 08876-1269 201-231-8300
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
† Gilway Technical Lamp, Woburn, MA 01801 617-935-4442
§† Honeywell Optoelectronics, Richardson, TX 75081 214-470-4271
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
† Micropac Inds., Inc., General Sensors Div., Garland, TX 75040 214-272-3571
§† Motorola Semiconductor Prods. Sector, Phoenix, AZ 85018-6606 602-244-6900
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Opto Technology, Inc., Wheeling, IL 60090 312-537-4277
Philips Electronics Ltd, Philips Comps., Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
Raytheon/TAG Semiconductors Ltd., Burlington, MA. 01803 ..... 617-272-3704 (3705)
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§† Teledyne Crystalonics, Teledyne Industries, Inc., Cambridge, MA 02140 617-491-1670
Thor Electronics, Linden, NJ 07036 201-486-3300

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Amperex Electronic Company, A Div. of North American Philips Corporation, Slatersville, RI 02876 401-762-3800
§† Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
§† General Electric Solid State Div., G.E. Corporation, Somerville, NJ 08876 201-685-6530
§† Germanium Power Devices, Andover, MA 01810 508-475-5982
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 408-433-2222
† International Rectifier Corp., Semiconductor Div., El Segundo, CA 90245 213-772-2000
§† Motorola Semiconductor Prods. Sector, Phoenix, AZ 85018-6606 602-244-6900
† Powertech, Inc., Fairlawn, NJ 07410 201-791-5050
§† Siliconix, Inc., Santa Clara, CA 95054 408-988-8000
§† Solitron Devices, Inc., Semiconductor Group, Riviera Beach, FL 33404-9978 407-848-4311
Sprague Electric Company, Distbn.Div., Mansfield, MA 02048-9102 617-339-8900
Texas Instrs., Data Sys. Group, Dallas, TX 75380-9063 1-800-527-3500
Thor Electronics, Linden, NJ 07036 201-486-3300

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† Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 .. 203-743-9272

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Fiberoptic Systems, Inc., Simi Valley, CA 93063, 805-583-2088 ..... B•1205
Interoptics, Purdy Group, Burlingame, CA 94010, 415-347-7727 ..... B•1214
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1208-1211
§† MERET, Inc., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1215
† Ross Engineering Corp., Campbell, CA 95008, 408-377-4621 ..... B•1217,1615, D•1340
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
AMP, Harrisburg, PA 17105 717-564-0100
§† APEC Fiber Optics Corp., College Station, TX 77840 409-693-5397
§ Artel Communications Corp., Hudson, MA 01749 617-562-2100
Avantek, Inc., Milpitas, CA 95035-7492 408-432-3080
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
§ Dymec Silicon Transistor Corp., Winchester, MA 01890 617-729-7870
† Fibronics International Inc., Communications Way, Hyannis, MA 02601-1892 508-778-0700
† Foundation Instruments Inc., Nepean, ON, CANADA K2E 7J6 613-226-4000
§ Fuji Electric Corp. of America, Los Angeles, CA 90017 213-622-4490
General Fiber Optics, Inc., Cedar Grove, NJ 07009 201-239-3400
GTE SUPPLY, GTE Communications Systems, Salt Lake City, UT 84116 800-433-4837
Hewlett-Packard Co., Cupertino, CA 95014 800-752-0900
§† Honeywell Optoelectronics, Richardson, TX 75081 214-470-4271
IPAC Grp., Bethel Pk, PA 15102 412-831-9200
§† Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
† Manage, Inc., Fibre Optics Elctrns. Sys. Grp., Chicopee, MA 01014 413-592-9123
† Math Assocs., Westbury, NY 11590 516-334-6800
3M Fiber Optic Products, Inc., W. Haven, CT 06516 203-934-7961
3 M Photodyne Inc., Camarillo, CA 93010 805-388-8378
§† Mikron Instr., Wyckoff, NJ 07481 201-891-7330
§ NEC Electronics, Inc., Mountain View, CA 94039 415-960-6000
† Optelecom, Inc., Gaithersburg, MD 20877 301-840-2121
† Ortel Corp., Alhambra, CA 91803 818-281-3636
§† SpecTran Corp., Sturbridge, MA 01566 508-347-2751
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† Vicon Industries, Inc., Melville, NY 11747 516-293-2200

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Analog Modules, Inc., Longwood, FL 32750, 407-339-4355 ..... D•1004
§ MERET, Inc., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1215
§ American Laser Systems, Inc., Goleta, CA 93117 805-967-0423
CATEL Telecommunications, Fremont, CA 94537 415-659-8988
§† Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
† Freed Transformer Co., Inc., Electronic Transformer Corp., Totowa, NJ 07511 201-942-2222
§† Laser Diode, Inc., Morgan Crucible, New Brunswick, NJ 08901 201-249-7000
† Ortel Corp., Alhambra, CA 91803 818-281-3636
Tektronix, Inc., Beaverton, OR 97077 800-835-9433

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§ Action Instruments, San Diego, CA 92123, 619-279-5726 ..... D•1157
§ Data Instruments, Inc., Acton, MA 01720, 508-264-9550 ..... B•1943
E-T-A Circuit Breakers, Chicago, IL 60648, 312-647-8303 ..... B•1956
§† NES, Inc. (Nationwide Electronic Systems), Carpentersville, IL 60110, 312-426-5900 ..... D•1153
§ Newport Electronics, Santa Ana, CA 92704-4426, 714-540-4914 .... D•1412-1413
Setra Systems, Inc., Acton, MA 01720, 508-263-1400;1-800-25-SETRA ..... B•1990-1992
§† Bailey Controls Co., Div. of Babcox & Wilcox, Wickliffe, OH 44092 216-585-8500
§ Beckman Industrial Corp., Emerson Electric Co., San Diego, CA 92123 .. 619-495-3200
Brooks Instrument Div., Emerson Elec. Co., Hatfield, PA 19440 215-362-3500
† Celesco Transducer Prods., Inc., Canoga Pk, CA 91304-5005 818-884-6860
§ Chessell Corp., Newtown, PA 18940 215-968-0660
Computer Instruments Div., Hempstead, NY 11550 516-483-8200
Controls Division, Ametek, Inc., Feasterville, PA 19047 215-355-6900
Degussa Corp., Temperature Sensing Products, So. Plainfield, NJ 07080 201-757-6500
DGH Corporation, Manchester, NH 03108 603-622-0452
Entran Devices, Fairfield, NJ 07006 ..... 201-227-1002;800-635-0650
§ Extech Instruments Corp., Waltham, MA 02154 617-890-7440
§ Fuji Electric Corp. of America, Los Angeles, CA 90017 213-622-4490
§ Hy-Cal Engineering, El Monte, CA 91731 818-444-4000
Kistler-Morse, Redmond, WA 98073 206-881-8000
† Kulite Semiconductor Prods., Inc., Leonia, NJ 07605 201-461-0900
Leeds & Northrup, General Signal, North Wales, PA 19454 215-699-2000
§ Love Controls Corp., Wheeling, IL 60090 312-541-3232
§† Mikron Instr., Wyckoff, NJ 07481 201-891-7330
Minco Products, Minneapolis, MN 55432 612-571-3121
§† MKS Instruments, Inc., Andover, MA 01810 508-975-2350
Omega Engineering, Stamford, CT 06907 800-826-6342
† Paine Corporation, Seattle, WA 98144 ..... 206-329-8600;800-426-0366
Princo Instruments, Inc., Southampton, PA 18966
Richard-Lee Co., Cranford, NJ 07016 201-276-0710
§† Robinson-Halpern Products, Transicoil, Inc., Plymouth Meeting, PA 19462-0248 215-825-9200
Schaevitz Engineering, Pennsauken, NJ 08110-1489 609-662-8000
§† Seaboard Electronics, New Rochelle, NY 10805 914-235-8073
Sensotec, Inc., Columbus, OH 43212 614-486-7723
§† Trans Metrics, Inc., Solon, OH 44139 216-248-2229
Validyne Engineering Corporation, Northridge, CA 91324 818-886-2057
Yokogawa Corp. of America, Newnan, GA 30265 404-253-7000

Transmitters, Radar — See Radar System Components (Vol. A)

Transmitters, Telemetry-1900 — *See Vol. D*

Transmitters, Tone-1900 — *See Vol. D*

Transmitters (MIL)-2440

Electronic Systems Div., Servo Corp. of America, Hicksville, NY 11802, 516-938-9700 ..... A•1782-1783
Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1208-1211
† Hazeltine Corp., Emerson Electric Co., Greenlawn, NY 11740 516-261-7000
† Microwave Systems Inc., Syracuse, NY 13211-2100 315-437-9951
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257

Transponders-1900 — *See Vol. D*

Transports, Tape (all kinds)-2000 — *See Vol. D*

TRIACs-4800 — *See Vol. A*

Triggers, SCR — See Controls, SCR (Vol. D)

Trimmers, Capacitor — See Capacitors, Variable, Padders & Trimmers (Vol. A)

Trimmers, Potentiometer — See Potentiometers, Trimmer (Vol. A)

Trimmers, Surface Mount, Capacitor-1500 — *See Vol. A*

Trimmers, Surface Mount, Potentiometer-4750 — *See Vol. A*

Tube Heat Dissipators-2600 — *See Vol. C*

Tubes, Ballast — See Resistors, Ballast (Vol. A)

Tubes, Cathode Ray, General Purpose-2450

World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1124
§ A.C. Interface Inc., Irvine, CA 92718 714-472-9524
Amperex Electronic Company, A Div. of North American Philips Corporation, Slatersville, RI 02876 401-762-3800
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., Deptford, NJ 08096 609-853-2525
Hitachi America, Ltd., San Jose, CA 95131 408-435-8300
Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
§ Mitsubishi Electronics, Torrance, CA 90502 213-217-5732
Philips Electronics Ltd, Philips Comps., Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§† Rank Brimar Inc., Scotts Valley, CA 95066 408-438-6440
Rauland-Zenith Electronics Corp., Melrose Pk, IL 60160 312-450-8992
Sam Sung Elctrn. Dvcs., America, Inc., La Mirada, CA 90638 213-802-8425
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
Tektronix, Inc., Display Devices Operation, Beaverton, OR 97077 ..... 503 627 6868
Thomas Electronics, Inc., Wayne, NJ 07470 201-696-5200
§ Thomson Electron Tubes & Devices Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000
Thor Electronics, Linden, NJ 07036 201-486-3300
† Zenith CRT & Components Operations, Glenview, IL 60025 312-391-7733

Tubes, Cathode Ray, Special Purpose-2450

World Products Inc., Systems Devices Grp., Sonoma 95476, 707-996-5201 ..... B•1124
Hitachi America, Ltd., San Jose, CA 95131 408-435-8300
Hughes Aircraft Co., Industrial Products Division, Carlsbad, CA 92009 ... 619-931-3000
† Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
† Litton Electron Devices, San Carlos, CA 94070 415-591-8411
§ Mitsubishi Electronics, Torrance, CA 90502 213-217-5732
§† Rank Brimar Inc., Scotts Valley, CA 95066 408-438-6440
Rauland-Zenith Electronics Corp., Melrose Pk, IL 60160 312-450-8992
† Raytheon Co., Microwave & Power Tube Div., Waltham, MA 02154 617-899-8400
Tektronix, Inc., Beaverton, OR 97077 800-835-9433
Tektronix, Inc., Display Devices Operation, Beaverton, OR 97077 ..... 503 627 6868
Thomas Electronics, Inc., Wayne, NJ 07470 201-696-5200
§ Thomson Electron Tubes & Devices Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000
Thor Electronics, Linden, NJ 07036 201-486-3300
† Zenith CRT & Components Operations, Glenview, IL 60025 312-391-7733

Tubes, Counting-2200 — *See Vol. D*

Tubes, Flash-3700

† EEV Inc., Elmsford, NY 10523 914-592-6050
EG&G, Inc., Electro-Optics Div., Salem, MA 01970 508-745-3200
§ Shokai Far East, Ltd., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400

Thor Electronics, Linden, NJ 07036 201-486-3300
§ Xenon Corp., Woburn, MA 01801 617-938-3594

Tubes, Ignitron-2200 — *See Vol. D*

Tubes, Image Converter-2450

§ A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
† EEV Inc., Elmsford, NY 10523 914-592-6050
ElectroPhysics Corp., Nutley, NJ 07110 201-667-2262
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Hitachi America, Ltd., San Jose, CA 95131 408-435-8300
Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
§ IR Scientific, Carlisle, MA 01741 508-667-7110
§ Thomson Electron Tubes & Devices Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000
Thor Electronics, Linden, NJ 07036 201-486-3300
§† Varo Electron Devices:An Imo Inds. Co., Garland, TX 75046 214-487-4129

Tubes, Indicator — See Tubes, Readout (Vol. B)

Tubes, Magnetron — See Tubes, Microwave (Vol. A)

Tubes, Microwave-3400 — *See Vol. D*

Tubes, Photomultiplier-3700

† Centronic, Inc., Morgan Crucible Co., Electronics Div., Newbury Park, CA 91320-1702 805-499-5902
Ealing Electro-Optics, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., San Diego, CA 92123 619-279-8034
Gamma Scientific Inc., San Diego, CA 92123 619-279-8034
Hamamatsu Corporation, Bridgewater, NJ 08807 201-231-0960
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Thor Electronics, Linden, NJ 07036 201-486-3300
§† Thorn EMI Electron Tubes Inc., Fairfield, NJ 07006 201-575-5586

Tubes, Readout (CRT, Cold-Cathode, Vacuum Fluorescent, Incandescent, etc.)-2450

Infodex, Inc., Wolcott, CT 06716, 203-879-4944 ..... B•1010-1011,1088
§ NEC Electronics, Inc., Mountain View, CA 94039, 415-960-6000 ..... B•1093
§ A E G Corporation, Somerville, NJ 08876-1269 201-231-8300
† Displays, Inc., Lewistown, PA 17044 717-242-2541
† EEV Inc., Elmsford, NY 10523 914-592-6050
† Electronics Research Associates Inc., Winsted, CT 06098 203-379-2731
§ Futaba Corporation of America, Electronic Components Div., Schaumburg, IL 60173 312-884-1444
Hitachi America, Ltd., San Jose, CA 95131 408-435-8300
§ IEE (Industrial Electronic Engineers), Van Nuys, CA 91405 818-787-0311
Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
§ Mitsubishi Electronics, Torrance, CA 90502 213-217-5732
Rauland-Zenith Electronics Corp., Melrose Pk, IL 60160 312-450-8992
Tektronix, Inc., Display Devices Operation, Beaverton, OR 97077 ..... 503 627 6868
§† Teltron, Inc., Birdsboro, PA 19508 215-582-2711
§ Thomson Electron Tubes & Devices Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000
Thor Electronics, Linden, NJ 07036 201-486-3300

Tubes, Strobe — See Lamps, Stroboscopic Source (Vol. B)

Tubes, TV Camera Pickup-3700

† Amperex Electronic Company, A Div. of North American Philips Corporation, Slatersville, RI 02876 401-762-3800
ATV Research, Inc., Dakota City, NE 68731 402-987-3771
† EEV Inc., Elmsford, NY 10523 914-592-6050
Hamamatsu Photonics K.K., Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Hitachi America, Ltd., San Jose, CA 95131 408-435-8300
† Imaging & Sensing Technology Corp., Horseheads, NY 14845 607-796-3372
Philips Electronics Ltd, Philips Comps., Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§† Teltron, Inc., Birdsboro, PA 19508 215-582-2711
§ Thomson Electron Tubes & Devices Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000
Thor Electronics, Linden, NJ 07036 201-486-3300
§† Vicon Industries, Inc., Melville, NY 11747 516-293-2200

Tubes, Transmitting-1900 — *See Vol. D*

Tubes, X-ray-2200 — *See Vol. D*

Tubes (MIL), Indicator & Pickup-2440

† EEV Inc., Elmsford, NY 10523 914-592-6050
§† Teltron, Inc., Birdsboro, PA 19508 215-582-2711

Tubes (MIL), Microwave-2440

† Litton Electron Devices, San Carlos, CA 94070, 415-591-8411 .. A•1786, B•1021
† EEV Inc., Elmsford, NY 10523 914-592-6050
Hughes Aircraft Co., Electron Dynamics Div., Torrance, CA 90509-2999 213-517-6000
Thomson Electron Tubes & Devices Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000
† VTM Microwaves, Inc., Westminster, CO 80030 303-426-6866

Tubes (MIL), Power & Gas, Planar-2440

Litton Electron Devices, San Carlos, CA 94070, 415-591-8411 ..... B•1021
† EEV Inc., Elmsford, NY 10523 914-592-6050

Tubes (MIL), Receiving, & Tube Shields-2440

Litton Electron Devices, San Carlos, CA 94070, 415-591-8411 ..... B•1021
Dearborn Wire & Cable, Inc., Wheeling, IL 60090 ..... 312-459-1000;800-323-0198
† EEV Inc., Elmsford, NY 10523 914-592-6050

Tubing, Ceramic-2500 — *See Vol. C*

Tubing, Fiberglass-2800 — *See Vol. C*

Tubing, Glass-2500 — *See Vol. C*

Tubing, Heat Shrinkable-Also See Caps, Forms & Tapes, Heat Shrinkable-2500 — *See Vol. C*

Tubing, Metal-2500 — *See Vol. C*

Tubing, Paper-2500 — *See Vol. C*

Tubing, Plastic-Also See Tubing, Spaghetti-2500 — *See Vol. C*

Tubing, Spaghetti-2500 — *See Vol. C*

Tubing, Spiral Wrap-2500 — *See Vol. C*

Tubing, Waveguide-3450 — *See Vol. A*

Tubing, Zipper-2500 — *See Vol. C*

Tuners, AM/FM-1300 — *See Vol. D*

Tuners, Microwave-3450 — *See Vol. A*

Tuning Forks-2300 — *See Vol. A*

Tweezers, Manual & Vacuum-5400 — *See Vol. C*

Ultraviolet Inspection Lighting-Also See Microscopes, Ultraviolet-4100 — *See Vol. D*

Urea Formaldehyde — See Plastic Raw Materials (Vol. C)

Valve Position Indicators/Transmitters-5500

ETI Systems, Polaris Indl. Entprs., Oceanside, CA 92054, 619-757-7770 ..... B•1242-1244
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ APEC Fiber Optics Corp., College Station, TX 77840 409-693-5397
§ Jamesbury Corp., Div. of Combustion Engineering, Inc., Worcester, MA 01605 617-852-0200
† Lisk, G. W., Co., Clifton Springs, NY 14432 315-462-2611
§ Norgren, Littleton, CO 80120-1663 303-794-2611
Regdon Solenoid, Inc., Westmont, IL 60559 312-789-0600

Valve Positioners & Actuators-4750 — *See Vol. A*

Valves, Solenoid-4550

§ Deltrol Controls, Milwaukee, WI 53215, 414-671-6800 ..... B•1659-1660
ETI Systems, Polaris Indl. Entprs., Oceanside, CA 92054, 619-757-7770 ..... B•1244
Lucas Ledex Inc., Vandalia, OH 45377-0427, 513-898-3621 ..... B•1669
Regdon Solenoid, Inc., Westmont, IL 60559, 312-789-0600 ..... B•1670
§† Automatic Switch Co., Florham Park, NJ 07932 1-201-966-2000
§† Barksdale Controls Div., Imc Delaval Inc., Los Angeles, CA 90058 213-589-6181
Bosch, Robert, Corp., Broadview, IL 60153 312-865-5200
§ Crouzet Controls, Inc., Schaumburg, IL 60173-5419 312-843-2200
† EEMCO Div., Datron Systems Inc., Los Angeles, CA 90039 818-247-7060
† Electronic Specialty Corp., Vancouver, WA 98665 206-574-5000
§ Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
§ Jamesbury Corp., Div. of Combustion Engineering, Inc., Worcester, MA 01605 617-852-0200
† Lisk, G. W., Co., Clifton Springs, NY 14432 315-462-2611
§ Magnatrol Valve Corp., Hawthorne, NJ 07507 201-427-4341
Mallory Timers, Emhart Elec./Elctrn. Grp., Indianapolis, IN 46201 317-636-5353
Norgren, Littleton, CO 80120-1663 303-794-2611
Parker Hannifin Corp., Cleveland, OH 44112-1290 216-531-3000
§† Snaptite/Allied, Erie, PA 16505 814-833-6131
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 714-554-4200
Veeco Instruments Inc., Plainview, NY 11803 516-349-8300

Valves, Vacuum-4100 — *See Vol. D*

Varactors — See Diodes, Varactor (Vol. A)

Varistors — See Resistors, Voltage Sensitive (Vol. A)

VCXO — See Oscillators, Voltage Controlled Crystal

VHF Equipment — See Generators (Vol. D), Receivers (Vol. D), etc.

Vibration Surveys — See Services, Vibration Surveys (Vol. D)

Vibration Test Systems — See Testers, Vibration (Vol. D)

Vibrators-4050 — *See Vol. D*

Video Components & Equipment — See Specific Component: Amplifiers (Vol. D), Cameras (Vol. D), Networks (Vol. D), etc.

Viewers (MIL)-2440

ElectroPhysics Corp., Nutley, NJ 07110 201-667-2262
† IR Scientific, Carlisle, MA 01741 508-667-7110
§† Mikron Instr., Wyckoff, NJ 07481 201-891-7330

Viewing Hoods, Cathode Ray Tube-2975 — *See Vol. D*

Vinyl Compounds — See Plastic Raw Materials (Vol. C)

Vises-5400 — *See Vol. C*

Visual Micro Inspection Systems-2900 — *See Vol. D*

VLF Equipment — See Receivers (Vol. D), Transmitters (Vol. D), etc.

VME Bus Cards-2025 — *See Vol. D*

Voice Recognition Equipment — See Recognition Equipment, Speech (Vol. D)

Voltage Selector — See Adaptors, US to European Power (Vol. C)

Voltage Sources-4000 — *See Vol. D*

Voltmeter, Electrostatic-2900 — *See Vol. D*

Wafer Fabrication, Semiconductor — See Semiconductor Wafer Fabrication (Vol. D)

Wall Plates — See Boxes, Junction, Outlet & Wall Plates (Vol. C)

Warning Systems, Lightning-4300

K-Tronics, K. T. Elctrns. Inc., Sunnyvale, CA 94086, 1-800-888-ELCO ... B•1375
Avex Electronics, Bensalem, PA 19020 ... 215-638-1515;800-345-1295
Mauell Corp., Dillsburg, PA 17019 ... 717-432-8686
Rodann Electronics Mfg. Co., Brea, CA 92621 ... 714-529-1301

Warning Systems (MIL)-2440

† American Electronic Laboratories, Inc., Lansdale, PA 19446 ... 215-822-2929
† Digital Radio Corp., Redondo Beach, CA 90277 ... 213-316-4114
† E-Systems, Greenville Div., Greenville, TX 75401 ... 214-455-3450
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 ... 516-933-3000
† Systems Research Laborotories, Arvin/Calspan, Dayton, OH 45440 ... 513-426-6000
† Teledyne Ryan Electronics, San Diego, CA 92123 ... 619-560-6400

Washers, Lock-2500 — *See Vol. C*

Washers, Plain-2500 — *See Vol. C*

Washers, Shoulder-2500 — *See Vol. C*

Waveguide-Coax Adapters-3450 — *See Vol. A*

Waveguides-3450 — *See Vol. A*

Waveguides (MIL)-2440

Litton Electron Devices, San Carlos, CA 94070, 415-591-8411 ... B•1021
† Ark Elctrns. Corp., Southampton, PA 18966 ... 215-322-6510
§† Dielectric Communications, General Signal, Raymond, ME 04071 ... 207-655-4555; 800-341-9678
† International Telecommunications Components, Inc., Deer Park, NY 11729 ... 516-243-1444
Lectronic Research Labs., Inc., Camden, NJ 08104 ... 609-541-4200
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ... 514-694-6666
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ... 516-549-6415/6102

Wave Soldering Equipment — See Soldering Equip, Printed Circuit (Vol. C)

Wave Traps — See Filters, Antenna (Vol. A), Filters, Microwave (Vol. A), etc.

Welding Equipment & Accessories (Excl. Equipment for Semiconductor Devices)-5400 — *See Vol. C*

Welding Machines, Laser-4100 — *See Vol. D*

White Noise Generator Modules — See Generators, White Noise (Vol.), Diodes, Noise

White Printers-4200 — *See Vol. C*

Windows, Sapphire-2500 — *See Vol. C*

Windows, Shielded — See Shields, RF (Vol. C)

Wire & Cable Ties-2500 — *See Vol. C*

Wire, Airframe-2440

§† Brim Electronics, Fair Lawn, NJ 07410, 201-796-2886 ... C•1820
§† Judd Wire Inc., Turners Falls, MA 01376, 413-863-4357 ... C•1865
MWS Wire Industries, Westlake Village, CA 91362, 818-991-8553 ... C•1882
† Barcel Wire & Cable Corp., Electronics Div., Irvine, CA 92714 ... 714-863-0300
§† Belden Wire and Cable, Cooper Industries, Richmond, IN 47375 ... 317-983-5200; 800-BELDEN-1
† BRIntec Corp., Brand-Rex Cable Systems Division, Willimantic, CT 06226-1128 ... 203-456-8000
§† Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412 ... 312-455-8830
§ Custom Cable Corp., Westbury, NY 11590 ... 516-334-3600
§† Daburn Electronics & Cable Corp., Northvale, NJ 07647 ... 201-768-5400
§† Dearborn Wire & Cable, Inc., Wheeling, IL 60090 ... 312-459-1000;800-323-0198
† Electro Weave, Worcester, MA 01604 ... 617-752-8932
§† FL Surprenant Div., Clinton, MA 01510 ... 617-368-1401
† General Wire Products, Inc., Worcester, MA 01604 ... 617-752-8260
† W. L. Gore & Assocs., Newark, DE 19714 ... 302-738-4880
† GSI Corp., Timonium, MD 21093 ... 301-252-1768
Judd Wire Inc., San Marcos, CA 92069 ... 619-744-7720
§† Olympic Wire & Cable, Fairfield, NJ 07006 ... 201-227-7996
§† Philadelphia Insulated Wire Co. Inc., Moorestown, NJ 08057 ... 609-235-6700
† Plastoid Corporation, Hamburg, NJ 07419 ... 201-827-7141
§† Specialty Cable Corporation, Wallingford, CT 06492 ... 800-456-SPEC
§† Standard Wire & Cable Co., Rancho Dominguez, CA 90220 ... 213-609-1811; 800-447-0006/821-527
Storm Products Co., Hinsdale, IL 60521 ... 312-323-9121
§† Tensolite Company, Subsidiary of Carlisle Corp., Buchanan, NY 10511 ... 914-737-5600
† Thermax Wire Corp., Flushing, NY 11354-2897 ... 718-939-8300
† United Wire & Cable Corp., Worcester, MA 01604 ... 617-757-3872
† Victor Wire & Cable Corp., Los Angeles, CA 90016 ... 213-870-9933

Wire, Antenna (All Types)-6000 — *See Vol. C*

Wire, Bare, Copper-6000 — *See Vol. C*

Wire, Bare, Nickel-6000 — *See Vol. C*

Wire, Bare, Nickel-Chrome-6000 — *See Vol. C*

Wire, Bonding-6000 — *See Vol. C*

Wire, Braid (Excluding Shielding)-6000 — *See Vol. C.*

Wire, Braid (Shielding) — See Braid, Cable (Vol. C)

Wire, Ceramic Insulated-6000 — *See Vol. C*

Wire, Clad (All Types)-6000 — *See Vol. C*

Wire Cutting & Stripping — See Services, Wire Cutting & Stripping (Vol. D)

Wire, Enamel Insulated — See Wire, Hookup (All Types) (Vol. C)

Wire, Fiberglass Insulated — See Wire, Glass Insulated (Vol. C)

Wire, Flame Retardant-6000 — *See Vol. C*

Wire, Flat Strip — See Cable, Flat (Vol. C)

Wire, Glass Insulated-6000 — *See Vol. C*

Wire, Gold-2500 — *See Vol. C*

Wire, Guy-6000 — *See Vol. C*

Wire, Heater — See Cable, Heater (Vol. C)

Wire, High Temperature (Over 125 + C)-6000 — *See Vol. C*

Wire, High Voltage (1000 Volts & Over)-6000 — *See Vol. C*

Wire, Hookup (All Types)-6000 — *See Vol. C*

Wire, Irradiated-6000 — *See Vol. C*

Wire, Lead-in & Ground-6000 — *See Vol. C*

Wire, Litz-6000 — *See Vol. C*

Wire, Magnet-6000 — *See Vol. C*

Wire Markers (All Types)-Also See Strips Marker & Fanning-6000 — *See Vol. C*

Wire, Multiconductor — See Cable, Multiconductor (Vol. C)

Wire Nuts-2500 — *See Vol. C*

Wire, Plastic Insulated — See Wire, Hookup (All Types) (Vol. C)

Wire, Plated (All Types)-6000 — *See Vol. C*

Wire, Radiation Resistant-6000 — *See Vol. C*

Wire, Resistance-6000 — *See Vol. C*

Wire, Semiconductor Lead-6000 — *See Vol. C*

Wire, Shielded-6000 — *See Vol. C*

Wire Shielding-Also See Braid, Cable-4525 — *See Vol. C*

Wire, Stainless Steel-6000 — *See Vol. C*

Wire, Strain Gauge-6000 — *See Vol. C*

Wire Connectors-2100 — *See Vol. C*

Wire Strippers, Automatic-4100 — *See Vol. D*

Wire Strippers, Chemical — See Chemicals, Wire Stripping (Vol. C)

Wire Strippers, Manual-5400 — *See Vol. C*

Wire Strippers, Thermal-5400 — ***See Vol. C***

Wire, Test Lead-6000 — ***See Vol. C***

Wire, TFE Insulated-6000 — ***See Vol. C***

Wire, Thermocouple-6000 — ***See Vol. C***

Wire, Transmission — See Cable, Transmission Line (Vol. C)

Wire, Twisted Pair — See Cable, Twisted Pair (Vol. C)

Wire (MIL)-2440

ABL Electronics Supply, Inc., Yorktown Hgts., NY 10598, 914-962-2253 ..... C•1762

§† **American Insulated Wire Corp., Leviton Mfg. Co., Pawtucket, RI 02862, 401-726-0700** ..... C•1763

§† **Brim Electronics, Fair Lawn, NJ 07410, 201-796-2886** ..... C•1820

Caton Connector Corp., Kingston, MA 02364, 617-585-4315 ..... C•1304

§† **Daburn Electronics & Cable Corp., Northvale, NJ 07647, 201-768-5400** .. C•1848

§† **Judd Wire Inc., Turners Falls, MA 01376, 413-863-4357** ..... B•1019

Mueller Elec. Co., Cleveland, OH 44114, 216-771-5225 ..... C•1458

MWS Wire Industries, Westlake Village, CA 91362, 818-991-8553 ..... C•1882

National Wire & Cable Corp., Los Angeles, CA 90031-1780, 213-225-5611 ..... C•1887-1889

§† Alpha Wire Corp., Elizabeth, NJ 07207-0711 201-925-8000

§† American Wire & Electronics, Costa Mesa, CA 92626 714-957-6905

Carol Cable Co. Inc., Pawtucket, RI 02862 401-724-9605

§† Consolidated Electronic Wire & Cable, Franklin Park, IL 60131-1412 312-455-8830

§ Cooner Wire Co., Chatsworth, CA 91311 818-882-8311

† DataCon, Inc., Burlington, MA 01803 617-273-5800

Dearborn Wire & Cable, Inc., Wheeling, IL 60090 ..... 312-459-1000;800-323-0198

† Gavitt Wire & Cable, Brookfield, MA 01506 508-867-6476

General Electric Co., Accessory Equipment Plant, Bridgeport, CT 06602 203-382-2000

§ International Wire Products Co., Wyckoff, NJ 07481 201-891-5800

§† Judd Wire Inc., San Marcos, CA 92069 619-744-7720

Lynn Electronics, Feasterville, PA 19047 ..... 215-677-6700;800-523-6075

† Markel Corp., Norristown, PA 19404 215-272-8960

† Molecu-Wire, Farmingdale, NJ 07727 201-938-9473

Raychem Corp., Elctrns. Grp., Menlo Park, CA 94025 415-361-3860

§† Specialty Cable Corporation, Wallingford, CT 06492 ..... 800-456-SPEC

§† Standard Wire & Cable Co., Rancho Dominguez, CA 90220 ..... 213-609-1811; 800-447-0006/821-527

§† Whitmor Wire & Cable, Valencia, CA 91355 805-257-2400

§† Wilco Wire & Cable Co., Inc., San Jose, CA 95133 408-926-8880

Wire Twisters, Automatic-5400 — ***See Vol. C***

Wire Twisters, Manual-5400 — ***See Vol. C***

Wire Ways-6000 — ***See Vol. C***

Wirewrapping Services — See Services, Wirewrapping (Vol. D)

Wiring Panels & Boards, Computer — See Boards, Programming (Vol. C)

Word Processors, Shared Logic Systems-2025 — ***See Vol. D***

Word Processors, Standalone Systems-2025 — ***See Vol. D***

Work Positioners, Circuit Board & Chassis — See Holders, Circuit Board (Vol. D), Jigs (Vol. D)

Work Room, Shielded-1400 — ***See Vol. C***

Work Stations, Computer-2000 — ***See Vol. D***

Work Stations, Laminar Flow-4100 — ***See Vol. D***

Work Stations/Decks, Data Entry-1400 — ***See Vol. C***

Wrenches-5400 — ***See Vol. C***

X-ray Detector Arrays (For Industrial Inspections)-4100 — ***See Vol. D***

X-ray Imaging System-4100 — ***See Vol. D***

X-ray Inspection Equipment-4100 — ***See Vol. D***

X-Y Axis Tables — See Simulators, Motion (Vol. D)

X-Y-Z Systems, Programmable-2550 — ***See Vol. D***

Yokes, Deflection, CRT-1800 — ***See Vol. A***

Yokes, Deflection, Oscilloscope-1800 — ***See Vol. A***

Yokes, Deflection, Radar PPI-1800 — ***See Vol. A***

Yokes, Deflection, TV Camera-1800 — ***See Vol. A***

Zener Diodes — See Diodes, Zener

Zone Boxes, Thermocouple — See Thermocouples, Elements & Accessories (Vol. B)

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

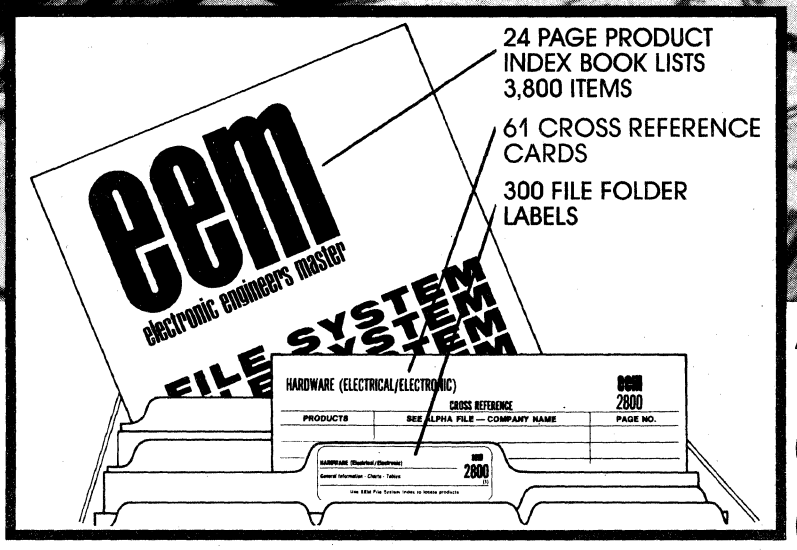
U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force



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MINIGLOSSARY
BASIC ASCII CODE

				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

Control Character Representations

NUL	Null
SOH	Start of Heading (CC)
STX	Start of Text (CC)
ETX	End of Text (CC)
EOT	End of Transmission (CC)
ENQ	Enquiry (CC)
ACK	Acknowledge (CC)
BEL	Bell
BS	Backspace (FE)
HT	Horizontal Tabulation (FE)
LF	Line Feed (FE)
VT	Vertical Tabulation (FE)
FF	Form Feed (FE)
CR	Carriage Return (FE)
SO	Shift Out
SI	Shift In
DLE	Data Link Escape (CC)
DC1	Device Control 1
DC2	Device Control 2
DC3	Device Control 3
DC4	Device Control 4
NAK	Negative Acknowledge (CC)
SYN	Synchronous Idle (CC)
ETB	End of Transmission Block (CC)
CAN	Cancel
EM	End of Medium
SUB	Substitute
ESC	Escape
FS	File Separator (IS)
GS	Group Separator (IS)
RS	Record Separator (IS)
US	Unit Separator (IS)
DEL	Delete

(CC) Communication Control
(FE) Format Effector
(IS) Information Separator

Special Graphic Characters

SP	Space
!	Exclamation Point
|	Logical OR
"	Quotation Marks
#	Number Sign
$	Dollar Sign
%	Percent
&	Ampersand
'	Apostrophe
(	Opening Parenthesis
)	Closing Parenthesis
*	Asterisk
+	Plus
,	Comma
-	Hyphen (Minus)
.	Period (Decimal Point)
/	Slant
:	Colon
;	Semicolon
<	Less Than
=	Equals
>	Greater Than
?	Question Mark
@	Commercial At
[	Opening Bracket
\	Reverse Slant
]	Closing Bracket
^	Circumflex
¬	Logical NOT
_	Underline
`	Grave Accent
{	Opening Brace
¦	Vertical Line (This graphic is stylized to distinguish it from Logical OR)
}	Closing Brace
~	Tilde

CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a]	
						Wh/kg	Wh/dm³
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-	NA	S	2.1	685	1.8	200	[h]
temperature	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

a Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.
b Based on fuel consumption only.
c Weight of air not considered in computation of watt hours.
d Water-activated
e Automatically activated; high rate discharge; 2- to 10-min rate.
f Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.
g Four-minute discharge rate.
h β-alumina electrolyte, 300°C operation.
i Fused salt; 350°C operation.
j Solid $RbAg_4I_5$ electrolyte.
k Several different cathode materials used.
l Fuel consumption is based on source of H_2.
m Based on methanol battery-fuel supply in situ.

MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

			Tolerance					
			Class 1					
Color	Digit	Multiplier	10pF or less	Over 10pF	Class 2	Temperature Coefficient ppm°C	Significant Figure	Multiplier
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

MINIGLOSSARY BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\ K\ A}{t_D}$

Metric: $C = \frac{.0884\ K\ A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\ CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\pi fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\pi fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta\ (\text{loss angle}) = \frac{ESR}{X_c} = (2\pi fC)\ (ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos ϕ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan}\ \delta\ (\text{loss angle}) = \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\ (Xc) = (DF)\ (\frac{1}{2}\pi fC)$

XII. Power Loss (watts)

Power loss = $(2\pi fCV^2)$ (DF)

XIII. KVA (Kilowatts)

$KVA = 2\pi fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\ (T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_O}{L_t} = \left(\frac{V_t}{V_O}\right)^x \quad \left(\frac{T_t}{T_O}\right)^\tau$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \text{---} + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\ C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \text{---} + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

Metric prefixes:

Pico	$\times 10^{-12}$
Nano	$\times 10^{-9}$
Micro	$\times 10^{-6}$
Milli	$\times 10^{-3}$
Deci	$\times 10^{-1}$
Deca	$\times 10$
Kilo	$\times 10^{3}$
Mega	$\times 10^{6}$
Giga	$\times 10^{9}$
Tera	$\times 10^{12}$

Symbols:

K	=	Dielectric Constant
A	=	Area of electrode overlap
t_D	=	Dielectric thickness
V	=	Voltage (volts)
t	=	time (hours)
R_S	=	Series Resistance (ohms)
f	=	frequency (Hertz)
L	=	Inductance (henries)
δ	=	Loss angle
ø	=	Phase angle
x+y	=	Exponent effect of voltage and temperature
L_O	=	Operating life (hours)
L_t	=	Test life (hours)
V_t	=	Test voltage (volts)
V_o	=	Operating voltage (volts)
T_t	=	Test temperature (°C)
T_o	=	Operating temperature (°C)

EEM MINIGLOSSARY CONNECTORS

Connector terminology is often quite confusing. This confusion starts with the very names of connectors. The name of a connector may derive from its shape, application, type of conductor or even method of termination.

Shape—Circular, cylindrical, and rectangular.

Electrical application—High voltage, RF, microwave, input/output, etc.

Mechanical application—Printed circuit, rack & panel, cable, etc.

Conductor type—Coaxial, flat cable, ribbon cable, flex circuit, etc.

Termination method—Wirewrap, soldercup, solderless, etc.

Hardware such as clamps, hoods, and adapters are frequently used to convert cable connectors to rack and panel types. This adds to the name confusion. A very common telephone connector, for example (the "C" type) got its name from the model number of the original maker.

Contact: The part(s) of the connector that actually provides circuit continuity between its two sections—the parts which are normally mated. The back end of the connector should properly be called the *termination*. This is the point where the wires or PC board is attached to the connector.

Contact alignments: Often called *contact float*. Describes the amount of allowable contact movement within the connector body. Permits self-alignment.

Male vs. female: In the U.S. this describes the contact construction. In Europe this term is more often used to describe the outer shell mating action which may be the reverse of the contacts.

Closed entry: A female contact which prevents entry of a male contact larger than a specific size.

Open entry: A female contact designed for a specific size of male contact but which will allow entry of larger male contacts by spring action.

Hermaphrodite: Contacts or connector bodies which are the same configuration. Male/female designations do not apply. Bodies usually have some mechanical means for maintaining polarity.

Hermetic seal: Glass-to-metal seals at terminations. Often used improperly to describe vacuum-tight seals.

Waterproof seal: May or may not be truly *waterproof*. May prevent easy entrance of casual water by means of a rubber or other boot.

Printed circuit connector: Connectors which are used in conjunction with printed circuit boards. There are two distinctly different styles.

Edgeboard. May be called *edge* or *card*. The printed circuit (PC) board edge enters the connector.

Two-piece: One part of the connecting pair is physically attached to the PC board itself. The other part is attached to something else such as a cable or a motherboard.

Readout: Describes the arrangement at the terminating edge of a PC board. May be single or double. A double readout PC board has termination strips on each side not usually interconnected.

Ribbon connectors: A type of connector which allows flat "ribbon" cable to be attached to a round or rectangular connector but also used interchangeably for flat connectors to flat cable.

Ribbon contact connector: Describes the contacts in a rectangular connector which have a self-wiping mating action. Not the same as ribbon connector.

Solderless terminal: Any style of termination which does not require solder for a permanent connection. See *crimp* and *insulation displacement*.

Crimp termination: A stripped wire is inserted into a barrel or trough which is then crimped to the conductor with a suitable tool.

Insulation displacement: Unstripped insulated wire is fitted into a channel containing metal teeth which are forced through the insulation to make contact with the conductor.

Service rating: The maximum rated voltage and/or current which may be applied continuously. May be called *working voltage*. Can be confused with the term used to describe how many times a connector may be mated and separated.

Withstanding voltage: Also called *test voltage*. The voltage a connector must withstand for one minute without breakdown. Applied between connectors and between connectors and shell and any grounding devices of the connector.

MAXIMUM CURRENT CAPACITY—CONDUCTORS

Size, AWG	MIL-W-5088				National Electrical Code	Underwriters Laboratory		American Insurance Association	500 c mils/A
	Copper		Aluminum			60°C	80°C		
	Single-wire	Wire-bundled	Single-wire	Wire-bundled					
30	...	...	...	...	...	0.2	0.4	...	0.20
28	...	...	...	...	...	0.4	0.6	...	0.32
26	...	...	...	...	...	0.6	1.0	...	0.51
24	...	...	...	...	...	1.0	1.6	...	0.81
22	9	5	...	...	...	1.6	2.5	...	1.28
20	11	7.5	...	...	...	2.5	4.0	3	2.04
18	16	10	...	...	6	4.0	6.0	5	3.24
16	22	13	...	...	10	6.0	10.0	7	5.16
14	32	17	...	...	20	10.0	16.0	15	8.22
12	41	23	...	...	30	16.0	26.0	20	13.05
10	55	33	...	...	35	...	...	25	20.8
8	73	46	58	36	50	...	...	35	33.0
6	101	60	86	51	70	...	...	50	52.6
4	135	80	108	64	90	...	...	70	83.4
2	181	100	149	82	125	...	...	90	132.8
1	211	125	177	105	150	...	...	100	167.5
0	245	150	204	125	200	...	...	125	212.0
00	283	175	237	146	225	...	...	150	266.0
000	328	200	...	...	275	...	...	175	336.0
0000	380	225	...	...	325	...	...	225	424.0

MINIGLOSSARY BASIC EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11				
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hexadecimal Digit
			12				12	12		12	12	12		12	12				Zone Punches
				11				11	11	11		11	11	11		11			
					0		0		0	0	0		0	0			0		
			9	9	9	9	9	9	9	9									Digit Punches
			①	②	③	④	⑤	⑥	⑦	⑧					⑨	⑩	⑪	⑫	
0000	0	8-1	NUL	DLE	DS		SP	&	-									0	8-1
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7
1000	8	8		CAN							h	q	y		H	Q	Y	8	8
1001	9	8-1		EM							;	r	z		I	R	Z	9	9
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6
1111	F	8-7	SI	IUS	BEL	SUB	I	¬	?	"									8-7
			12				12				12	12		12	12	12		12	Zone Punches
				11				11				11	11	11		11	11	11	
					0				0		0		0	0	0		0	0	
			9	9	9	9									9	9	9	9	

Card Hole Patterns

①	12-0-9-8-1	⑤	No-Punches	⑨	12-0	⑬	0-1
②	12-11-9-8-1	⑥	12	⑩	11-0	⑭	11-0-9-1
③	11-0-9-8-1	⑦	11	⑪	0-8-2	⑮	12-11
④	12-11-0-9-8-1	⑧	12-11-0	⑫	0		

Control Character Representations

ACK	Acknowledge	EOT	End of Transmission	PF	Punch Off
BEL	Bell	ESC	Escape	PN	Punch On
BS	Backspace	ETB	End of Transmission Block	RES	Restore
BYP	Bypass	ETX	End of Text	RS	Reader Stop
CAN	Cancel	FF	Form Feed	SI	Shift In
CC	Cursar Control	FS	Field Separator	SM	Set Mode
CR	Carriage Return	HT	Horizontal Tab	SMM	Start of Manual Message
CU1	Customer Use 1	IFS	Interchange File Separator	SO	Shift Out
CU2	Customer Use 2	IGS	Interchange Group Separator	SOH	Start of Heading
CU3	Customer Use 3	IL	Idle	SOS	Start of Significance
DC1	Device Control 1	IRS	Interchange Record Separator	SP	Space
DC2	Device Control 2	IUS	Interchange Unit Separator	STX	Start of Text
DC4	Device Control 4	LC	Lower Case	SUB	Substitute
DEL	Delete	LF	Line Feed	SYN	Synchronous Idle
DLE	Data Link Escape	NAK	Negative Acknowledge	TM	Tape Mark
DS	Digit Select	NL	New Line	UC	Upper Case
EM	End of Medium	NUL	Null	VT	Vertical Tab
ENQ	Enquiry				

Special Graphic Characters

¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
|	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

MINIGLOSSARY ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise.* The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

Insulation resistance: (IR) An insulating material's total DC leakage.

Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.

MINIGLOSSARY OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

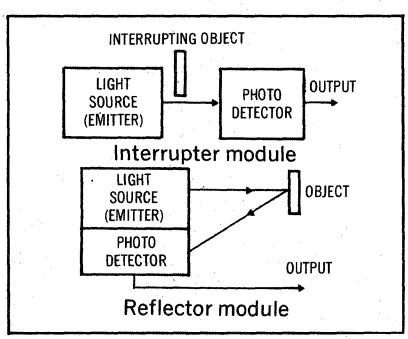
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

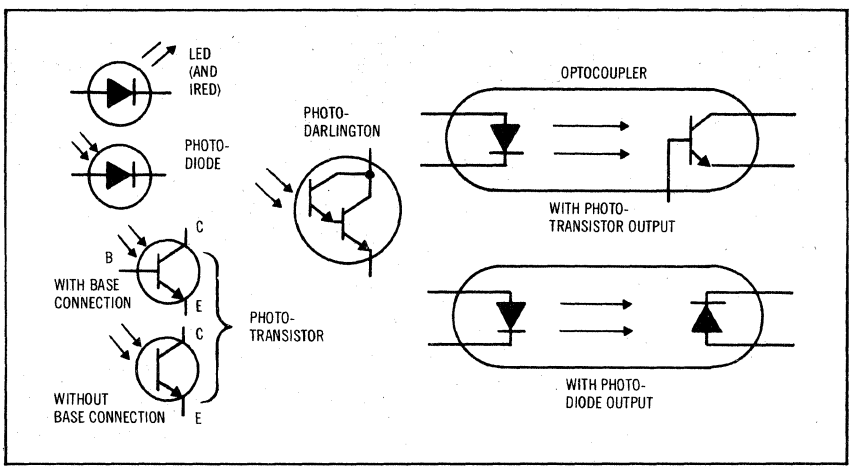
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

eem MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

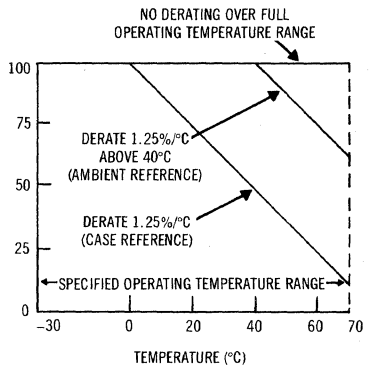


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

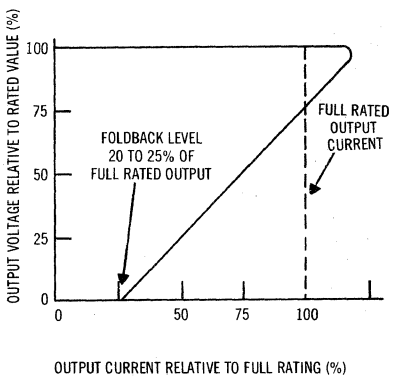


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

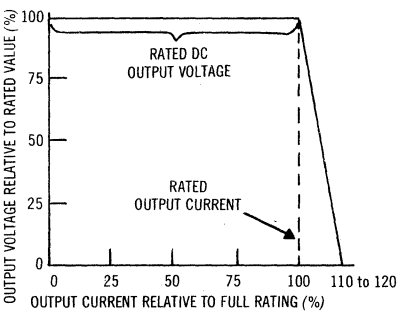


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

eem MINIGLOSSARY ELECTROMECHANICAL RELAYS

RELAYS

Hybrid: Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

Differential: Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

Close-differential: The dropout value is specified close to the pickup value.

Frequency sensitive: Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

Hermetically sealed: Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

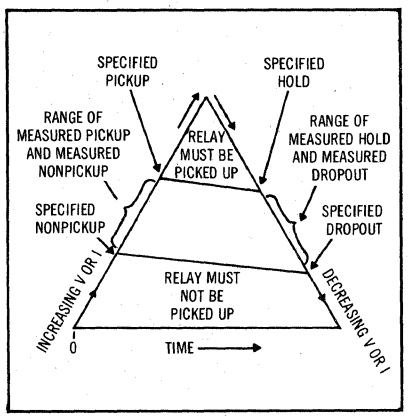
Encapsulated: Imbedded in a suitable potting compound.

Sealed: Enclosed in a relatively airtight cover. (Not the same as hermetically sealed.)

Covered: Unsealed metal or plastic enclosure or housing.

CONTACTS

Dry circuit: contacts that carry current but do not open or close during energizing of the load circuit. Often wrongly used in reference to low level contacts.



Low Level: Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.

OPERATING CHARACTERISTICS

Measured dropout: The value at which all contacts restore to their unoperated position as current or voltage decreases.

Specified dropout: The value at or *above* which all contacts *must* restore to their unoperated position as voltage or current is decreased.

Specified hold: The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

Specified nonpickup: The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

Measured pickup: The value at which all contacts function as voltage or current increases on an unoperated relay.

Specified pickup. The value at or *below* which all contacts *must* function as voltage or current increases on an unoperated relay.

Sensitivity: Specified pickup expressed in watts.

Normal bridging: The make-before-break action between adjacent contacts on relays designed for this purpose.

Abnormal bridging: The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

Magnetic freezing: Sticking of the armature to the core as a result of residual magnetism.

TIME

Actuation: The interval from coil energization or de-energization to the functioning of a specified contact.

Initial actuation: The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

Final actuation: Sum of initial actuation *and* bounce intervals following an actuation.

Contact bounce: The interval from close or opening of a contact to the end of the bounce of "chatter."

Chatter: See bounce.

Operate: Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

Release: Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

Transfer: The interval between opening a closed contact and closing an open contact of a break-before-make relay.

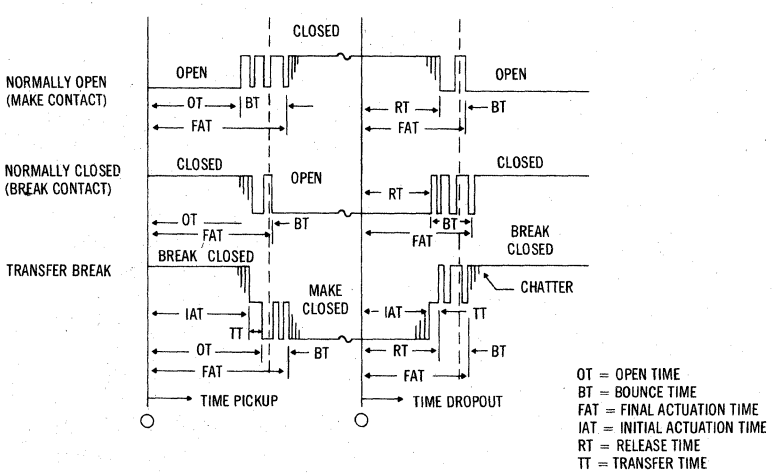
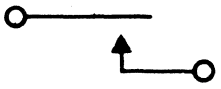


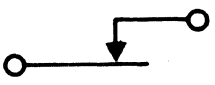
Fig. 2. Typical time vs. current (non-inductive load)

MINIGLOSSARY
RELAY CONTACT FORMS

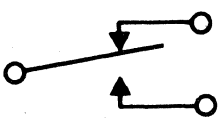
A
Make
SPST-NO



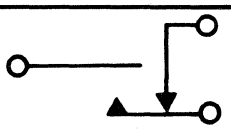
B
Break
SPST-NC



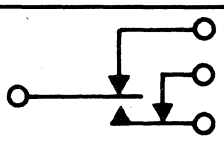
C
Break, Make
(Transfer)
SPDT



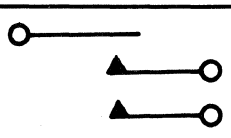
D
Make, Break
(Continuity
Transfer)



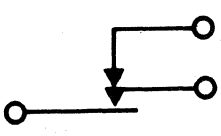
E
Break,
Make,
Break



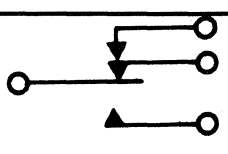
F
Make,
Make



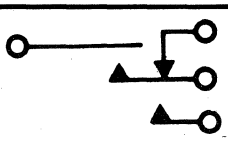
G
Break,
Make



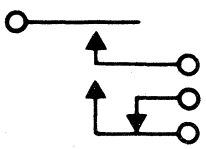
H
Break,
Break,
Make



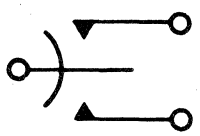
I
Make,
Break,
Make



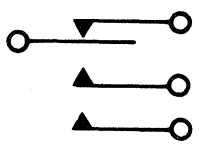
J
Make,
Make,
Break



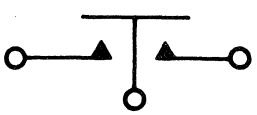
K
Center off
SPDT



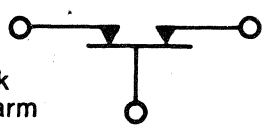
L
Break,
Make,
Make



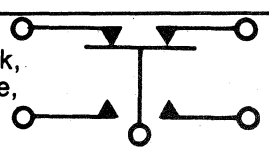
U
Double
make
Contact
on arm



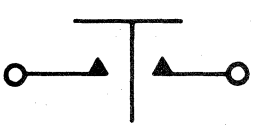
V
Double break
Contact on arm



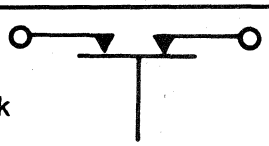
W
Double break,
Double make,
Contact
on arm



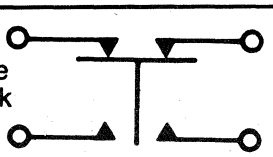
X
Double
make



Y
Double break

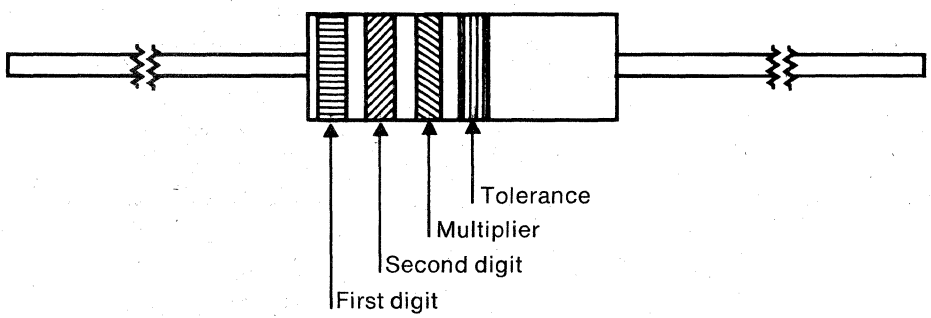


Z
Double make
Double break
SPDT-DB

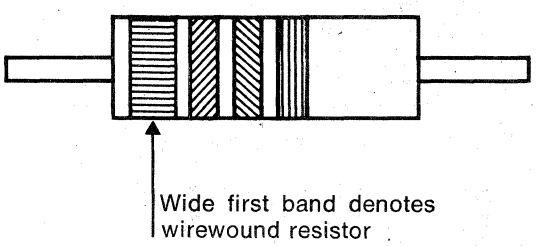


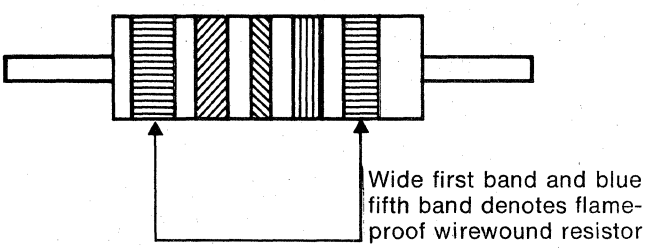
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes



Color code for general-purpose industrial resistors

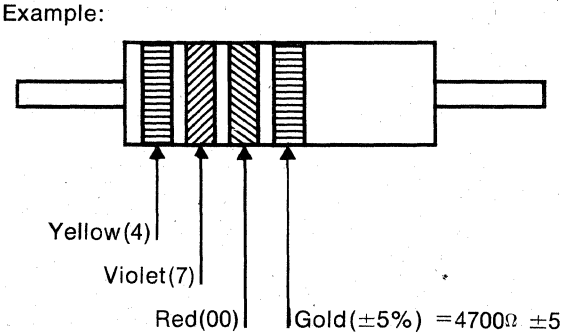




Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:



MINIGLOSSARY SERVO COMPONENTS

SPECIFICATIONS

Excitation: The input voltage and frequency.

Transformation Ratio: The ratio of the output voltage, at maximum coupling, to the input voltage.

Phase Shift: The lead or lag of the output voltage with respect to the input voltage. For most synchros and resolvers, the phase shift can be approximated by the angle whose tangent is the ratio of the primary winding's DC resistance to its reactive component.

Impedance: Specified as R + jX, where R is the AC resistive component and X is the reactive component. Important impedances are: (a) Z_{po} (or Z_{ro} for rotor primary units), which is the impedance of the primary winding with the secondary open; (b) Z_{so}, which is the impedance of the secondary winding with the primary open; and (c) Z_{ss}, which is the impedance of the secondary with the primry shorted (essentially when driven by a low impedance).

Null Voltage: The voltage remaining when the unit is at electrical zero or in the minimum coupling position.

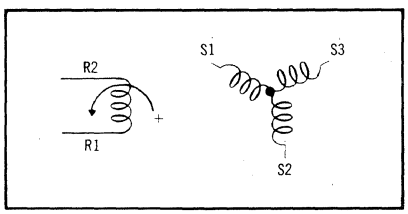
Accuracy: The error of the position of the rotor with respect to the electrical angle. It is defined as the output voltage driven by the "speed" (pole pairs) of the unit, referenced to the starting point of the calibration (usually the electrical zero position). Error is commonly expressed in minutes of arc (1/60 of a degree) or in seconds of arc.

Loads: For a transmitting unit, the impedance that the output voltage signal faces. This can be a receiver, a differential with its load, a control transformer, an A/D converter, etc.

Operation Temperature: The ambient temperature range over which the unit performs its primary function.

FUNCTIONS

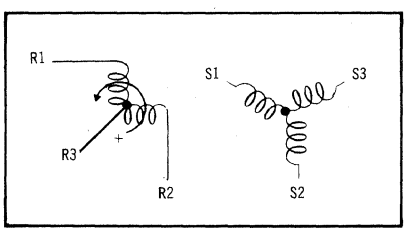
Transmitter: A unit with a Y-connected stator that outputs a signal proportional to the position of its single-phase excited rotor. High power units, called "torque transmitters," are used to drive one or more receivers. Low power transmitters are used to drive control transformers.



Receiver: A unit with a three-phase stator excited by the input, usually from a torque transmitter, and a single-phase rotor that follows the resulting stator field. Usually used to drive a position pointer.

Control Transformer: A unit with a three-phase stator excited by the input from a transmitter and a single-phase rotor mechanically driven to the null position by an external motor or other device.

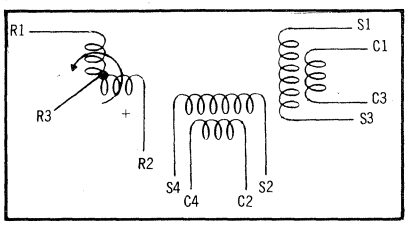
Differential: A unit with a three-phase stator and a three-phase rotor. It is usually connected between a transmitter, which excites its stator, and a receiver or control transformer. It can be used to "dial in" correction factors for the synchro chain.



Transolver: A unit with a three-phase stator and a two-phase rotor that can be used either as a control transmitter (with one rotor phase excited and the other shorted), or as a control transformer with the signal obtained from one phase of the rotor—making sure the other phase is equally loaded to prevent unbalances.

Differential Resolver: A unit with a two-phase stator and a three-phase rotor that is used as a transolver with the advantage that when connected as a control transformer, the signal does not travel through slip rings.

Resolver: A unit with a two-phase rotor and a two-phase stator that is used to create or receive SIN-COS signals such as vector resolutions for solving inertial platform coordinate transformations, unknowns of right triangles, etc. Resolvers can also be used as transmitting, differential, or receiving elements by proper choice of impedances. It is also possible to use resolvers as phase shifters where, in one mode, one rotor phase is excited and the two stator windings are feeding an appropriate RC network and indicating a phase shift, referred to the input, that corresponds to the rotor position.



Compensated Resolver: A unit with a "2×2" phase stator and a two-phase rotor used as a resolver with the added benefit of feedback windings in parallel with the stator windings that increase the useful accuracy over a wide range of environmental operating conditions.

Linear Transformer: A unit with a single-phase stator and single-phase rotor designed to provide a linear output voltage that is directly proportional to the rotor input angle. It operates over a range of less than ±90°, and is analogous to a potentiometer providing infinite resolution, but without contact between the elements. It can be used only with AC voltages.

Brushless Synchro: Available in two types—hairspring and bobbin. Hairspring synchros use spiral wound conductor springs to pick off the rotor signal, and are generally limited to a ±165° rotation. Most have mechanical stops to prevent damage due to overrotation. Bobbin synchros pick off the rotor signal with rotary transformers inside the unit, allowing the rotor unlimited motion.

Pancake Unit: A name derived from the physical dimensions of the unit, which has a diameter that exceeds axial length. Sizes range from under 1" to 20" or more. The unit is frequently used as a gimbal pickoff element and is designed to fit a particular application envelope. It can be supplied as a rotor and stator only.

THERMAL CONDUCTIVITY OF DIELECTRICS AT ROOM TEMPERATURE

Material	Thermal Conductivity, J/ (m.K)
Diamond	658
BeO	167
Graphite	117-200
Bonded SiC	42
MgO	42
Al_2O_3	33
TiC	33
BN	28
Mullite	6.3
Titania	3.3-4.2
Porcelain	1.7
Fused silica glass	1.5
Soda-lime glass	0.8
Cast epoxies	0.17-1.3
Wood	0.5-2.5
Melamines	0.3-0.7
Mica	0.3-0.7
Phenolics (molded)	0.17-0.67
Polyethylenes	0.33
Nylons	0.17-0.25
TFE fluorocarbons	0.25
Elastomers	0.08-0.17
Foams	0.003-0.04

89
90 Manufacturers and Sales Offices Directory

Each manufacturer is listed alphabetically with complete address and telephone number of main offices. The names of those with data pages in this edition of EEM are shown in **boldface**

Many manufacturers also show FAX, TWX and Telex numbers, FSC (Federal Supply Code), other pertinent company data, their sales and/or local distributor offices and phones. The page numbers of their data pages in this edition are shown in all volumes.

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FAX: 508-373-8881

AAK CORP. 747 River St, Haverhill, MA 01832, Tel: 508-373-3769, TELEX: 04 26 3109-1; FSC No.: 04 26 3109-1; Empl.: 20; *Sls. Mgr.:* Marie Credit ..... **D•1542-1543**

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OH Cleveland, Tiby Co. 216-371-5335
PA Cheltenham, Stein Instr. Corp. 215-379-1990

AAVID™

FAX: 603-528-1478

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Can Victoria, BC, Queale Elctrns. Ltd. 604-388-6111
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FAX: 201-526-6866

ABACUS CONTROLS INC., 89 Readington Rd., Somerville, NJ 08876, Tel: 201-526-6010, TELEX: 888186 ABACUS CONT UD; FSC No.: 54241; Empl.: 45; *Sls. Mgr.:* L. Albrecht ..... **D•2159-2161**

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GA Atlanta, Scientific Dvcs. 205-536-1969
GA Savannah, Scientific Dvcs. 904-651-4407
MA Wareham, Elctrn. Sls. of New England 617-295-7634
MO St. Louis, AME Sls. 314-962-9771,
NC Winston-Salem, Scientific Dvcs. 919-765-5776
TX Dallas, True Techn. 214-691-7870
EXP New York, NY, XPort Trading Co. 212-466-4204,

ABALON PRECISION MFG., 1040 Home Street, Bronx, NY 10459, Tel: 212-589-5682, FAX: 212-589-0300; Empl.: 25; *Sls. Mgr.:* Norman C. Orent

ABB METRAWATT, 2150 W. 6th Ave. Unit J, Broomfield, CO 80020, Tel: 303-469-5231, 800-821-6327, TELEX: 4970869, FAX: 303-469-4256; Empl.: 20; *Sls. Mgr.:* Brad Seavoy

ABB SEMICONDUCTOR, ASEA Brown Boveri, 2150 W. 6th Ave., Broomfield, CO 80020, Tel: 303-469-1883, TELEX: 299745, FAX: 303-469-8394; FSC No.: 4800; Empl.: 18; *Sls. Mgr.:* Mike Melvin; *Dist. Mgr.:* Dave Whitcomb

Abbott TECHNOLOGIES INC

FAX: 818-954-9305

ABBOTT TECHNOLOGIES, INC., Burbank Division, Transformers, 639 So. Glenwood Pl, Burbank, CA 91506, Tel: 818-841-3630, TELEX: 69-6282; FSC No.: 58910; Empl.: 50; *Sls. Mgr.:* Frank S. Goitz ..... **A•2219-2230; D•1563-1571, 2162-2163**

Local Sales Offices & Reps
FL Altamonte Springs, Gugel Assocs. Inc. 305-788-0845
IN Indianapolis, JFCO, Inc. 317-576-9363
MI Grand Rapids, JFCO, Inc. 616-949-1020
NJ Palisades Pk., Abbott Technlgs., Inc. .. 201-461-4005
OH Vandalia, JFCO, Inc. 513-890-8322
PA Pittsburgh, JFCO, Inc. 412-823-5400
TN Nashville, Mil-Spec Sls. Co. 615-367-2427
TX Richardson, Abbott Transistor Labs. .. 214-437-0697
Can Rexdale, Ontario, Source Elctrns., Ltd. 416-676-0830

ABBOTT TECHNOLOGIES, INC., Sun Valley Division, Power Supplies, 8203 Vineland Ave., Sun Valley, CA 91352, Tel: 818-841-3630, TELEX: 75-2972, FAX: 818-954-9305; Empl.: 50; *Sls. Mgr.:* Frank Goitz ..... **D•1563-1571, 2162-2163**

Local Sales Offices & Reps
MO Kansas City, Abrams & Assocs. 314-569-0447
NJ Palisades Pk., Abbott Technlgs., Inc. .. 201-461-4005
TX Richardson, Abbott Technlgs., Inc. 214-437-0697

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FAX: 213-939-1995

ABBOTT TRANSISTOR LABS, Power Supplies, 2727 S. La Cienega Blvd., Los Angeles, CA 90034, Tel: 213-936-8185, TELEX: 69-1398; FSC No.: 15755; Empl.: 500; *Sls. Mgr.:* Mike Brown ..... **D•1545-1562**

Local Sales Offices & Reps
CA Mtn. View, Martinez & Assocs. 415-966-1012
NJ Ft. Lee, Abbott Transistor Labs. 201-461-4411
TX Richardson, Abbott Transistor Labs. .. 214-437-0697
UT Bountiful, Anderson & Assocs. 801-292-8991
WA Bellevue, Comtec 206-453-1188
Can Ottawa, Subtec Ltd. 613-738-1470

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FAX: 914-962-2296

ABL ELECTRONICS SUPPLY, INC., 1736 Front St, Yorktown Hgts., NY 10598, Tel: 914-962-2253; Empl.: 18; *Sls. Mgr.:* George Wiesel ..... **C•1308, 1760-1762**

ABLESTIK LABORATORIES, 833 W. 182nd St, Gardena, CA 90248, Tel: 213-532-9341, TWX: 910-346-7606, FAX: 213-516-9417; FSC No.: 21109; Empl.: 150; *Sls. Mgr.:* D. W. Lefever

ABORN ELECTRONICS INC., 2108 D Bering Dr., San Jose, CA 95131, Tel: 408-436-5444, TELEX: 184817 MSGSNDR, FAX: 408-287-4535; FSC No.: 8Z441; Empl.: K. Bomin; *Sls. Mgr.:* V. Lumba

ABRAMS INSTRUMENT CORP., 2859 W. Jolly Rd, Okemos, MI 48864, Tel: 517-332-6405, TWX: 810-251-0785; FSC No.: 00048; *Sls. Mgr.:* Merlyn Gates

ACC ELECTRONICS COMPANY, Echlin Inc., 1300 W. Oak, Independence, KS 67301, Tel: 316-331-1000, TELEX: 436482, FAX: 316-331-1422; Empl.: 1000; *Sls. Mgr.:* Leon Allen ..... **A•1736**

ACCEL INDUSTRIAL HEAT SINK CORP., 3709 Medford St., Los Angeles, CA 90063, Tel: 213-261-5156, FAX: 213-261-5159; FSC No.: 26701; *Sls. Mgr.:* James Bergen

ACCEL TECHNOLOGIES, INC., 7358 Trade St., San Diego, CA 92121, Tel: 619-695-2000, TELEX: 201-582 ATI UR, FAX: 619-695-6527; Empl.: 25; *Sls. Mgr.:* Ray Schnorr

ACCU DATA, INC., 1331 S. State, Provo, UT 84606, Tel: 801-377-9156; Empl.: 10; *Sls. Mgr.:* Ralph D. Bradley; *Dist. Mgr.:* Ralph D. Bradley

ACCUDYNE CORP., P.O. Box 1429, Janesville, WI 53547, Tel: 608-752-9081; FSC No.: 18356; Empl.: 540; *Sls. Mgr.:* R. E. Mowris; *Dist. Mgr.:* R. E. Mowris

ACCUGRAPH CORP., 50 Gervais Drive, Suite 204, Don Mills, ONT, Canada M3C 1Z3, Tel: 416-441-2211, TELEX: 06-986973, FAX: 416 441-2228; Empl.: 155; *Sls. Mgr.:* Dennis Kukulsky; *Dist. Mgr.:* Dennis Kukulsky

ACCULEX CORPORATION, MetraByte, 440 Myles Standish Blvd., Taunton, MA 02780, Tel: 508-880-3660, TELEX: 240713; *Sls. Mgr.:* Brian Smothers .... **D•1378**

ACCUMET ENGINEERING, 518 Main St., Hudson, MA 01749, Tel: 508-568-8311, FAX: 508-562-4384; *Sls. Mgr.:* C. T. Haering

Local Sales Offices & Reps
MD Pasadena, Spectro-Lambda 301-437-7633
NJ Clarksburg, Micro-Lambda 609-259-0400
NY Huntington, Compar New York 516-423-5660
TX Dallas, C & J Assocs. 214-931-6693

ACCUPROBE, INC., 1 Harrison Ave, Box 1044, Salem, MA 01970, Tel: 617-745-7878, TELEX: 882194 Accuprobe UD, FAX: 617-745-7922; Empl.: 26; *Sls. Mgr.:* Thomas H. Murphy; *Dist. Mgr.:* T. H. Murphy

ACCURATE ELECTRONICS, 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036, Tel: 216-366-6330, TELEX: 469705, FAX: 216-366-0522; FSC No.: 11375; Empl.: 35; *Sls. Mgr.:* J. F. Seybold

ACCURIDE, 12311 Shoemaker, Santa Fe Springs, CA 90670, Tel: 213-903-0373, TWX: 910-586-1632, FAX: 213-903-0208; *Sls. Mgr.:* Jackie Pinto

ACCUSONIC DIVISION, Ferranti O.R.E. Inc., Box 709, Falmouth, MA 02541, Tel: 617-548-5800, TELEX: 6817399 OREFAL UW; Empl.: 125; *Sls. Mgr.:* Robert Beede

ACCUSONIC SYSTEMS CORP., Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Park, NY 11040, Tel: 516-328-3300; Empl.: 15 (This Subsidiary); *Sls. Mgr.:* Dennis Goodman

ACCUTRONICS/CONNOR-WINFIELD, See Connor-Winfield

acdc electronics

FAX: 619-439-4243

ACDC ELECTRONICS, Div. of Emerson, 401 Jones Rd., Oceanside, CA 92054, Tel: 619-757-1880, TWX: 910-322-1470; Empl.: 750; *Sls. Mgr.:* Mike Kirkowski; *Dist. Mgr.:* Ray Brown ..... **D•1572-1578**

Local Sales Offices & Reps

IA	Davenport, Rush & West	319-388-9494
CA	Los Angeles, ACDC	818-848-9252
CA	Oceanside, ACDC	619-439-4200
CA	Santa Clara, ACDC Elctms.	408-727-1627
CO	Colorado Springs, Omega Ltd.	719-598-6845
CO	Englewood, Omega Ltd.	203-762-1921
MD	Columbia, Delta III Assocs.	301-730-4700
FL	Satellite Beach, ACDC Elctms.	407-773-8692
IL	Elk Grove VL, Tri Star Grp.	312-593-0200
IL	Naperville, ACDC Elctms.	312-355-8444
IN	Indianapolis, Leslie M. Devoe Co.	317-842-3245
KS	Olathe, Rush & West	913-764-2700
MA	Sudbury, ACDC Elctms.	508-443-9903
MI	Oak Park, A. Blumenburg, Inc.	313-968-3230
MN	Eden Prairie, Electronic Innovators	612-941-0830
MO	St. Louis, Rush & West	314-965-3322
NY	Central Islip, ACDC	516-348-7710
NY	E. Rochester, Tri-Tech	716-385-6500
NY	Endwell, Tri-Tech	607-754-1094
NY	Fayetteville, Tri-Tech	315-446-2881
NY	Fishkill, Tri-Tech	914-897-5611
OH	Dayton, Lyons Corp.	513-278-0714
OH	Richfield, Lyons Corp.	216-659-9224
OH	Westerville, Lyons Corp.	614-895-1447
OK	Bixby, MGR Elctms.	918-369-5186
OR	Beaverton, Earl & Brown	503-643-5500
PA	Willow Grove, Tech. Sls.	215-784-0170
WI	Brookfield, Tri-Star Grp.	414-782-2670
TX	Dallas, MGR ELctms.	214-238-5246
VA	Midlothian, Delta III Assocs.	804-379-1816
NC	Raleigh, R.W. Mitscher Co.	919-848-0941
WA	Redmond, Earl & Brown	206-885-5064

Local Distributors

CO	Englewood, Displays Plus	303-779-8053
FL	Melbourne, Component Distrs.	305-724-9900
GA	Norcross, Applied Power	404-263-0421
IL	Bensenville, Goold Elctms.	312-860-7171
IL	Bensenville, Magnuson Elctms.	312-595-7575
IN	Indianapolis, Mar Elctms.	317-633-6699
IN	Indianapolis, Custom Svc. Elec.	317-879-9119
MA	Needham, Cronin Elctms.	617-449-5000
MA	Peabody, Time Elctms.	508-532-9701
MI	Madison Hgts., McNaughton-McKay	313-399-7500
NY	Hauppauge, Sager Elctms.	516-348-1300
NY	Rochester, Simcona	718-328-3230
OH	Cincinnati, Hughes Peters, Inc.	513-351-2000
OH	Columbus, Hughes Peters, Inc.	614-294-5351
WI	Mequon, Taylor Elec.	414-241-4321
PA	Philadelphia, PEI Genesis	215-673-0400
TX	Dallas, Norvell Elctms.	214-233-0020
WI	Oshkosh, Electronic Inds.	414-235-8930
WA	Redmond, Priebe Elctms.	206-881-0508

ACD-ELCOR PRODUCTS, P.O. Box 244, Bethel, CT 06801, Tel: 203-743-3510; Empl.: 3

ACHESON COLLOIDS, Div. of Acheson Industries, Inc., P.O. Box 611747, Port Huron, MI 48061-1747, Tel: 313-984-5581, TWX: 810-231-5265, FAX: 313-984-1446; Empl.: 200

A.C. INTERFACE INC., 15560 Rockfield, Unit 1E, Irvine, CA 92718, Tel: 714-472-9524, TELEX: 655-328; FSC No.: OAP 78; Empl.: 23; *Sls. Mgr.:* Bill Roth; *Dist. Mgr.:* Ray Ponkey

ACL INC., 1960 E. Devon Ave., Elk Grove, IL 60007, Tel: 312-981-9212, 800-STATIC-0, TELEX: 4330251, FAX: 312-981-9278; Empl.: 12; *Sls. Mgr.:* Ralph D. Considine

Local Sales Offices & Reps

AK	Anchorage, VWR Sci.	907-274-6616
AZ	Phoenix, More Sls. Inc.	602-788-9181
CA	Los Angeles, Diversitech	714-240-7720
CA	San Diego, VWR Sci.	619-297-4851
CA	San Francisco, VWR Sci.	415-467-4100
CA	San Jose, Devtec Elctms. Inc.	408-295-2005
CO	Denver, JBR Mktg. Svcs.	303-451-5338
CO	Denver, VWR Sci.	303-371-0970
FL	Miami, VWR Sci.	305-625-7181
GA	Atlanta, EMI Mktg. Force	404-948-6023
HI	Honolulu, VWR Sci.	808-836-1361
IL	Batavia, VWR Sci.	800-932-5000
IL	Chicago, Restronics of IL	312-437-7707
LA	New Orleans, VWR Sci.	504-733-4181
MA	Shirley, May Assocs.	508-425-9157
OH	Dayton, Shamrock Elctrn. Sls.	513-258-1227
MN	Edina, Restronics Co., Inc.	612-941-9135
MO	Liberty, Lectro Reps, Inc.	816-781-2522
NJ	Bridgeport, VWR Sci.	609-467-3333
NM	Los Alamos, VWR Sci.	505-662-5558
NJ	Norwood, Wilson Inds.	201-767-7060
NY	Vestal, Advancetech Prods.	607-785-0050
OR	Portland, Carr & Assocs.	503-636-7402
TX	Dallas, Kruvand Assocs.	214-437-3355
TX	Dallas, VWR Sci.	713-641-0681
UT	Salt Lake City, VWR Sci.	801-972-6400
WA	Seattle, Carr & Assocs.	206-839-6334
FL	Windermere, Thomas & Assocs.	407-948-6023

ACME DIVISION, Allied Products Corporation, P.O. Box 1404, New Haven, CT 06505, Tel: 203-562-2171, TELEX: 295503 Acme UR; Empl.: 75; *Sls. Mgr.:* Marvin Leonard

Acme Electric Electronic Distribution

FAX: 716-968-3948

ACME ELECTRIC CORPORATION, 20 Water Street, Cuba, NY 14727, Tel: 716-968-2400; *Sls. Mgr.:* Bill Bengle; *Dist. Mgr.:* Donald Chesner ..... **D•1580-1583**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, O'Donnell Assocs. S.W.	602-944-9542
CA	San Jose, O'Donnell Assocs., North	408-432-1940
CO	Englewood, Harthun Assocs.	303-792-5050
FL	Deerfield Bch., Cartwright & Bean	305-429-3400
FL	Orlando, Cartwright & Bean	407-422-4531
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Des Plaines, Electron Mktg.	312-298-2330
IN	Ft. Wayne, Needler Sls. Co., Inc.	219-447-2123
IN	Indianapolis, Luebbe Sls.	317-845-7389
IN	Indianapolis, Needler Sls. Co., Inc.	317-255-8056
KS	Shawnee Mission, Lowell Kangas & Assocs.	913-631-3515
LA	Covington, Cartwright & Bean	504-892-1780
MD	Gaithersburg, Naudain Assocs.	301-258-5040
MA	Framingham, Marathon Sls.	508-875-3566
MI	Jackson, Cartwright & Bean	601-981-1170
MI	Livonia, Luebbe Sls.	313-489-8828
MN	Minneapolis, Boerger & Assocs.	612-560-3435
MO	St. Louis, Lowell Kangas & Assocs.	314-821-4050
NJ	Matawan, Shepard & Assocs.	201-566-0095
NM	Albuquerque, O'Donnell Assocs. S.W.	505-889-4522
NY	E. Syracuse, Ossmann & Assocs.	315-437-7052
NY	Henrietta, Ossmann & Assocs.	716-359-1200
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Lumberton, Acme Elec. Corp.	919-738-9202
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Cincinnati, Luebbe Sls.	513-530-0600
OH	Cleveland, Luebbe Sls.	216-333-0425
OH	Cleveland, Marlow Assocs.	216-991-6500
OH	Columbus, Luebbe Sls.	614-431-0474
OH	Dayton, Luebbe Sls.	513-294-0426
OH	Dayton, Marlow Assocs.	513-274-9666
OK	Tulsa, Milco Mktg.	918-664-2277
OR	Beaverton, Pacific Specialists	503-641-9373
PA	Pittsburgh, Luebbe Sls.	412-364-0490
PA	Pittsburgh, Marlow Assocs.	412-343-5050
PA	Prospect Pk., Elf Sls. Co.	215-534-3340
TN	Memphis, Cartwright & Bean	901-362-8345
TX	Austin, Milco Mktg.	512-251-9918
TX	Houston, Milco Mktg.	713-723-5037
TX	Richardson, Milco Mktg.	214-783-2716
UT	Salt Lake City, Acme Elec. Corp.	801-539-0227
WA	Redmond, Pacific Mktg. Specialists	206-882-3144
WI	Waukesha, Electron Mktg.	414-547-1505

Local Distributors

AL	Decatur, Forbes Distbg.	205-353-4762
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AL	Huntsville, Arrow Elctms.	205-837-6955
AL	Huntsville, Forbes Distbg.	205-837-1579
AL	Mobile, Forbes Distbg.	205-479-4535
AZ	Phoenix, Arrow Elctms.	602-437-0750
AZ	Phoenix, Cetec/Future	602-272-7951
CA	Chatsworth, Allied Elctms.	818-701-7500
CA	Chatsworth, Cetec/Future	818-700-0914
CA	Fremont, Allied Elctms.	415-770-0590
CA	Irvine, Cetec/Future	714-250-4141
CA	Los Angeles, Arrow Elctms.	818-701-7500
CA	Menlo Pk., Casey Johnston	415-328-6892
CA	San Diego, Allied Elctms.	619-565-4800
CA	San Diego, Arrow Elctms.	619-565-4800
CA	San Diego, Cetec/Future	619-278-5020
CA	San Jose, Cetec/Future	408-434-1114
CA	San Jose, ITT Multicomp.	408-279-0685
CA	San Jose, Rose Elctms.	408-263-9700
CA	Santa Ana, ITT Multicomp.	714-835-9019
CA	Santa Monica, Transworld Trade	213-476-8406
CA	Sunnyvale, Arrow Elctms.	408-745-6600
CA	Tustin, Allied Elctms.	714-669-4190
CA	Tustin, Arrow Elctms.	714-838-5422
CO	Denver, Allied Elctms.	303-790-1664
CO	Englewood, Arrow Elctms.	303-790-4444
CO	Englewood, NEP Elctms.	303-799-9898
CT	Wallingford, Arrow Elctms.	203-265-7741
FL	Altamonte Springs, Arrow Elctms.	305-682-6923
FL	Clearwater, Allied Elctms.	813-539-0369
FL	Deerfield Bch., Arrow Elctms.	305-429-8200
FL	Ft. Lauderdale, American Battery	305-583-2470
FL	Ft. Lauderdale, Hammond Elctms.	305-973-7103
FL	Jacksonville, Hammond/EMSCO	904-356-4851
FL	Lantana, Sylvia Prods.	305-482-5295
FL	Orlando, EMSCO	305-849-6362
FL	Orlando, Hammond Elctms.	305-849-6060
FL	Palm Bay, Arrow Elctms.	305-725-1480
FL	Pompano Bch., Allied Elctms.	305-978-3008
FL	Tampa, Hammond/EMSCO	813-253-2684
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GA	Marietta, Americom	404-428-8400
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GA	Norcross, Arrow Elctms.	404-449-8252
GA	Norcross, Hammond Elctms.	404-449-1996
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IL	Chicago, NEP Elctms.	312-625-8400
IL	Elgin, Allied Elctms.	312-697-8200
IL	Itasca, Arrow Elctms.	312-250-0500
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Advent Elctms.	317-872-4910
IN	Indianapolis, Arrow Elctms.	317-243-9353
IN	Indianapolis, Bell Inds.	317-875-8200
IA	Cedar Rapids, Arrow Elctms.	319-395-7230
IA	Cedar Rapids, Iowa Radio Supp.	319-393-4510
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KS	Wichita, Radio, Inc.	316-264-2798
KY	Florence, URI Elctms.	606-371-4423
KY	Lexington, Radio Elctm.	606-255-6661
KY	Louisville, Peerless Elctms.	502-637-7674
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MI	Ann Arbor, Bell Inds.	313-971-9093
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MI	Ferndale, RAM Meter, Inc.	313-398-6767
MI	Grand Rapids, Arrow Elctrns.	616-243-0912
MI	Grand Rapids, R S Elctrns.	616-241-3483
MI	Livonia, Allied Elctrns.	800-433-5700
MI	Livonia, R S Elctrns.	313-525-1155
MN	Eden Prairie, Allied Elctrns.	612-829-7554
MN	Edina, Arrow Elctrns.	612-830-1800
MN	Minneapolis, Bergquist Co.	612-835-2322
MO	Kansas City, LComp Elctrns.	816-221-2400
MO	Maryland Hgts., Chelsea Inds.	314-997-9700
MO	Maryland Hgts., LComp Elctrns.	314-291-3563
MO	Montgomery, Forbes Distbg.	205-263-2083
MO	St. Louis, Arrow Elctrns.	314-567-6888
MO	St. Louis, Vansickle Elctrns.	314-621-5000
NH	Manchester, Arrow Elctrns.	603-668-6968
NJ	Green Brook, Apparatus Elec.	201-752-8400
NJ	Lodi, TRC	201-779-8282
NJ	Marlton, Arrow Elctrns.	609-596-8000
NJ	Marlton, Circuit Sls.	201-583-8455
NJ	Mt. Laurel, Allied Elctrns.	609-234-7769
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Parsippany, Arrow Elctrns.	201-538-0900
NM	Albuquerque, Arrow Elctrns.	505-243-4566
NY	Buffalo, Summit Inds.	716-887-2800
NY	Cen. Islip, Circuit Sls.	516-348-7670
NY	Hauppauge, Arrow Elctrns.	516-231-1000
NY	Hauppauge, Sager Elctrl.	516-348-1300
NY	Long Island City, Interface Computer	718-726-4223
NY	Melville, Arrow Elctrns.	516-391-1300
NY	Mineola, Allied Elctrns.	516-248-2360
NY	Mt. Vernon, QAR Elctrns.	914-699-2224
NY	Rochester, Allied Elctrns.	716-244-9440
NY	Rochester, Arrow Elctrns.	716-427-0300
NY	Rochester, CAM/RPC Elctrns.	716-427-9999
NY	Rochester, Simcona	716-328-3230
NY	Ronkonkoma, Arrow Elctrns.	516-467-1000
NY	Roslyn Hgts., Micro Connections	516-625-1717
NC	Asheville, Southeastern Elctrns.	704-253-1446
NC	Charlotte, Southeastern Elctrns.	704-523-1122
NC	Charlotte, United Elec.	704-372-2650
NC	Durham, Southeastern Elctrns.	919-688-8204
NC	Fayetteville, Southeastern Elctrns.	919-483-0371
NC	Greensboro, Hammond/EMSCO	919-275-6391
NC	Greensboro, Southeastern Elctrns.	919-273-8675
NC	Hickory, Southeastern Elctrns.	704-322-9493
NC	Jacksonville, Southeastern Elctrns.	919-353-4171
NC	Kingston, Southeastern Elctrns.	919-523-5113
NC	Raleigh, Allied Elctrns.	919-876-5845
NC	Raleigh, Arrow Elctrns.	919-876-3132
NC	Raleigh, Southeastern Elctrns.	919-828-2311
NC	Wilmington, Southeastern Elctrns.	919-791-7365
NC	Winston-Salem, Arrow Elctrns.	919-725-8711
OH	Centersville, Arrow Elctrns.	513-435-5563
OH	Cincinnati, Hughes-Peters, Inc.	513-351-2000
OH	Cincinnati, R S Elctrns.	513-793-2450
OH	Cincinnati, URI Elctrns.	513-761-4030
OH	Cleveland, CAM/RPC Elctrns.	216-461-4700
OH	Columbus, Arrow Elctrns.	614-436-0928
OH	Columbus, Hughes-Peters, Inc.	614-294-5351
OH	Dayton, Bell Inds.	513-435-8660
OH	Maumee, R S Elctrns.	419-893-0721
OH	Solon, Arrow Elctrns.	216-248-3990
OH	Warren, REM Elctrns.	216-373-1300
OK	Oklahoma City, Radio, Inc.	405-789-0741
OK	Tulsa, Altair Co.	918-252-5781
OK	Tulsa, Arrow Elctrns.	918-252-7537
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Beaverton, Arrow Elctrns.	503-645-6456
OR	Beaverton, Rose Elctrns.	503-629-9288
OR	Tualatin, Moore Elctrns.	503-692-5333
PA	Allentown, Yates Battery	215-437-6700
PA	Drexel Hill, Kass Elctrns.	215-449-2300
PA	Erie, REM Elctrns.	814-453-5626
PA	Essington, Tri-Com	215-521-3080
PA	Monroeville, Arrow Elctrns.	412-856-7000
PA	N. Huntingdon, REM Elctrns.	412-864-7423
PA	Pittsburgh, Allied Elctrns.	412-367-4124
PA	Pittsburgh, CAM/RPC Elctrns.	412-782-3770
PA	Reading, Yates Battery	717-383-0226
PA	Trevose, Sager Elctrns.	215-638-7491
SC	Greenville, Hammond/EMSCO	803-233-4121
TN	Nashville, Carlton Bates Co.	501-562-9100
TX	Austin, Allied Elctrns.	512-389-3771
TX	Austin, Altair Co.	512-837-4970
TX	Austin, Arrow Elctrns.	512-835-4180
TX	Carrollton, Arrow Elctrns.	214-380-6464
TX	Corpus Christi, Douglas Elctrns.	512-883-5103
TX	Dallas, Allied Elctrns.	214-553-4370
TX	El Paso, Era Elctrns.	915-592-4126
TX	Ft. Worth, Allied Elctrns.	817-336-5401, 800-433-5700
TX	Houston, Altair Co.	713-462-3029
TX	Houston, Arrow Elctrns.	713-530-4700
TX	Richardson, Altair Co.	214-231-5166
UT	Salt Lake City, Arrow Elctrns.	801-973-6913
VA	Roanoke, Southeastern Elctrns.	703-344-661
WA	Kent, Arrow Elctrns.	206-575-4420
WA	Seattle, Allied Elctrns.	206-547-2827
WI	Brookfield, Arrow Elctrns.	414-792-0150
WI	Mequon, Taylor Elctrns.	414-241-4321
WI	New Berlin, Allied Elctrns.	414-796-1280
WI	New Berlin, NEP Elctrns.	414-785-9100
EXP	NY/Farmingdale, Arrow Export	516-293-6363
PR	Hato Rey, Arrow Elctrns.	809-764-4384
Can	Burnaby, BC, Arrow Elctrns.	1-800-268-6935
Can	Concord, Ont., ITT Multicomp.	416-736-1144
Can	Mississauga, Ont., Arrow Elctrns.	416-672-7769
Can	Montreal, Que., Arrow Elctrns.	514-735-5511
Can	Nepean, Ont., Arrow Elctrns.	613-226-6903
Can	Ottawa, Ont., Wackid Radio	613-728-1821
Can	Pt. Claire, Que., Future Elctrns.	514-694-7710
Can	Quebec, Arrow Elctrns.	418-687-4231
Can	Ville St. Laurent, Que., ITT Multicomp.	514-335-7697
Can	Yellowknife, Yukon, Northern Comm	403-873-3953

ACME ELEC. HEATING CORP., 4685 E. 11th Ave., Hialeah, FL 33013, Tel: 305-685-8326; Empl.: 12

ACME MODEL ENGINEERING CO., 654 Bergen Blvd., Ridgefield, NJ 07657, Tel: 201-943-7650; Empl.: 29

ACME TRANSFORMER, Acme Electric Corporation, Rte. 4, Box 54, Lumberton, NC 28358, Tel: 919-738-1121, FAX: 919-739-0024; *Sls. Mgr.:* Don Chesner

ACON, INC., 15c Plymouth Dr., South Easton, MA 02375, Tel: 508-230-8022, FAX: 508-230-2371; Empl.: 5 **D•1584-1586**

Local Sales Offices & Reps

CA	San Jose, Silicon Valley Sls.	408-432-1967
CT	Hamden, Datcom	203-288-7005
MA	Waltham, Datcom	617-891-4600
OK	Tulsa, Advance Tech. Sls.	918-664-0482
TX	Austin, Advance Tech. Sls.	512-331-9979
TX	DALLAS, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888

ACOPIAN, Box 638, Easton, PA 18044, Tel: 215-258-5441, TWX: 510-651-4919, FAX: 215-258-2842; FSC No.: 14749; *Sls. Mgr.:* T. Skopal **D•1587-1613**

Local Sales Offices & Reps

FL	Melbourne, Acopian	407-727-1172
MD	Ellicott City, Doss Elctrns.	301-465-1336

ACOUSTIC POWER SYSTEMS, INC., 5731 Palmer Way, Ste. A, Carlsbad, CA 92008, Tel: 619-438-4848, TELEX: 4995113 (SHAKE), FAX: 619-438-8845; Empl.: 5

ACRODYNE CONTROLS, See Accudyne Corp.

ACROMAG INC., 30765 Wixom Rd., Wixom, MI 48096, Tel: 313-624-1541, TELEX: 247354, FAX: 313-624-9234; Empl.: 100; *Sls. Mgr.:* J. Welsand

ACROSYSTEMS CORP., 66 Cherry Hill Dr., Beverly, MA 01915, Tel: 508-927-8880; Empl.: 30; *Sls. Mgr.:* Herbert Tobey

ACS COMMUNICATIONS SYSTEMS, 480 Spring Pk. Pl., Ste. 900, Herndon, VA 22070, Tel: 703-471-0892, TWX: 710-833-0326, FAX: 703-437-9333; FSC No.: 56496; Empl.: 32; *Sls. Mgr.:* Thomas Mitchell, VP

ACTION INSTRUMENTS
...the Industrial I/O Company

FAX: 619-279-6290

ACTION INSTRUMENTS, 8601 Aero Dr., San Diego, CA 92123, Tel: 619-279-5726; Empl.: 230; *Sls. Mgr.:* Keith Rosburg; *Dist. Mgr.:* Mary Hyde **D•1157**

Local Sales Offices & Reps

IN	Indianapolis, Techn. Sls. & Mktg.	317-849-6612
TX	Houston, Regional Office	713-771-9426

ACTIVE CONTROL INSTRUMENTATION, P.O. Box 243-Wildwood Circle, Key Largo, FL 33037, Tel: 305-451-1000, FAX: 305-451-3232; FSC No.: 55116; Empl.: 6 **D•1134**

ACTOWN-ELECTROCOIL, INC., 2414 Highview, Spring Grove, IL 60081, Tel: 815-675-6641, FAX: 815-675-2050; Empl.: 200; *Sls. Mgr.:* Les Friedman

AC TRANSFORMER, 89 Madison St., Newark, NJ 07105, Tel: 201-589-8574; FSC No.: 3677; Empl.: 13; *Sls. Mgr.:* George Giangrande, Sls. Consit.

ACUREX CORP./AUTODATA DIV., 555 Clyde Ave., P.O. Box 7042, Mountain View, CA 94039, Tel: 415-967-9100, TELEX: 34-6391, TWX: 910-379-6593, FAX: 415-967-7727; Empl.: 720; *Sls. Mgr.:* Rudolf Touitou; *Dist. Mgr.:* Rudolf Touitou

Local Sales Offices & Reps

AL	Huntsville, Kemp Instrs. Co.	205-837-4304
IN	Indianapolis, Stress Analysis Svcs.	317-254-1475
CA	Sunnyvale, Westech	408-720-1949
CO	Broomfield, Hannah-Hill, Inc.	303-460-0602
FL	DeLeon Springs, Dell-Tech Control Co.	904-985-5530
GA	Doraville, Kemp Engrg.	404-452-8050
IL	Wheaton, Ray Knitter Assocs., Inc.	312-690-6363
MA	Natick, Andruss-Peskin	617-653-3919
OR	Gladstone, Calvert Control	503-236-1358
NJ	Mt. Laurel, P.D.C. Corp.	609-273-8282
KS	Shawnee Mission, Comtel Midwest	913-268-0762
NC	Charlotte, Walk/Man Instrs.	704-375-3132
OH	Medina, Stress Analysis Svcs.	216-725-7733
OK	Stillwater, Acudata	405-743-1886
MN	Wayzata, Comtel Midwest	612-476-1551
TX	Plano, Acudata	214-424-3567
NM	Albuquerque, Hannah Hill	505-292-4098
Can	Chomedey Laval, Que., Technolor Instrs., Inc.	514-331-7405

ADAC CORP., 70 Tower Office Pk., Woburn, MA 01801, Tel: 617-935-6668, TELEX: 951802; Empl.: 80; *Sls. Mgr.:* Gerald Feldeisen

ADAGE, INC., 165 Lexington Rd., Billerica, MA 01821, Tel: 508-667-7070, TELEX: 710-347-1594; Empl.: 105; *Sls. Mgr.:* Bruce E. Johnson; *Dist. Mgr.:* N/A

ADALET-PLM DIV, Div. Scott & Fetzer Co., 4801 W. 150th St., Cleveland, OH 44135, Tel: 216-267-9000, TELEX: 98-5349; FSC No.: 73389; Empl.: 177; *Sls. Mgr.:* J. L. Smelko

ADAMS-MAXWELL DIVISION, Coast Magnetics, 1207 North La Brea Ave. Inglewood, CA 90302-1284, Tel: 213-673-3245, TELEX: 686103AMISPACEASA, FAX: 213-673-8828; FSC No.: 22558; Empl.: 60; *Sls. Mgr.:* Dev Dosaj

ADAMS RITE PRODUCTS, INC., 540 W. Chevy Chase Dr., Glendale, CA 91204, Tel: 818-241-5121, TWX: 910-497-2276; Empl.: 150; *Sls. Mgr.:* Jonas Williams

ADAMS-RUSSELL ELECTRONICS CO., INC., Haverhill Rd., Amesbury, MA 01913, Tel: 508-388-5210, TWX: 710-347-6360; FSC No.: 11556; Empl.: 400; *Sls. Mgr.:* H. Adjemian

ADAMS-RUSSELL, Anzac Div., 80 Cambridge St., Burlington, MA 01803, Tel: 671-273-3333, TELEX: 200155, TWX: 710-332-0258; FSC No.: 21912; Empl.: 300; *Sls. Mgr.:* Mike Smith

ADAMS-RUSSELL, INC., 10713 Gilroy Rd., Hunt Valley, MD 21030, Tel: 301-771-0077, TELEX: 87442, FAX: 301-771-6025; FSC No.: 29644; *Sls. Mgr.:* Frederick D. Reynolds

ADAPTIVE NETWORKS, P.O. Box 1020 Kendall Sq., Cambridge, MA 02142, Tel: 617-497-5150; Empl.: 20; *Sls. Mgr.:* Michael Liebson; *Dist. Mgr.:* Michael Liebson

ADATEK, INC., 700 Airport Way, Sandpoint, ID 83864, Tel: 208-263-1471, 800-323-3343, TELEX: 62903932, FAX: 208-263-6596; Empl.: 13; *Sls. Mgr.:* Ken Brookings; *Dist. Mgr.:* Suzy Hook

ADCOUR, INC., 18 Billings St., PO Box 277, Sharon, MA 02067, Tel: 617-784-8123, FAX: 617-784-5563; Empl.: 29; *Sls. Mgr.:* William O'Connell; *Dist. Mgr.:* William O'Connell

ADC TELECOMMUNICATIONS, INC., 4900 W. 78th St., Minneapolis, MN 55435, Tel: 612-835-6800, TELEX: 290321, FAX: 612-893-3292; Empl.: 1750; *Sls. Mgr.:* Michael Hopkins

ADDACON, INC., 3702-C Alliance Dr., Greensboro, NC 27407, Tel: 919-852-6200, FAX: 919-852-6256; *Sls. Mgr.:* Lynn Cummings

A.D. DATA, INC.:PHOTOGRAPHIC SCIENCES CORP.(PSC), 770 Basket Rd, Webster, NY 14580, Tel: 716-265-1600, FAX: 716-265-1689; FSC No.: 23389; Empl.: 12; *Sls. Mgr.:* Jack Petz; *Dist. Mgr.:* J. Cessna, J. Butters

ADDITIVE PRODUCTS DIV., Kollmorgen Corp., P.O. Box 700, West La., Aquebogue, NY 11931, Tel: 516-722-4100, FAX: 516-722-4154; Empl.: 500; *Sls. Mgr.:* Lenny Smookler

ADE, INC., 1430 E. 130th St, Chicago, IL 60633, Tel: 312-646-3400, FAX: 312-646-3919; FSC No.: 62049

ADI ELECTRONICS, 101 Trade Zone Dr., Ronkonkoma, NY 11779, Tel: 516-737-1800, TWX: 800-645-5402; Empl.: 200; *Sls. Mgr.:* Fred Farrace

ADIRONDACK WIRE & CABLE, ACS Industries Inc., 162 Hamley Ave., Woonsocket, RI 02895, Tel: 1-401-769-1600, FAX: 1-401-769-1607; Empl.: 200; *Sls. Mgr.:* Julian Caduto; *Dist. Mgr.:* Ruth Mills

ADTECH POWER INC., 1620 S. Sunkist St., Anaheim, CA 92806, Tel: 714-634-9211, TELEX: 68-1498, FAX: 714-634-0802; FSC No.: 56410; Empl.: 70; *Sls. Mgr.:* Stuart B. Morrey; *Dist. Mgr.:* Stuart B. Morrey

ADTRON CORPORATION, 745 N. Gilbert Rd., Ste. 124-361, Gilbert, AZ 85234, Tel: 602-961-7511; Empl.: 3; *Sls. Mgr.:* Rosemary Richards

Distributor

ADVACOM INC., 5620 West Rd., McKean, PA 16426, Tel: 1-800-458-0512, 814-476-7774.....625, 634, 642, 661, 725, 735, 741, 748, 761, 771, 786, 827

ADVANCE, A Unit of Zero Corporation, 6900 Beck Avenue, N. Hollywood, CA 91605, Tel: 818-983-0333; *Sls. Mgr.:* Kevin Quinn ..... **C•1099**

Local Sales Offices & Reps

AL	Huntsville, So. Mktg. & Assocs.	205-534-6020
AZ	Phoenix, Shefler/Kahn	602-257-9015
AZ	Scottsdale, Casola Assocs.	602-860-5061
AZ	Tempe, HISCO/Arizona	602-968-6171
CA	Carson, Aetna Labs.	213-532-4779
CA	Los Angeles, Landa & Assocs.	213-879-0770
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CA	San Diego, Qualtronics	619-695-0118
CA	Santa Ana, Landa & Assocs.	714-543-7805
CA	Sherman Oaks, Advance Engrg.	818-983-0333
CA	Sunnyvale, Eagle Mktg.	408-736-0448
CO	Aurora, HISCO/Denver	303-341-0411
CO	Golden, J.F. Hurlbut Co.	303-279-7796
CT	New Milford, Ray Perron Co.	203-354-2569
FL	Bradenton, T G & Assocs.	813-753-4158
FL	Hypoluxo, H. J. Leary	305-582-5456
GA	Woodstock, Protech Sys.	404-926-0342
IL	Elk Grove, Restronics	312-437-7707
IL	Elmhurst, FF/Hill-Gray	312-832-4101
IN	Indianapolis, MEI	317-872-5662
MD	Columbia, ARA Elctrns.	301-953-1733
MA	Needham, Ray Perron Co.	617-449-6162
MA	Palmer, Beniot-Senecal	413-283-8343
MN	Minnetonka, Production Autmation N.	612-935-1414
MO	Hazelwood, Stone & Assocs.	314-895-4565
MO	Kansas City, Production Automation S.	816-737-3030
NH	Dover, Ray Perron Co.	603-742-2321
NJ	Livingston, Argo Zeta	201-680-1004
NM	Albuquerque, Shefler/Kahn	505-274-0499
NY	Smithtown, T & K Sls.	516-724-3456
NY	Whitney Point, Tae-Rep ...	607-692-3705/772-6952
OH	Cincinnati, Ken Hoffman Co.	513-931-1621
OH	Kettering, Ken Hoffman Co.	513-299-8448
OR	Beaverton, Evergreen Mktg. Grp.	206-633-3160
PA	West Conshocken, Eastern Comp. Sls. Corp.	215-825-8610
TX	Austin, Barry Sls.	512-837-3616
TX	Bedford, P. R. Zano & Assocs.	214-688-0652
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
WA	Federal Way, Rick Carr & Assocs.	206-839-6334
WA	Seattle, Evergreen Mktg. Grp.	206-633-3160
WI	Madison, FF/Hill-Gray	608-246-8155
EXP	Rio Pjedras, PR, Elctrn. Sls. Assocs.	809-762-6259

ADVANCE CONVERSION DEVICES CO., 274 S. Salem St., Randolph, NJ 07869, Tel: 201-989-0095; FSC No.: 52298; Empl.: 24; *Sls. Mgr.:* D. J. Fedderly ..... **D•2164-2165**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs., Inc.	205-533-9108
AZ	Scotsdale, Dave Menegay & Assocs.	602-994-9519
AR	El Dorado, Kemp Engrg. Co., Inc.	918-663-4501
CA	Campbell, SMA	408-370-6900
CA	Costa Mesa, FLW Inc.	714-751-7512
CO	Denver, Elcom, Inc.	303-337-2300
GA	Norcross, Hughes Assocs., Inc.	404-622-1587
GA	Warner Robins, Hughes Assocs., Inc.	912-477-1889
IA	Des Moines, The Beams Co.	515-255-1148
KS	Shawnee Mission, The Beams Co.	913-631-0200
MD	Elliott City, Dyna-Rep Co.	301-992-4350
MA	Lexington, E. F. Dillon, Inc.	617-862-1118
MI	Ann Arbor, SKM Ashby Assocs., Inc.	313-995-4082
MN	Minneapolis, Integrated Peripherals Sys., Inc.	612-831-0349
MS	Corinth, Hughes Assocs., Inc.	601-287-2915
MO	St. Louis, The Beams Co.	314-434-8448
NJ	Franklin Lakes, Hansen & Hughes Assocs.	201-848-8900
NM	Albuquerque, Brytec Sls. Inc.	505-884-1123
NY	Clinton, Advanced Comps. Corp.	315-853-6438
NY	Greenlawn, Hanson & Hughes Assocs.	516-754-3608
NY	N. Syracuse, Advance Comps.	315-699-2671
NY	Rochester, Advanced Comps. Corp.	716-544-7017
NY	Scottsdale, Advanced Comps. Corp.	716-889-1429
NC	Cary, Hughes Assocs., Inc.	919-467-7029
OH	Cleveland, SKM Ashby Assocs., Inc.	216-461-0826
PA	Evdenheim, Espy Sls. Co.	215-576-0780
TN	Jonesboro, Hughes Assocs.	615-753-2719
TN	Nashville, Hughes Assocs.	615-871-0908
TX	Lewisville, J. Hughes Co.	817-430-1683
TX	Stafford, Jim Hughes Co.	713-343-0673
VA	Alexandria, Dyna-Rep Co.	703-354-1222
EXP	NY/New York, Roburn Agencies, Inc.	212-989-5939

ADVANCED ANALOG, Intech, 2270 Martin Ave., Santa Clara, CA 95050, Tel: 408-988-4930, FAX: 408-988-2702; FSC No.: 52467; Empl.: 150; *Sls. Mgr.:* Michael Sullivan ..... **D•1616**

ADVANCED CIRCUIT TECHNOLOGY, 118 Northeastern Blvd., Nashua, NH 03062, Tel: 603-880-6000, 800-234-FLEX, TWX: 710-228-8961, FAX: 603-880-1785; FSC No.: 57034; Empl.: 185; *Sls. Mgr.:* David Bouley, Dir. of Sls.

ADVANCED COMPONENTS INDS., INC., Spitznagel GmbH, 120 Center Street, El Segundo, CA 90245, Tel: 213-322-4249, TELEX: 5106000379 ACI LSA CA, FAX: 213-322-6661; *Sls. Mgr.:* Irma Spreitzer ..... **A•2248**

Local Sales Offices & Reps

CA	Los Angeles, Power Partners, Inc.	213-215-0800
CA	San Ramon, Tech. Consits.	415-830-0829
CT	Hopkinton, Berkshire Elctrns.	508-435-9356
IL	St. Charles, XYZ Mktg.	312-584-3001
ME	Hopkinton, Berkshire Elctrns.	508-435-9356
MA	Hopkinton, Berkshire Elctrns.	508-435-9356
NH	Hopkinton, Berkshire Elctrns.	508-435-9356
WI	St. Charles, XYZ Mktg.	312-584-3001

ADVANCED CONTROL SYS., 205 Oak Street, Pembroke, MA 02359, Tel: 617-826-4477, FAX: 617-826-9987; Empl.: 8; *Sls. Mgr.:* Leopold Bric ..... **D•1135**

ADVANCED DETECTOR CORP., Applied Solar Energy Corp., 15251 E. Don Julian Rd., Industry, CA 91746, Tel: 818-369-6886, TWX: 910-584-4890, FAX: 818-336-8694; Empl.: 297

ADVANCED ELECTRONIC PACKAGING, 21562 Surveyor Circle, Huntington Beach, CA 92646, Tel: 714-969-1150; *Sls. Mgr.:* Douglas A. Hill

ADVANCED FILTER DEVICES, INC., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009, Tel: 619-438-2074, FAX: 619-438-5937; FSC No.: 56620; Empl.: 45; *Sls. Mgr.:* Herbert Johnson

ADVANCED HIGH VOLTAGE CO., P.O. Box 2136, Lancaster, CA 93539, Tel: 805-946-2600; *Sls. Mgr.:* John Richardson ..... **D•1617**

ADVANCED INPUT DEVICES, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814, Tel: 208-765-8000, TWX: 510-776-0584; FSC No.: 95666; Empl.: 300; *Sls. Mgr.:* Kevin Malone

ADVANCED INTERCONNECTIONS CORP., 5 Energy Way, West Warwick, RI 02893, Tel: 401-823-5200, TWX: 910-240-3454, FAX: 401 823-8723; FSC No.: 05-0394638; *Sls. Mgr.:* Max E. Rice

ADVANCED KINETICS, 1239 Victoria St., Costa Mesa, CA 92627, Tel: 714-646-7165, TELEX: 18-2714, FAX: 714-722-9039; Empl.: 32; *Sls. Mgr.:* Mitch Barker

ADVANCED LINEAR DEVICES, INC., 1180F Miraloma Way, Sunnyvale, CA 94086-4606, Tel: 408-720-8737, TWX: 510-100-6588, FAX: 408-720-8297; Empl.: 10; *Sls. Mgr.:* G. M. O'Neal; *Dist. Mgr.:* G. M. O'Neal

ADVANCED MATERIALS SYSTEMS, See Handy & Harman Electronic Materials Corp.

ADVANCED MICRO DEVICES, P.O. Box 3453, 901 Thompson Pl, Sunnyvale, CA 94088, Tel: 408-732-2400, TELEX: 34-6306, TWX: 910-339-9280, FAX: 408-982-7447; Empl.: 17,000; *Sls. Mgr.:* Steve Zelencik; *Dist. Mgr.:* Al Frugaletti

ADVANCED MICRO SYSTEMS, INC., 31 Flagstone Drive, Hudson, NH 03051, Tel: 603-882-1447, FAX: 603-889-0425; Empl.: 50

ADVANCED POWER PRODUCTS, 1510 Garden St. Ste. 17, Santa Barbara, CA 93101, Tel: 805-965-0042, FAX: 805-684-4400

ADVANCED PRECISION CONTROLS, 409 Calle San Pablo, No. 100, Camarillo, CA 93010, Tel: 805-388-1344, FAX: 805-388-1270; Empl.: 20; *Sls. Mgr.:* Judy Williams; *Dist. Mgr.:* Judy Williams

ADVANCED SYSTEMS CONCEPTS, 2333 N. Lake Ave., Altadena, CA 91001, Tel: 818-791-0983, TELEX: 701 215 ASCI, FAX: 818-791-8347; FSC No.: 6U785; Empl.: 15; *Sls. Mgr.:* Maria Reddix; *Dist. Mgr.:* B. Lee

ADVANCED TECHN. RESEARCH LABS., 5645 K General Washington Dr., Alexandria, VA 22312, Tel: 703-750-2920; FSC No.: 91375; Empl.: 12; *Sls. Mgr.:* Bob Palma, Sr.; *Dist. Mgr.:* Bob Palma, Sr.

ADVANCED THERMAL PRODUCTS, INC., P.O. Box 249, St. Marys, PA 15857, Tel: 814-772-0278, FAX: 814-722-0905; *Sls. Mgr.:* John M. Sidoni

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg.	205-722-0440
GA	Atlanta, DHR Mktg.	404-564-0529
NY	Syracuse, John R. Costello	315-472-0322
NC	Raleigh, DHR Mktg.	919-781-1961
SC	Greenville, DHR Mktg.	803-235-3594
TX	Dallas, Eatman Engineering	214-771-1903
WI	New Berlin, Thomas Labant	414-425-7157

AD-VANCE MAGNETICS, INC., 625 Monroe St, Rochester, IN 46975, Tel: 219-223-3158, TWX: 810-290-0294, FAX: 219-223-2524; FSC No.: 50788; Empl.: 33; *Sls. Mgr.:* Kay Nixon ..... **C•1730**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp	205-539-8476
CA	El Cajon, ATronix Technlg.	619-444-1501
CA	Los Altos, Frauman Assoc.	415-941-0660
CA	Woodland Hills, ATronix Technlg.	818-703-7212
CO	Englewood, Component Sls. Inc.	303-779-8060
CT	Branford, Abbott-Allison	203-481-0405
FL	Hollywood, Askland Electronic Components	305-987-1974
IL	Westchester, W. G. Brouillette	312-345-6500
NJ	Flanders, K & R Engrg. Sls. Corp.	201-584-5235, 800-631-9362
NC	Winston-Salem, Murcota Corp.	919-722-9445
PA	Stewartstown, Eastern Comps. Sls. Corp.	717-993-6261
PA	W. Conshohocken, Eastern Comps.	215-825-8610
TX	Dallas, J. M. Spell Co. Inc.	214-620-0040
UT	Salt Lake City, Component Sls. Inc.	801-268-8440
VA	Herndon, Eastern Comps.	703-444-1089
VA	Vinton, Eastern Comps. Sls. Corp.	703-344-4756
WA	Bellevue, Caruso & Co.	206-455-8811

ADVANCE POWER SUPPLIES, INC., 32111 Aurora Rd., Solon, OH 44139, Tel: 216-349-0755, FAX: 216-349-0142; Empl.: 6

ADVANCE WIRE & CABLE, The Advance Group, 1661 Industrial Way, Belmont, CA 94002, Tel: 415-592-4550, TELEX: 334475, FAX: 415-593-8859; FSC No.: 57775; Empl.: 158; *Sls. Mgr.:* Ed Mittelbusher; *Dist. Mgr.:* Ed Mittelbusher

Local Sales Offices & Reps

AZ Phoenix, The Advance Grp. 602-437-1334
CA Anaheim, The Advance Grp. 714-870-0300
CA Belmont, The Advance Grp. 415-592-4550
CA Mission Viejo, Robert M. Riell Co. 714-380-8903
CO Lakewood, CDT 303-989-6563
FL Orlando, Gillum Sls. 305-857-2110
FL Tampa, Gillum Sls. 813-531-2248
FL Tampa, Standard Mktg. Inc. 813-933-5833
GA Duluth, DTM Inc. 404-381-5592
IL Deerfield, Flaherty-Haines, Inc. 312-948-7800
ME Worcester, Spec-Tec 617-795-7270
MD Ellicott City, Tech. Sls. Inc. 301-461-2400
MN Minneapolis, TecTeam Sls. Inc. 612-854-6616
NY Commack, JL Sls. Assocs. 516-462-5666
NY Victor, Schumacher, Scruggs & Kirby 716-248-8750
OH Cleveland, JFCO Inc. 216-398-6300
OH Dayton, JFCO 513-890-7251
SC Greer, Advance Wire & Cable 803-877-9600
TX Plano, K & H Sls. 214-423-6520
WA Redmond, The Advance Grp. 206-867-0416

ADVANTEST®

FAX: 312-634-2872

ADVANTEST AMERICA, INC., 300 Knightsbridge Parkway, Lincolnshire, IL 60069, Tel: 312-634-2552; Empl: 163; *Sls. Mgr.:* Hiroji Agata ..... **D•1215-1217**

Instruments

Local Sales Offices & Reps

AL Huntsville, Southern Mktg. Assocs. 205-534-6020
AZ Phoenix, Advantest America, Inc. 602-840-9470
AZ Phoenix, Barnhill Associates, Inc. 602-788-9596
CA Carson, Amasco 213-516-8561
CA San Jose, Amasco 408-262-1500
CA Santa Clara, Advantest America, Inc. .. 408-970-9922
CA Santa Monica, Advantest America, Inc. 213-392-0088
CO Englewood, Barnhill Associates 303-741-3844
CT Wallingford, Pat Jenks Assocs. 203-265-9939
FL Longwood, Southern Mktg. Assocs. ... 407-682-7317
FL Orlando, Advantest America, Inc. 407-859-0722
GA 404-565-0603
GA Marietta, Southern Mktg. Assocs. 404-565-0603,
IL Elmhurst, Sector Engineering 312-530-7850
IL Lincolnshire, Advantest America, Inc. 312-634-2552
IL Park Ridge, Aegis 312-823-1587
IN Indianapolis, Sector Engineering 317-842-1120
MD Rockville, Creative Mktg. Assocs. 301-251-4100
MA Beverly, Pat Jenks Assocs. 508-921-4600
MA Marlboro, Advantest America, Inc. 508-481-1141
MI Madison Hgts., WKM Associates, Inc. 313-588-2300
MN Minneapolis, Sector Engineering 612-593-1809
NJ Fort Lee, Advantest America, Inc. 201-886-0300
NM Albuquerque, Barnhill Assocs., Inc. 505-299-7658
NY Elmsford, Metrotek Associates, Inc. ... 914-347-4112
NY Fayetteville, DB Associates, Inc. 315-446-0220
NC Greensboro, Southern Mktg. Assocs., Inc. 919-282-6001
OH Dayton, WKM Associates, Inc. 513-434-7500
OK Tulsa, Barnhill Associates,Inc. 918-744-6535
OR Portland, Advantest America, Inc. 503-255-8985
OR Wilsonville, SYNTEK 503-682-2750
PA Allentown, Advantest America, Inc. 215-264-7680
PA Northampton, AEGIS 215-837-8400
PA Southampton, Eastern Instrmn. of Phila. 215-355-7700
PA Stroudsburg, AEGIS 717-421-8660
TX Austin, Advantest America, Inc. 512-451-3936
TX Austin, Aegis 512-451-6188
TX Farmers Branch, Advantest America, Inc. 214-239-7834
TX Richardson, Barnhill Associates 214-231-2573
UT Salt Lake City, Barnhill Associates 801-262-3000
VT Williston, Advantest America, Inc. 802-879-8974
WA Bellevue, SYNTEK 206-462-7700
Can Mississauga, Ont., Allan Crawford Assocs., Ltd. 416-890-2010
Can N. Vancouver, B.C., Allan Crawford Assocs., Ltd. 604-988-2195
Can Ottawa, Ont., Allan Crawford Assocs., Ltd. 613-596-9300
AL Huntsville, Southern Mktg. Assoc. 205-534-6020
AZ Phoenix, Barnhill Assocs. 602-788-9596
CA Camarillo, Advantest America, Inc. 808-987-6415
CA San Jose, Amasco 408-262-1500
CA Torrance, Amasco 213-516-8561
CO Englewood, Barnhill Assocs. 303-741-3844
CT Wallingford, Pat Jenks Assocs. 203-265-9939
FL Longwood, Southern Mktg.Assoc. 407-682-7317
GA Marietta, Southern Mktg. Assoc. 404-565-0603
IL Elmhurst, Sector Engrg. & Sls. 312-530-7850
IN Indianapolis, Sector Engrg. & Sls. 317-842-1120
MD Frederick, Advantest America, Inc. 301-662-1696
MD Rockville, Creative Mktg. Assoc. 301-251-4100
MA Beverly, Pat Jenks Assocs. 508-921-4600
MI Madison Heights, WKM Assocs. 313-588-2300
MN Minneapolis, Sector Engrg. & Sls. 612-593-1809
NM Albuquerque, Barnhill Assocs. 505-299-7658
NY Canastota, New York Hytek Assocs. .. 315-697-8415
NY Elmsford, Metrotek Assocs. 914-347-4112
NC Greensboro, Southern Mktg. Assoc. ... 919-854-5588
OH Dayton, WKM Assocs. 513-434-7500
OH Independence, WKM Assocs. 216-524-5930
OR Wilsonville, Syntek 503-682-2750
PA Pittsburgh, WKM Assocs. 412-892-2953
PA Southampton, Eastern Instrs. of PA ... 215-355-7700
TX Austin, Barnhill Assocs. 512-451-0217
TX Houston, Barnhill Assocs. 713-776-9825
TX Richardson, Barnhill Assocs. 214-231-2573
TX San Antonio, Barnhill Assocs. 512-694-5575
UT Orem, Barnhill Assocs. 801-262-3000
VA Sterling, Advantest America, Inc. 703-444-3372
WA Bellevue, Syntek 206-462-7700
WI Milwaukee, Sector Engrg. & Sls. 414-352-8280
Can Calgary,AL, Allan Crawford Assocs. ... 403-295-0822
Can Mississauga, Ont., Allan Crawford Assocs. 416-890-2010
Can N. Vancouver, B.C., Allan Crawford Assocs. 604-988-2195
Can Ottawa, Ont., Allan Crawford Assocs. 613-596-9300
Can St. Laurent, QE, Allan Crawford Assocs. 514-747-7878

ADVANTEST CORPORATION, NS Bldg. 14th,4-1,Nishi-Shinjuku 2-Chome,Shinjuku-ku, Tokyo 160, Tokyo 163, Japan, Tel: 03-342-7500, TELEX: 232-4914 ADVAN J, FAX: 03-342-7510; Empl.: 1300; *Sls. Mgr.:* Keishi Kaetsu

A E G CORPORATION, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269, Tel: 201-231-8300, TELEX: 833409 ..... **B•1127**

Local Sales Offices & Reps

AZ Tempe, Cantec Sls. Inc. 602-829-0191
CA El Monte, Cook Entprs. 213-686-2120
CA Livermore, United Tech. Mktg. 415-449-7644
CA San Clemente, A.T.A. Assocs. 714-498-7180
CA Santa Ana, Technlg. Solutions 714-558-9562
CA Sunnyvale, AEG Western Region 408-426-9946
CA Woodland Hills, Technlg. Solutions ... 818-704-1693
CT Farmington, Ray Perron & Co., Inc. 203-673-4825
FL Clearwater, Sigma Tech. Assocs., Inc. 813-791-0271
GA Norcross, Electramark 404-446-7915
IL Chicago, Janus Ins. 312-250-9650
IL Des Plaines, AEG Sls. Off. 312-299-8799
IL Rolling Meadows, Phase II Mktg. 312-806-1330
IL Schaumburg, AEG Cen. Region 312-303-6460
IN Ft. Wayne, M/S Sls. & Assocs., Inc. ... 219-436-3023
IA Cedar Rapids, J.P. & Assocs. 313-393-9790
MD Annapolis, Paragem, Inc. 301-269-1898
MA Needham, Ray Perron & Co., Inc. 617-449-6162
MA New Bedford, AEG Eastern Region ... 617-990-1057
MI St. Claire Shores, DEM Sls. 313-777-1750
MN Minnetonka, J.P. & Assocs., Inc. 612-935-7930
NH Dover, Ray Perron & Co., Inc. 603-742-2321
NJ Haddonfield, Sunday O'Brien 609-429-4013
NY Commack, ERA 516-543-0510
NY Long Island City, M. H. Lynn 718-352-9233
NY Syracuse, Micro-Tech Mktg. 315-458-5242
NY Syracuse, Pi Tronics Inc. 315-455-7346
NC Raleigh, Zucker Assocs., Inc. 919-782-8433
OH Cleveland, Arthur H. Baier Co. 216-461-6161
OH Columbus, Arthur H. Baier Co. 614-764-1144
OR Tigard, Elctrn. Comp. Sls. 503-245-2342
PA Camp Hill, Quick Response 717-938-9696
PA Pittsburgh, Arthur H. Baier Co. 412-367-7799
TX Garland, Pro Comp Sls. 214-276-1948
TX Hurst, Pro Comp Sls. 817-589-0336
VA Lynchburg, Paragem 804-528-0681
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301
WI Milwaukee, Janus Inc. 414-542-7575
WI Milwaukee, Phase II Mktg. 414-272-1171
Can Brampton, Ont., Cantec Reps., Inc. 416-791-5922
Can Dollard des Ormeaux, Que., Cantec Reps. 514-683-6131
Can Ottawa, Ont., Cantec Reps., Inc. 613-725-3704

Local Distributors

AZ Phoenix, Cetec/Future 602-272-7851
CA Anaheim, Pacesetter Elctrns. USA, Inc. 714-779-5855
CA Chatsworth, Cetec/Future 818-700-0914
CA Irvine, Cetec/Future 714-250-4141,818-446-5733
CA Irvine, Integrated Elctrns. 714-837-9960
CA Milpitas, Cable Conn 408-943-6655
CA Orange, Elctrn. Connexions Corp. 714-998-9241
CA Sacramento, Integrated Elctrns. 916-424-5297
CA San Diego, Cetec/Future, Inc. 619-278-5020
CA San Jose, Future Elctrns. 408-435-9100
CA San Jose, Integrated Elctrns. 408-435-1000
CA Santa Clara, Cetec/Future, Inc. 408-748-8550
CA Sunnyvale, Pacesetter Elctrns. 408-734-5470
CA Sunnyvale, SAI 408-720-0760
CO Denver, Integrated Elctrns. 303-292-6121
CO Westminster, Future Elctrns. 303-650-0123
CT Danbury, Future Elctrns. 203-743-9594
CT Wallingford, Midstoth Elctrns. 203-265-9900
FL Altemonte Springs, SAI 305-831-6201
FL Boca Raton, Plainview Elctrns. 305-997-7705
FL Clearwater, Future Elctrns. 813-578-1770
FL Ft. Lauderdale, Reptron Elctrns. 305-735-1112
FL Orlando, Future Elctrns. 305-767-8414
FL Tampa, Reptron Elctrns. 813-855-4656
GA Norcross, Future Elctrns. 404-441-7676
GA Norcross, Reptron Elctrns. 404-446-1300
IL Des Plaines, Rod Graham 312-299-8799
IL Hoffman Estates, Integrated Elctrns. .. 312-843-2040
IL Schaumberg, Future Elctrns. 312-882-1255
IL Schaumberg, Reptron Elctrns. 312-882-1700
IN Indianapolis, Mar Elctrns. 317-633-6699
IA Cedar Rapids, Dee Elctrns. 319-365-7551
MD Columbia, Future Elctrns. 301-995-1222
MD Columbia, Gen. Radio Supply Co. 301-995-6744
MA Westboro, Future Elctrns. 617-366-2400
MA Wilmington, SAI 617-657-5700
MI Livonia, Reptron Elctrns. 313-525-2700
MN Minnetonka, Reptron Elctrns. 612-938-0000
NJ Camden, General Radio 609-964-8560
NJ Cherry Hill, Exact Inc. 609-429-6586
NJ Mount Laurel, Future Elctrns. 609-778-7600
NJ Newark, Samar Corp. 201-344-4453
NJ West Berlin, Gen. Components Inc. ... 609-768-6767
NM Albuquerque, Elctrn. Dvcs., Inc. 505-884-2950
NY Liverpool, Future Elctrns. 315-451-2371
NY Melville, SAI 516-293-2710
NY Rochester, Future Elctrns. 716-272-1120
OH Worthington, Reptro Elctrns. 614-436-6675
OR Beaverton, Future Elctrns. 503-645-9454
OR Beaverton, Integrated Elctrns. 503-641-1690
TX Ft. Worth, Swieco, Inc. 817-335-6521
TX San Antonio, Sherman Elctrns. 512-224-1004
UT N. Salt Lake City, Integrated Elctrns. .. 801-298-1869
UT Salt Lake City, Future Elctrns. 801-972-8489
VT Rutland, SAI 802-775-7126
WA Bellevue, Future Elctrns. 206-881-8199
WA Bellevue, Integrated Elctrns. 206-455-2727
Can Calgary, Alb., Future Elctrns. 403-235-5325
Can Downsview, Ont., Future Elctrns. 416-638-4771
Can Edmonton, Alb., Future Elctrns. 403-438-2858
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Pointe Claire, Que., Future Elctrns., Inc. 514-694-7710
Can Vancouver, B.C., Future Elctrns. 604-294-1166

TELEFUNKEN electronic
Creative Technologies

FAX: 201-231-8353

A E G CORPORATION, Telefunken Semiconductors Div., 3140 Route 22, Somerville, NJ 08876-1269, Tel: 201-231-8300; *Sls. Mgr.:* John Szafranski ..... **B•1127**

Local Sales Offices & Reps

AL Huntsville, Elctrn. Mktg. Assocs. 205-536-3044
AZ Tempe, Cantec Sls., Inc. 602-345-1276
CA Campbell, Kottmeier Assocs., Inc. 408-371-8700
CA Fallbrook, Gary Chilcote Assocs. 619-728-7678
CA Santa Ana, Technlg. Solutions 714-558-9562
CA Woodland Hills, Technlg. Solutions ... 818-704-1693
CO Broomfield, Western Region Mktg. 303-469-8808
CT Bethel, Ray Perron Co., Inc. 203-798-0261
CT Farmington, Ray Perron Co., Inc. 203-673-4825
FL Tampa, Laramar, Inc. 813-963-3910
GA Atlanta, Elctrn. Mktg. Assocs. 404-448-1215
IL Rolling Meadows, Phase II Mktg. 312-806-1330
IN Ft. Wayne, M/S Sls. & Assocs. 219-436-3023
IN Greenwood, M/S Sls. & Assocs. 317-881-0110
MD Annapolis, Parogem, Inc. 301-269-1898
MA Needham, Ray Perron Co., Inc. 617-449-6162
MI Grand Rapids, DEM Sls., Inc. 616-344-4024
MI St. Clair Shores, DEM Sls., Inc. 313-777-1750
MN Minnetonka, J.P. & Assocs., Inc. 612-935-7930
NH Merrimack, Ray Perron Co., Inc. 603-424-4423
NY Commack, ERA 516-543-0510
NY Kingston, Micro-Tech Mktg., Inc. 914-338-7588

NY N. Syracuse, Micro-Tech Mktg., Inc. ... 315-458-5242
NY Rochester, Micro-Tech Mktg., Inc. 716-328-1420
NC Raleigh, Zucker Assocs. 919-782-8433
OR Tigard, Elctrn. Comp. Sls. 503-245-2342
PA Drexel Hill, DNE Sls. 215-789-6822
TX Hurst, Procomp Sls. 817-589-0336
TX Richardson, Procomp Sls. 214-669-1500
VA Lynchburg, Parogem, Inc. 804-528-0681
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301
Can Brampton, Ont., Cantec Reps. 416-791-5922
Can Ottawa, Ont., Cantec Reps. 613-725-3704
Can Quebec, Cantec Reps. 514-683-6131

Local Distributors

CA Pacesetter Elctrns. 714-779-5855
CO Integrated Elctrns. 303-292-6121
CT Midstate Elctrns. 203-265-9900
FL Reptron Elctrns. 813-854-2351
IN Mar Elctrns. 317-633-6699
IA Dee Elctrns. 319-365-7551
NJ Gen. Comps., Inc. 609-768-6767
NJ GRS Elctrns. 609-964-8560
NY SAI 516-293-2710
Can Quebec, Future Elctrns. 514-694-7710

AEG TELEFUNKEN, SEMICONDUCTOR GRP., See AEG Corp.

AEL, INC, See American Electronic Labs

AEMC CORPORATION, 99 Chauncy Street, Boston, MA 02111, Tel: 617-451-0227, 800-343-1391, TELEX: 95-1073, FAX: 617-423-2952; *Sls. Mgr.:* George Wood

AEROCOM, 3090 S.W. 37th Ave., Miami, FL 33133, Tel: 305-448-6503, TELEX: 6812020, FAX: 305-448-6916; FSC No.: 81535; Empl.: 55; *Sls. Mgr.:* Thomas A. Coleman

AEROFLEX
An ARX Company

FAX: 516-694-6771

AEROFLEX LABORATORIES INC., ARX, Inc., 35 South Service Road, Plainview, NY 11803, Tel: 516-694-6700, TWX: 510-224-6417; FSC No.: 88379; Empl.: 490 ..... **A•1737; B•1224-1227**

Local Sales Offices & Reps

AZ Mesa, Sonoran Western Inds., Inc. 602-820-9986
AZ Phoenix, Knight Co. 602-994-1311
CA Los Altos Hills, HB Mktg. 415-941-4080
CA Los Angeles, Knight Co. 213-670-2833
CA Orange, Qualitech Assocs. 714-639-9820
CA Palos Verdes, W.J. Miller Co. 213-375-3001
CA Palos Verdes's Peninsula, W. J. Miller Co. 213-375-3001
CA Santa Clara, Computer Modules, Inc. 408-496-1881
CA Sunnyvale, Qualitech Assocs. 408-732-4800
CO Littleton, Computer General 303-972-0752
CO Parker, Parker Webster Co. 303-841-4888
CT Hartford, C.S.I. Interconnect Prods. 203-644-8637
CT Hartford, C.S.I. Interconnect Prods. 203-873-1425
CT S. Windsor, C.S.I. Interconnect Prods. 203-644-1276
CT So. Windsor, C.S.I. Interconnect Prods. 203-644-8637
CT Southbury, Dynamic Technigs. 203-262-6220
FL Clearwater, Brennan Assocs., Inc. 813-446-5006
FL Lake Buena Vista, Brennan Assocs. .. 813-988-0561
FL Orlando, Brennan Assocs., Inc. 305-239-4399
FL Palm Bay, Star Tec Data Sys., Inc. 305-727-2247
GA Atlanta, Magaro & Assocs. 404-451-8862
IL Northfield, Feller Assocs., Inc. 312-446-8065
IA Cedar Rapids, Field Sls. Off. 319-364-0566
KS Wichita, Avionic Eng'r. Sls. Co. 316-264-6201
KS Wichita, Avionic Engrg. Sls. Co. 316-264-6201
MD Gaithersburg, SimComp 301-258-9358
MA Newberry Port, C.S.I. Interconnect Prods. 617-465-6276
MA Wayland, Daner Hayes 800-225-8760
MA Westborough, Technical Applications Assocs., Inc. 508-366-9781
MN Edina, Micro Resources Corp. 612-830-1454
MN Minneapolis, International Elctrns., Inc. 612-571-0000
NJ Ft. Lee, Nexus Technig. Sls., Inc. 201-947-0151
NJ Glen Gardner, Daner Hayes 201-537-4386
NJ Montvale, Henley Chemical Co. 201-307-0422
NY Albertson, DOL Engrg. 516-747-3944
NY Albertson, DOL Engrg., Inc. 516-747-3944
NY Cazenovia, DOL Engrg. 315-655-8602
NY Cazenovia, DOL Engrg. 315-334-0722
NY Hicksville, C.S.I. Interconnect Prods. ... 516-334-0722
NY Port Washington, Daner Hayes 516-767-9169
NY Youngstown, DOL Engrg. 716-754-7051
OH Novelty, Feller Assocs., Inc. 216-338-3774
OH Novelty, Field Sls. Off. 216-338-3774
OH Solon, J.R. Thornberry Co. 216-248-4995
OK Tulsa, Milko Mktg. 918-582-9411
PA Horsham, Nexus Technig. Sls., Inc. ... 215-675-9600
TX Austin, Milko Mktg. 214-453-3023
TX Dallas, Tesco, Inc. 214-553-1200
TX Houston, Milko Mktg. 713-723-5003
TX Richardson, Milko Mktg. 214-783-2785
TX Richardson, Milko Mktg. 214-783-2716
VA Front Royal, Eltron Sls. Ltd. 703-635-7201
WA Mercer Island, Eagle Entprs., Inc. 206-232-7401
WA Mercer Island, Electronic Comp. Sls., Inc. 206-232-9301
EXP NJ/Montvale, Henley Elctrns. 201-307-0422
Can Laval, Que., Elcom GMBH, Inc. 514-668-3361
Can Nepean, Ont., Multilek, Inc. 613-226-2365

AEROSPACE OPTICS, INC., 3201 Sandy La., Fort Worth, TX 76112, Tel: 817-451-1141, TELEX: 75-8461; Empl.: 83; *Sls. Mgr.:* Ben L. Fryrear

AEROTECH, INC., 101 Zeta Dr., Pittsburgh, PA 15238, Tel: 412-963-7470, TWX: 710-795-3125, FAX: 412-963-7459; Empl.: 156; *Sls. Mgr.:* F. Armstrong; *Dist. Mgr.:* K. Ross

AEROTRONIC, General Signal, Riverside Dr., Contoocook, NH 03229, Tel: 603-746-4631, TWX: 710-366-1684, FAX: 603-746-4679; FSC No.: 67272; Empl.: 100

AEROVOX INC., 740 Belleville Ave., New Bedford, MA 02745, Tel: 617-994-9661, TWX: 710-344-6985, FAX: 617-994-9635; FSC No.: 4K459; Empl.: 800; *Sls. Mgr.:* Jack Chmura; *Dist. Mgr.:* Bob Ritchie

AERTECH INDS., See TRW Microwave

AES CORP., 285 Newbury St., Peabody, MA 01960, Tel: 508-535-7310, TELEX: 387852 AES CORP INTL, FAX: 508-535-7313; Empl.: 25; *Sls. Mgr.:* Philip G. Huntley

AETNA ENGINEERING, P.O. Box 7749, Van Nuys, CA 91409-7749, Tel: 818-341-9409; Empl.: 6; *Sls. Mgr.:* T. W. Collins

AFI/DATATROL, See Datatrol, Div. of Data Card Corp.

AIL, DIV. CUTLER-HAMMER, See Eaton Corp. AIL Div.

AIL SYSTEMS, INC., Eaton Corp., Commack Rd., Deer Park, NY 11729, Tel: 516-595-3094, TWX: 510-227-6073; FSC No.: 00752; Empl.: 4600; *Sls. Mgr.:* J.B. Migliaccio

AILTEC DIV. CUTLER-HAMMER, See Eaton Corp., Elctrn. Instrmn. Div.

AIMSCO INC., Cheler Corp., 4024 22nd Ave. W., Seattle, WA 98199-0056, Tel: 206-284-5563, 800-426-0244, TWX: 910-444-1333, FAX: 206-285-4327; Empl.: 30; *Sls. Mgr.:* C. Ernst; *Dist. Mgr.:* Carl Teichman

AIPHONE, 1700 130th Ave. NE, Bellevue, WA 98005, Tel: 206-455-0510, FAX: 206-455-0071; Empl.: 44; *Sls. Mgr.:* Jim Morrison

AirBorn

FAX: 214-931-9305

AIRBORN, INC., 4321 AirBorn Dr., Addison, TX 75001-0519, Tel: 214-931-3200, TELEX: 79-4200, TWX: 910-860-5230; FSC No.: 10400;Multiple; Empl.: 548; *Sls. Mgr.:* T. V. Lee, Sls. Mgr.; *Dist. Mgr.:* Jerry Jameson ..... **C•1132-1143**

Local Sales Offices & Reps

AL Huntsville, South Design & Mktg. 205-880-3623
AZ Tempe, Piper Sls. Co. 602-949-0048
CA Downey, Buffa Co., Inc. 213-923-4618
CA Sunnyvale, Marquez & White 408-746-0800
FL Ft. Lauderdale, Southland Comps. 305-491-6110
IL Des Plaines, ESCO Assoc. 312-298-5310
IA Cedar Rapids, Dytronix 319-377-8275
KS Wichita, Dytronix 316-838-0884
MD Hunt Valley, Eagle Sls. Corp. 301-666-3930
MN St Paul, Johnson Co. 612-641-1878
MO Bridgeton, Dytronics, Inc. 314-291-4777
KS Leawood, Dytronix 913-339-6333
NH Nashua, Solla - Tronics 603-882-7146
NY Glen Cove, Dynorep 516-676-1598
NM Albuquerque, Piper Sls. Co. 505-883-9090
NY Penfield, Upstate Comps. 716-381-6070
NC Raleigh, GWC 919-790-7879
OH Dayton, Electro-Com 513-299-0864
TX Austin, Pro-Mark 214-644-0467
TX Richardson, Pro-Mark 214-644-0467
WA Seattle, Eltech Inc. 206-643-4330
Can Mississauga, Ont., Source Elctrns. Ltd. 416-676-0830
Can Ottawa, Ont., Source Elctrns. Ltd. 613-737-7580

Local Distributors

TX Addison, AirBorn Distribution Service 214-931-3200
TX Dallas, Accutronic Prods. 214-484-4923
TX Dallas, Hallmark Elctrns. 214-553-4300

Distributor

AIR ELECTRO INC., 7700 Gloria Ave., Van Nuys, CA 91406, Tel: 213-873-6400, 818-988-4400, TELEX: 66-2459, TWX: 910-495-1794, FAX: 818-988-4746 ..... **C•1310**

AIR/FLEX INDS. INC., 2422 Merced Ave., S. El Monte, CA 91733, Tel: 818-579-7060, FAX: 1-818-579-7063; FSC No.: 22782; *Sls. Mgr.:* Karl Thorp

Airflyte ELECTRONICS CO.

FAX: 201-436-6024

AIRFLYTE ELCTRNS. CO., 56 New Hook Rd., P. O. Box 231, Bayonne, NJ 07002, Tel: 201-436-2230; Empl.: 85; *Sls. Mgr.:* John Piret ..... **B•1228-1233**

Local Sales Offices & Reps

CA Los Altos, Poltronics 415-941-3020
CA Signal Hill, Thorson Co. 213-595-0361
CT No. Haven, Kitchen & Kutchin 203-239-0212
IL Park Ridge, Probe Elctrns. 312-698-2044
MA Lexington, Kitchen & Kutchin 617-862-8230
NJ Kinnelon, Avionics Equip. 201-838-8105
NY Rochester, Milton C. Matthews Co. 716-271-1910
PA Downingtown, Budd Elctrns. Corp. 215-458-8258
TX Austin, Electra Reps., Inc. 512-339-1163
TX Dallas, Electra Reps., Inc. 214-248-3852

AIR LAND SYSTEMS CORPORATION, 2710 Prosperity Ave., Fairfax, VA 22031, Tel: 703-573-1100, TELEX: 710-833-1174, TWX: Airland Frax; Empl.: 50

AIR MAZE CORP., 25000 Miles Rd., Cleveland, OH 44128, Tel: 216-292-6800, TELEX: 98-5413; Empl.: 300; *Sls. Mgr.:* G. E. Yoho

AIR-O-TRONICS, Trush Group, Route 20 E., Cazenovia, NY 13035, Tel: 315-655-2387, TWX: 710-541-1530, FAX: 315-655-3862; FSC No.: 16663; Empl.: 15

AIRPAX CO., CAMBRIDGE DIVISION, Woods Rd., Cambridge, MD 21613, Tel: 301-228-4600, TELEX: 6849138, TWX: 710-865-9655, FAX: 301-228-8910; FSC No.: 81541; Empl.: 1100; *Sls. Mgr.:* Bob Phillips ..... **B•1352**

Local Sales Offices & Reps

AL Huntsville, BCI 205-539-4411
AZ Tempe, Westrep 602-820-9932
CA Anaheim, Westrep 213-404-3881
CA San Diego, Westrep 619-566-6580
CA Santa Ana, Airpax Co. 408-980-0410
CO Littleton, Lange Sls. 303-795-3600
CT Clinton, Selmark Assocs. 203-573-9088
FL Pompano Bch., Airpax Co. 305-978-9019
GA Chamblee, BCI 404-455-0405
IL Palatine, Somers-Stanton, Inc. 312-991-1108
IN Indianapolis, Airpax Co. 317-573-9911
IA Marion, Rep Assocs. 319-373-0152
MD Frederick, Airpax Co. 301-243-3133
MA Millis, Selmark 508-376-2914
MI Farmington Hills, Airpax Co. 313-553-6030
MN Minnetonka, Airpax Co. 612-933-0170
MO Florissant, Delltron 314-839-0033
MO Kansas City, Delltron 816-436-6445
NH Hopkinton, Selmark Assocs. 603-746-3299
NY Fishkill, Airpax Co. 914-897-3170
NY Jericho, Airpax Co. 516-822-2410
NY Rochester, Airpax Co. 716-654-7470
NC Winston-Salem, L.G. White 919-725-3612

OH	Dayton, Baehr, Greenleaf	513-439-0724
OH	Westlake, Baehr, Greenleaf	216-892-1770
OH	Worthington, Baehr, Greenleaf	614-847-0220
OR	Beaverton, Airpax Co.	503-641-6130
PA	Harleysville, T. Jackson	215-256-8877
PA	Pittsburgh, Russell F. Clark	412-242-9500
SC	Greenville, L.G. White	803-271-0630
TX	Dallas, Airpax Co.	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larson Assocs.	414-258-0529

AIRPAX CO., Cheshire Div., Cheshire Indl. Pk., Box E, Cheshire, CT 06410, Tel: 203-271-6000, TWX: 710-455-4048, FAX: 203-271-6100; Empl.: 800; *Sls. Mgr.:* John Ricardi ..... **B•1931; D•1137**

Local Sales Offices & Reps

AL	Huntsville, B.C.I.	205-539-4411
AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	213-404-3881
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Airpax Co.	408-980-0410
CO	Littleton, Lange Sls.	303-795-3600
CT	Clinton, Selmark Assocs.	203-573-9088
FL	Pompano Bch., Airpax Co.	305-978-9019
GA	Chamblee, B.C.I.	404-455-0405
IL	Palatine, Somers-Stanton, Inc.	312-991-1108
IN	Indianapolis, Airpax Co.	317-573-9911
IA	Marion, Rep Assocs.	319-373-0152
MD	Frederick, Airpax Co.	301-243-3133
MA	Millis, Selmark Assocs.	508-376-2914
MI	Farmington Hills, Airpax Co.	313-553-6030
MN	Minnetonka, Airpax Co.	612-933-0170
MO	Florissant, Delltron	314-839-0033
MO	Kansas City, Delltron Co., Inc.	816-436-6445
NH	Hopkinton, Selmark Assocs.	603-746-3299
NY	Fishkill, Airpax Co.	914-897-3170
NY	Jericho, Airpax Co.	516-822-2410
NY	Rochester, Airpax Co.	716-654-7470
NC	Winston-Salem, L. G. White	919-725-3612
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
OH	Worthington, Baehr, Greenleaf & Assocs.	614-847-0220
OR	Beaverton, Airpax Co.	503-641-6130
PA	Harleysville, Thomas Jackson Assocs.	215-256-8877
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
SC	Greenville, L.G. White Southern, Inc.	803-271-0630
TX	Dallas, Airpax Co.	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larson Assocs.	414-258-0529

AIRPAX CO., Frederick Div., Husky Park P.O. Box 500, Frederick, MD 21701, Tel: 301-663-5141, TWX: 710-862-0901, FAX: 301-698-0624; Empl.: 600; *Sls. Mgr.:* Joe Ruth, Mktg. Mgr.; *Dist. Mgr.:* B. L. Reeder ..... **B•1413, 1887**

Local Sales Offices & Reps

AL	Huntsville, B.C.I.	205-539-4411
AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	213-404-3881
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Airpax Co.	408-980-0410
CO	Littleton, Lange Sls.	303-795-3600
CT	Clinton, Selmark Assocs.	203-573-9088
FL	Pompano Bch, Airpax Co.	305-978-9019
GA	Chamblee, B.C.I.	404-455-0405
IL	Palatine, Somers-Stanton Inc.	312-991-1108
IN	Indianapolis, Airpax Co.	317-573-9911
IA	Marion, Rep Assocs., Inc.	319-373-0152
MD	Frederick, Airpax Co.	301-243-3133
MA	Millis, Selmark Assocs.	508-376-2914

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MO	Florissant, Delltron Co.	314-839-0033
MO	Kansas City, Delltron Co., Inc	816-436-6445
NH	Hopkinton, Selmark Assocs.	603-746-3299
NY	Jericho, Airpax Co.	516-822-2410
NY	Fishkill, Airpax Co.	914-897-3170
NY	Rochester, Airpax Co.	716-654-7470
NC	Winston-Salem, L. G. White Southern	919-725-3612
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
OH	Worthington, Baehr, Greenleaf & Assocs.	614-847-0220
OR	Beaverton, Airpax Co.	503-641-6130
PA	Harleysville, Thomas Jackson Assocs.	215-256-8877
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
SC	Greenville, L. G. White Southern, Inc.	803-271-0630
TX	Dallas, Airpax Co.	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larson Assocs.	414-258-0529

Local Distributors

CA	Santa Ana, Norstan Elctrns.	714-540-4165
OK	Tulsa, Altair	918-665-0524
TX	Houston, Altair	713-462-3029
TX	Richardson, Altair	214-231-5166

AIRPAX CO., International Div., West Johnson Ave., Cheshire, CT 06410, Tel: 203-272-0301, TELEX: 643967; Empl.: 350; *Sls. Mgr.:* Walter Kalwara

AIRPAX CO., SENSOR DIV., A Division of North American Philips Corp., Cheshire Industrial Park, Cheshire, CT 06410, Tel: 203-272-0301, TELEX: 962421, TWX: 710-455-4048, FAX: 203-271-1395; Empl.: 200; *Sls. Mgr.:* Jim Rochford

AIRTRON, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950, Tel: 201-539-5500, TWX: 710-986-7473, FAX: 201-539-0357; FSC No.: 80006; Empl.: 500; *Sls. Mgr.:* M. R. Grosso, Natl. Sls. Mgr.

AIR-VAC ENGRG., 100 Gulf St., Milford, CT 06460, Tel: 203-874-2541, FAX: 203-783-1383; Empl.: 40

AJAX MAGNETHERMIC CORP., 1745 Overland Ave., N.E., Warren, OH 44482, Tel: 216-372-8511, TELEX: 098-2482, FAX: 216-372-8644; Empl.: 500

AKG ACOUSTICS, INC., 77 Selleck St., Stamford, CT 06902, Tel: 203-348-2121, TELEX: 285481, FAX: 203-324-1942; Empl.: 25; *Sls. Mgr.:* Rowland Powers

AKRO-MILS, 1293 S. Main St., Akron, OH 44301, Tel: 216-253-5593, TELEX: 98-6321, FAX: 216-253-9801; Empl.: 200; *Sls. Mgr.:* W. J. Tonachio; *Dist. Mgr.:* D. Martin

ALADDIN ELCTRNS., See AIE Div. of Vernitron

ALAN GORDON ENTPRS., INC., P.O. Box 3914, 5362 Cahuenga Blvd., N. Hollywood, CA 91601, Tel: 818-985-5500, TELEX: AGE-FOTO LSA 662532, TWX: 910-321-4526 GO, FAX: 213-871-2193; FSC No.: 94972; Empl.: 81; *Sls. Mgr.:* D. Sahlein

ALAN INDUSTRIES INC., P.O. Box 1203, Columbus, IN 47201, Tel: 812-372-8869, FAX: 812-372-5909; FSC No.: 52750; Empl.: 36; *Sls. Mgr.:* Blayde A. Kennedy

ALARM CONTROLS CORPORATION, P.O. Box 280, Deer Park, NY 11729, Tel: 516-586-4220, FAX: 516-586-6500; FSC No.: 55042; Empl.: 50; *Sls. Mgr.:* John Benedetto

ALASCO RUBBER & PLASTICS CORP., 617 Mountain View Ave.ó7, Belmont, CA 94002, Tel: 415-595-4100, FAX: 415-595-0298; FSC No.: 13862; Empl.: 25; *Sls. Mgr.:* Philip K. Nordberg

ALBAR, INC., 19013 36th Ave. W., Lynnwood, WA 98036, Tel: 206-771-4006, 800-822-5227, FAX: 206-771-2163; Empl.: 50; *Sls. Mgr.:* Mark Molina

ALBEROX CORPORATION, New Bedford Ind'l. Pk., New Bedford, MA 02745, Tel: 508-995-1725, FAX: 508-995-6954; Empl.: 180

ALBION INDUSTRIES, 800 N. Clark St., Albion, MI 49224, Tel: 517-629-9441

ALDEN COMPUTER SYSTEMS, One Salem Green, Ste. 420, Salem, MA 01970, Tel: 508-744-1314; *Sls. Mgr.:* Donald O'Brien

ALDEN ELECTRONICS, INC., 40 Washington Street, Westboro, MA 01581, Tel: 508-366-8851, TELEX: 94-8404, FAX: 617-898-2427; Empl.: 145; *Sls. Mgr.:* L. A. Farrington

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FAX: 508-583-0164

ALDEN PRODUCTS CO., P.O. Box 860, 117 N. Main St., Brockton, MA 02403, Tel: 508-583-0160, TELEX: 28-7793 ALDN UR; FSC No.: 01009; Empl.: 150; *Sls. Mgr.:* Donald J. Paul ..... **C•1144-1146**

ALDEN SYSTEMS, Alden Products Co., 262 N. Main St., P.O. Box 860, Brockton, MA 02403-0860, Tel: 508-583-0160, TELEX: 287 793 ALDN UR, FAX: 508-583-0164; Empl.: 150; *Sls. Mgr.:* D. Paul

A. L. DESIGN, INC., 4232 Ridge Lea Rd., Amherst, NY 14226, Tel: 716-833-6272, FAX: 716-833-8856; Empl.: 20

ALEPH INTERNATIONAL, 1026 Griswold, San Fernando, CA 91340, Tel: 818-365-9856

A.L.E. SYS., INC., 150 Homer Ave., Ashland, MA 01721, Tel: 508-881-5252, TELEX: 928-209, FAX: 617-235-6588; Empl.: 65; *Sls. Mgr.:* Barry Essig

ALEXANDER BATTERIES, New Product/OEM Divison, P.O. Box 28880, San Diego, CA 92128, Tel: 619-480-4445, TELEX: 371-9855, FAX: 619-480-1351; Empl.: 175; *Sls. Mgr.:* Dave Zeman ..... **D•1451**

Local Sales Offices & Reps

CO	Denver, Aurora Mktg.	303-758-3051
GA	Atlanta, Alexander Battery S.E.	404-968-4087
IL	McHenry, Alexander Battery Co.	815-344-0666
IA	Mason City, Jon Alexandres	515-423-8955
MN	Minneapolis, Paul Ohlin	612-941-7697
NJ	Middlesex, Jim Sapp	201-271-5880
OH	Dublin, Alexander Battery, Mideast	614-764-8771
TX	Arlington, Alexander Battery South	800-323-3813

ALEXANDER MANUFACTURING COMPANY, P.O. Box 1508, Mason City, IA 50401, Tel: 800-247-1821, 515-423-8955, TELEX: 3719855, FAX: 515-423-1644; Empl.: 250

ALFORD MANUFACTURING CO., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01801, Tel: 617-935-8610, FAX: 617-933-4512; FSC No.: 07177; Empl.: 20; *Sls. Mgr.:* Fred Abel

ALGO, INC., 9198-C Red Branch Rd., Columbia, MD 21045, Tel: 301-730-7442, TELEX: 333405; Empl.: 12; *Sls. Mgr.:* G. J. O'Mara

ALINABAL, 28 Woodmont Rd., Milford, CT 06460, Tel: 203-877-3241, TWX: 710-462-1178, FAX: 203-877-3241 (ext. 360); Empl.: 255

ALLEN AVIONICS, INC., 224 E. 2nd St., Mineola, NY 11501, Tel: 516-248-8080, FAX: 516-747-5481; Empl.: 300; *Sls. Mgr.:* Richard Mintz ..... **A•1504, 1684**

Local Sales Offices & Reps

AZ	Phoenix, J. F. Hurlbut Co.	602-952-2079
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Palo Alto, Adtek Assocs.	415-323-5414
CA	San Diego, Van Gott & Assocs.	619-308-0667
CO	Golden, J. F. Hurlbut Co.	303-279-7796
NY	Plainview, Eastern Metro Assocs.	516-931-1414
OR	Beaverton, Evergreen Mktg. Grp.	503-643-8020
PA	Huntingdon Valley, Rabal Assocs.	215-947-4825
TX	Dallas, Bradenco Corp.	214-352-3554
VA	Alexandria, Vanguard Engrg. Sls.	703-768-1660
WA	Seattle, Evergreen Mktg. Grp.	206-633-3160

ALLEN BRADLEY CO., ELECTRONIC COMPONENTS DIV., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, Tel: 915-592-4888, 800-592-4888, TELEX: 749-400, FAX: 915-594-8922; Empl.: 6500; *Sls. Mgr.:* Hugh Tyler; *Dist. Mgr.:* Chestley Grimsley ..... **A•2080-2081**

Local Distributors

AZ	Phoenix, Wyle Labs.	602-249-2888
CA	Calabasas, Wyle Laboratories	818-880-9000
CA	Chatsworth, Marshall Elctrns. Grp.	818-407-4100
CA	Chatsworth, TTI, Inc.	818-709-1010
CA	El Monte, Marshall Inds. Elctrns. Grp.	818-459-5500

CA El Segundo, Wyle Labs. 213-322-8100
CA Irvine, Marshall Inds. Elctrns. Grp. 714-859-5050
CA Irvine, Wyle Labs. 714-863-9953
CA Milpitas, Marshall Elctrns. Grp. 408-943-4600
CA Milpitas, TTI, Inc. 408-946-5577,
CA Rancho Cordova, Wyle Labs. 916-638-5282
CA San Diego, Wyle Labs. 619-565-9171
CA Santa Clara, Wyle Labs. 408-727-2500
CO Thornton, Wyle Distbn. Grp. 303-457-9953
CT Stratford, TTI, Inc. 203-375-1400
CT Wallingford, Marshall Elctrns. Grp. 203-265-3822
FL Orlando, Hammond Elctrns., Inc. 305-849-6060
FL Orlando, TTI, Inc. 305-859-1000
GA Atlanta, Marshall Elctrns. Grp. 404-923-5750
GA Atlanta, TTI, Inc. 404-662-0911
IL Chicago, Newark Elctrns. 312-784-5100
IL Palatine, Ohm Elctrns., Inc. 312-359-5500
IN Ft. Wayne, Graham Elctrns. Supp., Inc. 219-423-3422
IN Indianapolis, Graham Elctrns. Div. 317-875-8200,
MD Gaithersburg, Almo Elctrns. Inc. 301-670-0090
MD Gaithersburg, Marshall Elctrns. Inc. 301-840-9450
MA Canton, Almo Elctrns. 617-821-1450
MA Wilmington, Marshall Elctrns. Grp. 617-658-0810
MA Wilmington, TTI, Inc. 617-658-4700,
MI Livonia, Marshall Elctrns. Grp. 313-525-5850
MN St. Paul, Ragon Elctrns. 612-642-2828
MO Independence, Shelly-Ragon 816-254-3410
MO St. Louis, Chelsea Inds. 314-997-7709,
NJ Fairfield, Marshall Inds. Elctrns. Grp. .. 201-882-0320
NJ Mt. Laurel, Marshall Elctrns. Grp. 609-234-9100
NY Hauppauge, Fairmont Elctrns. Sls. Corp. 516-231-3313
NY Hauppauge, Marshall Elctrns. Grp. 516-273-2424
NY Johnson City, Marshall Elctrns. Grp. 607-798-1611
NY Rochester, Marshall Elctrns. Grp. 716-235-7620
NY Ronkonkoma, TTI, Inc. 516-737-2000
NC Greensboro, Hammond Elctrns., Inc. .. 919-275-6391
OH Columbus, Electronics Mktg. Corp. 614-229-4161
OH Dayton, Marshall Elctrns. Grp. 513-236-8088
OH Solon, Marshall Elctrns. Grp. 216-248-1788
OR Hillsboro, Wyle Labs. 503-640-6000
PA Philadelphia, Almo Elctrns. Corp. 215-698-4000
TX Fort Worth, TTI, Inc. 817-831-0441
TX Houston, Harrison Equip. Co., Inc. 713-879-2600
TX Richardson, Wyle Labs. 214-235-9953
UT Salt Lake City, Wyle Labs. 801-974-9953
WA Bellevue, Wyle Labs. 206-453-8300
WI Milwaukee, Marsh Elctrns., Inc. 414-475-6000
Can Montreal, Quebec, Arrow Elctrns. Canada Ltd. 514-735-5511
Can Nepean, Arrow Elctrns. Canada Ltd. ... 613-226-6903
Can Quebec, Arrow Elctrns. Canada Ltd. ... 418-687-4231
Can Toronto, Ont., Arrow Elctrns. Canada Ltd. 416-672-7769,

ALLEN-BRADLEY CO., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201, Tel: 414-382-2000, TELEX: 26699, TWX: 4311016; Empl.: 1600; *Dist. Mgr.:* Bob Anderson

ALLEN-BRADLEY CO., MAGNETICS DIVISION, Div. of Rockwell Corp., 5900 N. Harrison St., Shawnee, OK 74801, Tel: 405-275-2100, TELEX: 4311016; *Sls. Mgr.:* Carl Tufts, Dir. Mktg./Sls.; *Dist. Mgr.:* Jerry White, Natl. Sls. Mgr.

FAX: 818-765-2387

ALLEN CO., INC., ROBERT G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, Tel: 818-765-8300, 800-999-3711; Empl.: 35; *Dist. Mgr.:* Susan Duke ..... **A•1006, 1870-1872**

Local Sales Offices & Reps

CA Sunnyvale, Robert G. Allen Co., Inc. ... 408-243-7007
CT Winsor, Alan Armstrong 203-688-4513
FL Clearwater, Cherith Sls. Inc. 813-791-7679
IL Chicago, Rendell Sls. 312-967-1513
KS Leawood, James W. Dixon Co. Inc. ... 913-649-0805
KS Mission, Mertens Assoc. Inc. 913-432-9323
MA Burlington, Omni Rep 401-333-2353
NJ Palisades Park, Janco Technlg. Inc. ... 201-941-4008
NM Albuquerque, Nelco Elctrns. 503-293-1399
NY Rochester, Micro Tech Mktg., Inc. 716-328-3000
OR Portland, SPS Elctrns. 503-297-6919
PA Frazer, Industrial Comps. Inc. 215-889-0650
TX Irving, Kite Elctrns. 214-986-0321
WA Redmond, Interstate Elctrns. 206-323-4140
EXP Dublin, Ireland, Standard Comps. Ltd. 375-25025
Can Ontario, Intrade Canada, Inc. 613-727-1272

ALLEN DATAGRAPH, INC., 2 Industrial Way, Salem, NH 03079, Tel: 603-893-1983, TWX: 710-366-0504, FAX: 603-893-9042; *Sls. Mgr.:* Tom Allen

ALLIED CONTROL, 100 Relay Rd., Plantsville, CT 06479, Tel: 203-621-6771, TWX: 710-473-0079 ALLIED CONTROL, FAX: 203-621-4932; FSC No.: 5945; *Sls. Mgr.:* Mark Freyermuth ..... **B•1415-1419, 1832-1833**

Local Sales Offices & Reps

CA Irvine, Component Mktg. Assocs., Inc. 714-951-5950
CA Tarzana, Component Mktg. Assocs., Inc. 818-708-8058
CO Denver, Elctrn. Sls., Inc. 303-771-6300
CT Clinton, Selmark Assocs., Inc. 203-573-9088
GA Lawrenceville, Electro-Rep Assocs. ... 404-564-1863
IL Skokie, Industrial Reps., Inc. 312-967-8430
IN Indianapolis, M & L Elctrn. Sls. 317-359-4742
MD Columbia, Delta III Assocs., Inc. 301-730-4700
MA Millis, Selmark Assocs., Inc. 508-376-2914
MN Wayzata, Cardinal Sls. Co. 612-475-0042
NH Hopkinton, Selmark Assocs., Inc. 603-746-3299
NJ Medford, Component Consultants 609-654-5300
NY Clark Mills, KLM-Garner 315-853-6126
NY Franklin Square, Cooper-Simon & Co., Inc. 516-489-0404
NC Charlotte, Electro-Rep Assocs. 704-527-2530
OH Beachwood, Elctrn. Salesmasters, Inc. 216-831-9555
OK Tulsa, Component Technlg. 918-749-2107
PA Pittsburgh, Process Engrg. Co. 412-561-5050
TX Austin, Comp. Technlg. 512-250-2450
TX Dallas, Comp. Technlg. 214-783-8831
TX El Paso, Alexander Entprs. 915-591-3142
TX Houston, Component Technlg. 713-961-1262
VA Midlothian, Delta III Assocs., Inc. 804-379-1816
WA Everett, Huntley Assocs. 206-337-5594
WI Milwaukee, Industrial Reps., Inc. 414-259-0965
Can North York, R. D. Assocs. 416-444-0959

Local Distributors

CA Hayward, KEA Elctrns. 415-887-2900
CA Los Angeles, Master Distrs. 213-452-1229
CA Monrovia, Erik-A Elctrns. 818-574-1020
CA Santa Ana, El-Com, Inc. 714-432-6633
CA Santa Ana, Norstan Elctrns. Inc. 213-924-7651
FL Ft. Lauderdale, Peerless Radio 305-973-4141
FL Orlando, T & T Prods. 407-857-2282
IL Chicago, Newark Elctrns. 312-784-5100
IN Indianapolis, Bell Inds. 317-875-8200
MA Newton, Greene-Shaw 617-969-8900
MN Minneapolis, Control Design 612-721-1628
MN Minneapolis, Sterling Elctrns. 612-831-2666
NJ Oakland, Relay Specialties 201-337-1000
NY Buffalo, Summit Distrbg. 716-887-2800
NY Farmingdale, Pride Elctrns. 516-293-4020
NY Hauppauge, Jaco Elctrns. 516-273-5500
NY Hauppauge, Sherburn Elctrns. 516-231-4300
NY Rome, Rome Elctrns. 315-337-5400
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Dayton, Stotts Friedman 513-298-5555
OK Oklahoma City, Electro Entprs. 405-427-6591
PA Philadelphia, P. E. I. Genesis 215-673-0400
PA Philadelphia, Shap Elctrns. 215-969-3300
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Can Pointe Claire, Que., Future Elctrns. 514-694-7710

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ALLIED-SIGNAL AEROSPACE CO., Communications Div., 1300 E. Joppa Rd., Towson, MD 21204, Tel: 301-583-4000, TWX: 710-232-1823, FAX: 201-337-7485; Empl.: 1500; *Sls. Mgr.:* Jack L. Shagena

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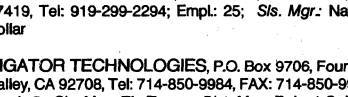

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NC Raleigh, Cartwright & Bean, Inc. of GA. 919-876-4130
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OR Clackamus, Larsco 503-655-1931
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ALPHA METALS, 600 Rte 440, Jersey City, NJ 07305, Tel: 201-434-6778, FAX: 201-434-7508; Empl.: 350; *Sls. Mgr.:* Dave Zerfoss, VP Sls.

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NM	Albuquerque, Charles Pinney	505-268-0950
UT	W. Valley City, Mike Dale	801-364-0606

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UT	W. Valley City, Hannah-Hill	801-364-0606

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MI	Farmington Hills, Advent Electronics	
NJ	Parsippany, Fabe Electro Sls., Inc.	201-299-1123
NJ	Rockaway, NASCO Electronics	201-625-7777
NY	Dewitt, Cronin Electronics	315-433-0033
NC	Raleigh, Comp. Dists.	919-787-7311
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CO	Boulder, Stratford Grp.	303-530-3194
FL	Deerfield Bch., Newell-Hynes	305-429-3207
GA	Marietta, Tenn Tech	404-971-1419
IL	Wheaton, Chadra-Schilke	312-653-8126
IN	Acton, Nationwide Comps.	317-872-7207
IA	Marion, MSB Assocs.	319-377-6261
KS	Shawnee Mission, MSB Assocs.	913-432-2131
MA	Andover, Crawford Assocs.	617-470-2122
MI	Grand Blanc, Inter-Comm	313-695-0665
MN	Golden Valley, Highland Sls.	612-546-2123
MO	St. Charles, MSB Assocs.	314-946-5577
NY	Marcellus, Mullahy Sls.	315-685-6280
NY	Patchogue, Optimum Sls.	516-758-0644
OH	Willoughby, Nationwide Comps.	216-946-3226
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PA	Elkins Pk., Arnold Assocs.	215-742-0600
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UT	Salt Lake City, Sage Sls.	801-467-5451
WA	Redmond, Doran Sls.	206-885-1885
EXP	CT/Litchfield, Intrade	203-567-5901

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CA	San Diego, Deco Elctrns.	619-693-1595
CA	San Jose, Rose Elctrns.	408-943-0200
CA	San Jose, Sierra West	408-435-7477
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CA	Sunnyvale, PSC	408-737-1333
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CT	Wallingford, Mid-State Elctrns.	203-265-9900
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FL	Ft. Lauderdale, Brothers Elctrns.	305-561-6700
FL	Largo, Elctrn. Precepts	813-544-3636
FL	Oakland Pk., Zelcon	305-565-2555
GA	Doraville, Specialty	404-458-6341
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IL	Chicago, Nep Elctrns.	312-625-8400
IL	Wheeling, Hawk Elctrns.	312-459-4030
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NJ	E. Brunswick, Brothers Elctrns.	201-238-2200
NJ	Oakland, Relay Specialties	201-337-1000
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NY	E. Syracuse, Add Elctrns.	315-437-0300
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FL	Lighthouse Pt., R. C. Simon & Co., Inc.	305-941-2757
GA	Lawrenceville, M. Lader Co.	404-264-8111
IL	Chicago, Tech. Sls., Inc.	312-237-7210
KS	Goddard, Midwest Tech. Sls., Inc.	316-794-8565
KS	Lenexa, Midwest Tech. Sls., Inc.	913-888-5100
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MO	St. Charles, Midwest Tech. Sls., Inc.	314-441-1012
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NM	Albuquerque, Bestech Elec. Comp. Sls.	505-298-0034
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NC	Greensboro, M. Lader Co.	919-674-8970
OH	Kettering, J. May Assocs., Inc.	513-299-8424
OR	Beaverton, Quest Mktg. Inc.	503-641-7377
PA	Conshohocken, M. Lader Co.	215-825-3177
TX	Richardson, Vector Sls. Co.	214-234-4291
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CA	Newbury Park, Interconn	805-499-4024
CA	San Diego, Cetinske Sls. Co.	619-487-3335
CA	San Jose, Arnold Tech. Sls., Inc.	408-954-0400
CO	Longmont, Luscombe Engrg. Co.	303-772-3342
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FL	Melbourne, Southern Elctm. Sls. Inc.	407-242-9661
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KS	Overland Pk., AME Sls.	913-262-3971
MD	Gaithersburg, Naudain Assocs. So. Inc.	301-258-5040
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OR	Beaverton, Thorson Co. N.W.	503-644-5900
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TX	Irving, EDC	214-257-0322
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CA	San Diego, Cypress Elctms.	619-535-0011
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CA	Santa Clara, Cypress Elctms.	408-980-2500
CA	Santa Monica, Master Distrs.	213-452-1229
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CT	Wallingford, The Greene-Shaw Co.	203-265-3333
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FL	Orlando, Time Elctms.	407-841-6565
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CO	Englewood, Cain Technlg.	303-220-8118
CT	Wethersfield, Compak, Inc.	203-563-4784
FL	Melbourne Bch., Millett Assocs.	305-725-5055
MD	Columbia, PSA	215-245-0513
MA	Hudson, Compak, Inc.	617-568-0331
PA	Trevose, PSA	609-234-0661
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OR McMinnville, Electro Design, Inc. 503-472-0481
PA Pittsburgh, Baehr Greenleaf 412-776-2151
TX Austin, Ammon & Rizos 512-454-5131
TX Houston, Ammon & Rizos 713-781-6240
TX Richardson, Ammon & Rizos 214-644-5591
UT Salt Lake City, Lange Sls., Inc. 801-487-0843
WA Redmond, Electro Design, Inc. 206-868-7400
PR Guaynabo, Isla Caribe Electro Sls., Inc. 809-724-1572
MA Marlboro, Spectra-Strip Sls. 508-481-2820

ar AMPLIFIER RESEARCH

FAX: 215-723-5688

AMPLIFIER RESEARCH, 160 School House Rd, Souderton, PA 18964-9990, Tel: 215-723-8181, TWX: 510-661-6094; FSC No.: 30639; Empl.: 72; *Sls. Mgr.:* L. Pokorny ..... **D•1002-1003**

Local Sales Offices & Reps

AL Huntsville, W. A. Brown Instrs. 205-830-9224
AZ Tempe, Mar Tech Assocs. 602-496-8648
CA N. Hollywood, O'Halloran Assoc. 213-877-0173
CA Palo Alto, O'Halloran Assoc. 415-969-1600
CO Boulder, H. Bass. Assoc. 303-530-7509
CT Hamden, J.B.L. Assoc. 203-281-3161
FL Ft. Lauderdale, W. A. Brown Instrs., Inc. 305-776-6661
FL Melbourne, W.A. Brown Instrs., Inc. 407-723-0766
FL Orlando, W.A. Brown Instrs., Inc. 407-648-9660
FL Tampa, W. A. Brown Instrs., Inc. 813-977-5460
GA Atlanta, W. A. Brown Instrs., Inc. 404-441-2980
GA Norcross, W. A. Brown Instrs., Inc. 404-449-7160
IL Park Ridge, Elctrn. Instr. Assocs. 312-298-2290
IN Indianapolis, Elctrn. Instr. Assocs. 317-257-7231
KS Lenexa, Midtec Assocs., Inc. 913-541-0505
MD Severna Park, Delmarva Eng. Assoc. Ltd. 301-647-8388
MA Lexington, R.J. Sickles 617-862-5100
MN Minnetonka, Elctrn. Instr. Assocs. 612-933-7793
MO St. Louis, Midtec Assocs., Inc. 314-275-8666
NJ Westfield, Metro Mics 201-233-6116
NM Albuquerque, Hewitt & Assocs. 505-299-7746
NY Amsterdam, Electro-Tech Sls., Inc. 518-864-5524
NY Hauppauge, Metro Mics 516-361-6134
NC Cary, W. A. Brown Instrs., Inc. 919-460-1120
OH Dublin, Micro Sls. 614-792-9117
OH North Olmsted, Micro Sls. 216-734-3080
OK Tulsa, The Hugh J. Daly Co. 918-494-7711
PA Philadelphia, R. Meyers Assoc. 215-224-1663
TX Austin, Airep Elctrns. 512-327-0778
TX Dallas, Airep Elctrns. 214-349-4360
TX Houston, Barmore Assoc. 713-944-8171
UT Bountiful, Herb Bass Assoc. 801-295-7100
WA Seattle, J. J. Assocs., Inc. 206-246-6619

AMPLIFONIX, INC., 2010 Cabot Blvd. West, Langehorne, PA 19047, Tel: 215-757-9600, FAX: 215-757-0378; FSC No.: 60979; Empl.: 60; *Sls. Mgr.:* Richard P. Dubois; *Dist. Mgr.:* Richard P. Dubois

AMPROBE INSTRUMENT, Core Industries, Inc, 630 Merrick Rd., Lynbrook, NY 11563, Tel: 516-593-5600, TWX: 510-225-8403, FAX: 516-593-5682; Empl.: 200; *Sls. Mgr.:* Duncan Ladd, VP Sls.; *Dist. Mgr.:* W. Eagle

AMPTEK, INC., 6 De Angelo Dr., Bedford, MA 01730, Tel: 617-275-2242, FAX: 617-275-3470; Empl.: 15

Local Sales Offices & Reps

EXP MA, Plainville, Teknis 617-695-3591

AMPTRONIX, INC., P.O. Box 8146, Rowland Heights, CA 91748, Tel: 213-666-1564; *Sls. Mgr.:* Lou Lim; *Dist. Mgr.:* Ching Lim

AMRAD & TRANSCON MFG. CO., Div. of D.J. Assocs., Inc., 8411 South Zero St, Fort Smith, AR 72903-7045, Tel: 501-452-3987, TELEX: 3791705 DJ USA, FAX: 501-452-7752; FSC No.: 55943; Empl.: 17; *Sls. Mgr.:* M. P. Beck; *Dist. Mgr.:* M. P. Beck

AMTEK DIGITAL SYSTEMS, INC., See Actek, Inc.

AMUNEAL MANUFACTURING CORP., 4737 Darrah St., Philadelphia, PA 19124, Tel: 215-535-3000, FAX: 215-743-1715; FSC No.: 23740; Empl.: 55; *Sls. Mgr.:* Larry Maltin ..... **C•1731**

Local Sales Offices & Reps

AZ Phoenix, Shefler-Kahn Co. 602-257-9015
CA Fremont, William Parks Assoc., Inc. ... 415-770-9058
CA La Canada, C.E.M., Inc. 818-790-8358
CA San Diego, C.E.M., Inc. 619-268-8911
CA San Diego, C.E.M., Inc. 619-692-3551
CA Santa Ana, C.E.M., Inc. 714-835-2702
CO Wheatridge, Waugaman Assocs., Inc. 303-423-1020
CT Meriden, MPS Elctrns. 203-235-1414
FL Melbourne, Reynolds & Assocs., Inc. 800-255-1965,407-259-7000
MD Baltimore, Muncy Sls. 301-484-6376
MA Norwood, MPS Elctrns. 617-769-8700
NJ Pennsauken, J.A. Maguire & Co. Inc. .. 609-665-5136
NM Albuquerque, Shefler Kahn Co. 505-296-0749
NY Yonkers, Sonkin Assocs. 914-968-8282
OH Kettering, F.L.Ohmer & Assoc. 513-434-1454
OR Tigard, Rep-West, Inc. 503-639-0325
PA Philadelphia, J.A. Maguire & Co. 215-627-1670
TX Houston, Eatman Engrg. 713-688-8339
TX Rockwall, Eatman Engrg. 214-771-1903
UT Salt Lake City, Waugaman Assoc. Utah, Inc. 801-261-0802
UT Salt Lake City, Waugaman Assocs. Utah, Inc. 801-261-0802
WA Seattle, Rep-West 206-283-8351
EXP NJ, Oradell, Sylvan Ginsbury 201-261-3200

ANACOM, 1335 S. Claudina, Anaheim, CA 92805, Tel: 714-774-8080, FAX: 714-774-7388

ANADEX INC., 1080 Avenida Acaso, Camarillo, CA 93010, Tel: 805-987-9660, TWX: 910-494-2761, FAX: 805-388-0133; Empl.: 15; *Sls. Mgr.:* Ken Mathews

Local Sales Offices & Reps

AL Huntsville, Currie, Peak & Frazier 205-536-1506
AZ Rustco Entprs. 602-263-0501
CA Canoga Pk, FLW, Inc. 818-719-0037
CA Carlsbad, FLW, Inc. 619-434-5251
CA Costa Mesa, FLW, Inc. 714-751-7512
CA Fremont, FLW, Inc. 415-651-6511
CT Wallingford, Pat Jenks Assocs. 203-265-9939
FL Orlando, Currie, Peak & Frazier 407-855-0843
GA Duluth, Currie, Peak & Frazier 404-497-9404
IL Arlington Hgts., Comtel Midwest 312-392-4040
IN Independance, WKM Assocs. 216-524-5930
IN Indianapolis, Comtel Midwest 317-253-1681
KS Shawnee Mission, Comtel Midwest ... 913-268-0762
LA Lafayette, Abcor, Inc. 318-237-3865
MA Beverly, Pat Jenks Assocs. 508-921-4600
MI Madison hgts., WKM Assocs. 313-588-2300
MN Wayzata, Comtel Midwest 612-476-1551
MO St. Louis, Comtel Midwest 314-991-5363
NM Albuquerque, Rustco Entprs. 505-293-8620
NY Plainview, Eastern Metro Assoc. 516-931-1414
NC Greensboro, Currie, Peak & Frazier ... 919-373-0380
OH Dayton, WKM Assocs. 513-434-7500
OK Tulsa, Abcor, Inc. 918-743-3249
PA Frazier, FLW Inc. 215-251-9700
TN Nashville, Currie, Peak & Frazier 615-459-0743
TX Dallas, Abcor, Inc. 214-231-8977
TX Houston, Abcor, Inc. 713-486-9251
WI New Berlin, Comtel Midwest 414-544-6042

ANADYNE POWER SUPPLY DIVISION, 14005 Stage Road, Santa Fe Springs, CA 90670-5216, Tel: 213-921-9364, FAX: 213-921-8163; Empl.: 100

ANAHEIM AUTOMATION, 910 E. Orangefair La., Anaheim, CA 92801, Tel: 714-992-6990, TELEX: 2978217 MCI, FAX: 714-992-0471; Empl.: 35

ANALOG & DIGITAL PERIPHERALS, INC.(ADPI), 251 South Mulberry, Troy, OH 45373, Tel: 513-339-2241, TWX: 810-450-2685, FAX: 513-339-0070; FSC No.: 31-0949-745; Empl.: 19; *Sls. Mgr.:* M. J. Keeney

ANALOG DEVICES, INC., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, Tel: 617-329-4700, TWX: 710-394-6577; FSC No.: 24355; Empl.: 5200

ANALOG EQUIPMENT CORPORATION, 5606 PGA Blvd., Palm Bch. Gardens, FL 33418, Tel: 407-622-3715, FAX: 407-622-4799; FSC No.: 67584; *Sls. Mgr.:* V. Ratner

ANALOGIC CORP., 8 Centennial Dr., Peabody, MA 01961, Tel: 508-977-3000, FAX: 508-681-7144; Empl.: 1300; *Sls. Mgr.:* Gary Gross; *Dist. Mgr.:* Chuck Davis

Local Sales Offices & Reps

AZ	Phoenix, Odyssey I	602-246-8846
CA	San Carlos, Western Digital & Instr.	415-591-6535
CA	Tustin, Analogic Corp.	714-543-0616
CO	Englewood, Odyssey I	303-773-8176
FL	Ft. Lauderdale, Analogic Corp.	305-565-4544
FL	Longwood, Southern Mktg. Assoc.	305-682-7317
KY	Florence, Analogic Corp.	606-283-8132
MD	Sykesville, Analogic Corp.	301-549-6650
MI	Plymouth, Analogic Corp.	313-455-6380
MN	Apple Valley, Analogic Corp.	612-432-2111
NJ	Budd Lake, Analogic Corp.	201-347-7477
NM	Albuquerque, Odyssey I	505-265-6645
NY	Bayville, Analogic Corp.	516-628-8640
NY	Frankfort, Kapital Instr. Sls.	315-894-4245
NY	Port Chester, Radiation Elctrns. Inc.	914-937-2300
TX	Dallas, Data Mktg. Assoc.	214-661-0300
UT	Salt Lake City, Odyssey I	801-485-4728
VA	Woodford, Analogic Corp.	804-633-4761
WA	Redmond, Western Rep	206-885-0004
WI	West Bend, Analogic Corp.	414-334-4145

Array Processors

CA	San Jose, Analogic Corp.	408-247-6401
CT	Avon, Power Mark, Inc.	203-678-0123
FL	Cape Canaveral, Analogic Corp	305-799-2300
GA	Lilburn, Micro-Spec	404-921-3840
IL	Rolling Meadows, Commodore I	312-394-5441
IL	Schaumburg, Analogic Corp.	312-882-5880
MD	Columbia, Analogic Corp.	301-596-5512
MA	Brighton, Power Mark, Inc.	617-783-9500
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
NJ	Boonton, PAF Assocs.	201-335-0680
NM	Albuquerque, Cleveland Entprs.	505-265-7893
NY	Smithtown, PAF Assocs.	516-360-0940
OH	Chagrin Falls, Midwest Mktg. Assocs.	216-247-6655
OH	Dayton, Midwest Mktg. Assocs.	513-433-2511
PA	Churchville, Dynamic Elec.	215-322-2611
PA	Pittsburgh, Staples	412-881-5990
TX	Houston, Acudata	713-580-2451
TX	Houston, Analogic Corp.	713-541-5331
Can	Nepean, Ont., Computer Aided Des.	613-225-0411

Digital Panel Instrs., Load Cell Digitizing Sys. & Temperature Instr.

AL	Birmingham, Regal Controls	205-967-5770
CA	San Jose, Analogic Corp.	408-247-6401
CT	Portland, BBI Elctrns.	203-342-0648
FL	Ft. Lauderdale, Analogic Corp.	
IL	Schaumburg, Analogic Corp.	312-882-5880
IN	Indianapolis, RDP Corp.	317-788-4296
MD	Hanover, Commonwealth Controls	301-796-5960
MA	Danvers, Analogic	617-777-4500
MA	Holbrook, McLellan Assocs.	617-767-4771
MI	Livonia, Lowell-Wendt	313-464-2722
MO	Manchester, Control Sys. Des.	314-227-4212
NY	Frankfort, Kapital Instrs.	315-894-4245
NY	NewYork, Flowmaster	212-741-9675
NC	Matthews, Zelco	704-541-6122
OH	Cleveland, RDP Corp.	216-659-3138
OH	Dayton, RDP Corp	513-253-6175
OK	Tulsa, Data Mktg. Assocs.	918-299-4818
PA	Pittsburgh, Wainwright Tech.	412-487-5055
PA	Pittsburg, RDP Corp.	412-487-2217
TX	Austin, Data Mktg. Assocs.	512-443-7722
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-780-2511
VA	Richmond, Commonwealth Controls	804-271-7700
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
WA	Seattle, Brett Assocs.	206-431-8090
Can	Mississaugua, Ont., Tracar Elctrns.	416-625-7752

ANALOGIC CORP., Data Conversion Prods. Grp., Audubon Rd., Wakefield, MA 01880, Tel: 508-977-3000, TELEX: 466-069; Empl.: 1900; *Sls. Mgr.:* John J. Flynn

ANALOGIC/3H, 1701 Rollins Rd., Burlingame, CA 94010, Tel: 408-734-5970, TELEX: 352022, FAX: 408-734-5139; *Sls. Mgr.:* Nabeel Tarazi

ANALOG MODULES INC.

FAX: 407-834-3806

ANALOG MODULES, INC., 126 Baywood Avenue, Longwood, FL 32750, Tel: 407-339-4355, TELEX: ANALOG MOD C1 467617; FSC No.: 61651; Empl.: 38; *Sls. Mgr.:* W. C. Hudson, VP Mktg. ..... **D•1004**

ANALOG SYSTEMS, P.O. Box 17389, Tucson, AZ 85731-7389, Tel: 602-290-1818, TWX: 275008 (RCA); FSC No.: 58976; Empl.: 9; *Sls. Mgr.:* Kelli Dayton; *Dist. Mgr.:* Kelli Dayton

ANALYTIC INSTRUMENTS CORPORATION, P.O. Box 542845, Dallas, TX 75354, Tel: 214-357-3882; Empl.: 15; *Sls. Mgr.:* Carl Dreher

ANAREN MICROWAVE, P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057, Tel: 315-432-8909, TELEX: 71-685-4503/4567, TWX: 310-685-4518/4568; FSC No.: 31597; Empl.: 424

ANASCO CORPORATION, 42A Cherry Hill Dr., Commerce Ctr. Bldg., Danvers, MA 01923, Tel: 800-826-2726, 508-777-8888, FAX: 508-774-1751

ANCO
Electronics Inc.

FAX: 714-989-9935

ANCO ELCTRNS., Pan Intl., 9852 Crescent Center, Rancho Cucamonga, CA 91730, Tel: 714-945-1365; Empl.: 12; *Sls. Mgr.:* Gail Clark; *Dist. Mgr.:* Barry Park, Natl. Sls. Mgr. ..... **C•1766-1767; D•1078**

AND, William J. Purdy Co., 770 Airport Blvd, Burlingame, CA 94010, Tel: 415-347-9916, TELEX: 677-1439, FAX: 415-340-1670; FSC No.: (PURDY UW); Empl.: 30; *Sls. Mgr.:* Clarence Bruce ..... **B•1048-1049, 1129**

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak, Frazier	205-536-1506
AZ	Phoenix, C. T. Carlberg & Assoc.	602-468-0750
CA	Anaheim, Impact	714-533-9933
CA	Burlingame, William J. Purdy	415-347-7701
CO	Englewood, William J. Purdy Assoc.	303-790-2211
CT	Meriden, Advance Comp. Sls.	203-238-6891
FL	Orlando, Currie, Peak, Frazier	305-855-0843
IL	Elmhurst, F.F./Hill Gray, Inc.	312-832-4101
IN	Indianapolis, John Sukup, Inc.	317-253-5501
MA	Framingham, Gallagher Assocs., Inc.	508-626-2346
MI	E. Detroit, Jack M. Thorpe Co.	313-779-6363
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MO	Grandview, Harris-Hanson	816-763-6200
NJ	Hopelawn, Kamco Indl. Sls., Inc.	201-442-6252
NM	Albuquerque, C. T. Carlson & Assocs.	505-836-1448
NY	Victor, Net Sls., Inc.	716-223-1030
NC	Greensboro, Currie, Peak & Frazier, Inc.	919-373-0380
OH	Cleveland, Marlow Assocs.	216-991-6500
OR	Beaverton, Pacific Mktg. Specialists	503-641-9373
TN	Smyrna, Currie, Peak & Frazier	615-459-0743
TX	Dallas, Elcom Mktg.	214-241-2166344390024
WA	Redmond, Pacific Mktg. Specialists	206-882-3144
Can	Oakville, Ont., Haltronics, Ltd.	416-844-2121

Local Distributors

AL	Huntsville, Newark Elctrns.	205-847-9092
AZ	Tempe, Newark Elctrns.	602-968-7441
CA	Anaheim, A to Z Elctrns.	714-632-1620
CA	Foster City, Newark Elctrns.	415-572-8300
CA	Fremont, Allied Elctrns.	415-770-0590
CA	Hawthorne, Kent	213-970-0997
CA	Inglewood, Newark Elctrns.	213-670-0020
CA	Los Angeles, Trebor Elctrns.	213-641-8304
CA	Sacramento, Integrated Elctrns.	916-424-5297
CA	San Jose, Rose Elctrn.	408-943-0200
CA	San Jose, Sierra West Elctrns.	408-435-7477
CA	Sunnyvale, Penstock	408-730-0300
CA	Torrance, Kent Elctrns.	213-320-2700
CO	Arvada, Denver Beta Wintronics	303-431-7161
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Denver, Newark Elctrns.	303-757-5834
CT	Stratford, Utronics, Inc.	203-378-4201
CT	Wallingford, Sager Electrical Supp.	203-265-4600
FL	Clearwater, Allied Elctrns.	813-539-0369
FL	Clearwater, Newark Elctrns.	813-441-3804
FL	Melbourne, Rome Elctrns. South	305-242-8151
FL	Miami, ESL Elctrn. Distr.	305-633-6973
GA	Norcross, Allied Elctrns.	404-446-8595
IL	Chicago, Fed. Screw Prods.	312-478-5744
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Rosemont, Advent Elctrns.	312-297-6200
IL	Schaumburg, Newark Elctrns.	312-310-8980
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Newark Elctrns.	317-872-7070
IN	Merrillville, Newark Elctrns.	219-738-2787
IA	Cedar Rapids, Advent Elctrns.	800-332-8407
KS	Overland Park, Newark Elctrns.	913-677-0727
MA	Canton, Almo Elctrns.	617-821-1450
MA	Columbia, Allied Elctrns.	301-381-1560
MA	Lynn, Land Elctrn. Supp.	617-592-2220
MI	Farmington Hills, Advent Elect.	313-447-1650
MI	Grand Rapids, Newark Elctrns.	616-455-9190
MI	Livonia, Shand Elctrns.	313-591-3980
MI	Oak Pk., Newark Elctrns.	313-967-0600
MN	Minneapolis, Newark Elctrns.	612-331-6350
MO	St. Louis, Newark Elctrns.	314-421-5066
NE	Omaha, Newark Elctrns.	402-392-1221
NH	Nashua, Newark Elctrns.	603-883-9110
NJ	Bordentown, Newark Elctrns.	609-298-4450
NJ	Cranford, Garden State Elect.	201-272-6400
NM	Albuquerque, Newark Elctrns.	505-883-6181
NY	Buffalo, Genessee Radio & Parts Co., Inc.	716-873-9661
NY	E. Syracuse, ADD Elctrns.	315-437-0200
NY	Farmingdale, Midway Indl. Elctrns.	516-293-6800
NY	Rochester, Allied Elctrns.	717-244-9440
NY	Rochester, Simcona	716-328-3230
NY	Rome, Rome Elctrns.	315-337-5400
NY	Syracuse, Newark Elctrns.	315-437-6611
NC	Greensboro, Newark Elctrns.	919-292-7240
NC	Raleigh, Allied Elctrns.	919-876-5845
OH	Cincinnati, Newark Elctrns.	513-771-9700
OH	Cleveland, Newark Elctrns.	216-391-9330
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Warren, REM Elect.	216-373-1300
OR	Beaverton, Almac Elctrns. Grp.	503-641-9070
OR	Portland, Newark Elctrns.	503-257-0741
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
PA	Drexel Hill, Kass Elect.	215-449-2300
PA	Philadelphia, Almo Elctrns.	215-698-4000
PA	Pittsburgh, Newark Elctrns.	412-367-2790
SC	Greenville, Newark Elctrns.	803-288-9610
TN	Knoxville, New Elctrns.	615-588-6496
TX	Fort Worth, Allied Elctrns.	817-336-5401
TX	Garland, Newark Elctrns.	214-487-8144
TX	Houston, Newark Elctrns.	713-783-1629
TX	Irving, Newark Elctrns.	214-258-1355
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
UT	West Valley City, Salt Lake Beta Wintronic	801-483-1882
VA	Richmond, Newark Elctrns.	804-282-5671
WA	Bellevue, Almac Elctrns. Corp.	206-643-9992
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Allied Elctrns.	206-547-2827
WI	Mequon, Lakeview Elctrns. Corp.	414-377-8250
Can	Oakville, Ont., PATtronics, Ltd.	416-844-2121
Can	Rexdale, Ont., Newark Elctrns.	416-675-1130

ANDEEN-HAGERLING, INC., 31899 Miles Road, Chagrin Falls, OH 44022, Tel: 216-349-0370, TELEX: 4931432; Empl.: 14; *Sls. Mgr.:* Eric Whitman

ANDERS, INC., 77 Wolcott Rd., Simsbury, CT 06070, Tel: 203-658-7666, FAX: 203-651-5597; FSC No.: 52045; Empl.: 18; *Sls. Mgr.:* Donald W. Miner

ANDERSEN LABORATORIES, 45 Old Iron Ore Rd., Bloomfield, CT 06002, Tel: 203-286-9090, FAX: 203-242-4472; FSC No.: 03947; Empl.: 130; *Sls. Mgr.:* Richard Johnson ..... **A•1343, 1505, 1685, 1777**

Local Sales Offices & Reps

AZ	Scottsdale, Thorson, Desert States, Inc.	602-998-2444
CA	Encinitas, Andersen Labs.	619-944-9982
CA	San Jose, Bayshore Microwave	408-434-6848
CA	Santa Ana, SSK USA, Inc.	714-250-4073
CO	Aurora, Thorson, Desert States, Inc.	303-671-7344
FL	Indian Harbor, S.E. Comp. Sls.	305-773-3767
GA	Atlanta, S.E. Comp. Sls.	404-451-5353
IL	Northfield, Feller Assocs.	312-446-8065
IA	Cedar Rapids, Feller Assocs.	319-364-0566
MD	Ellicott City, Thiem Assocs.	301-465-4630
MD	Owings Mills, Neal Deoul Assocs.	301-363-4311
MA	Wayland, High Tech Sls.	617-653-3838
NM	Albuquerque, Thorson, Desert States, Inc.	505-293-8555
NY	Melville, Carnes Assocs.	516-694-1600
NY	Rockville Ctr., Milano Bros.	516-764-2200

NY Utica, Upstate Engrg. Sls. 315-797-6721
PA Huntingdon Valley, Rabal Assoc. 215-947-4825
TX Dallas, McDonald Assocs. 214-238-1858
Can St. Laurent, Que., R.F. Microwave 514-335-2335

ANDERSON ELECTRONICS, INC.

FAX: 814-696-0403

ANDERSON ELECTRONICS, P. O. Box 89, Hollidaysburg, PA 16648, Tel: 814-695-4428; Empl.: 60; *Sls. Mgr.:* W. H. Anderson ..... **A•1344**

Local Sales Offices & Reps

CA La Habra, GRU Assocs. 213-691-2993
CA Sunnyvale, Logan Sls 408-732-6020
FL Melbourne, Southern Elctrns. Sls. Co. 305-242-9661
GA Lawrenceville, B. T. Funderburk, Inc. .. 404-963-9495
IL South Elgin, R.K. Elctrn. 312-695-8552
MA Woburn, Microwave Comp. Mktg., Inc. 617-273-3106
MI Southfield, R. C. Nordstrom & Co. 313-559-7373
NY Smithtown, LI., PAF Assocs. 516-360-0940
NC Raleigh, B. T. Funderburk, Inc. 919-782-3493
OH Worthington, Elctrn. Sls. & Technlg. Inc. 614-436-9452
PA Rydal, Espy Sls. 215-576-0780
TX Plano, GW Prods. 214-422-1746
WA Seattle, Harry Levinson Co. 206-382-1300
Can Hamilton, Ont., Cartwright South All Assocs. 416-528-0294

ANDERSON POWER PRODUCTS, Div. of High Voltage Engineering, 145 Newton St., Boston, MA 02135, Tel: 617-787-5880, TELEX: 940453, FAX: 617-254-9217

ANDON ELCTRNS. CORP., 4 Court Dr., Lincoln, RI 02865, Tel: 401-333-0388, FAX: 401-333-0278; FSC No.: OEBT2; Empl.: 55; *Sls. Mgr.:* Irene Small; *Dist. Mgr.:* Irene Small ..... **C•1268-1270**

ANDOVER, INC., 310 North Earl Avenue, Lafayette, IN 47904, Tel: 317-447-1157, FAX: 317-447-1150; Empl.: 120; *Sls. Mgr.:* Harry O. Minns

ANDREW CORP., 10500 W. 153rd St., Orland Pk., IL 60462, Tel: 800-255-1479, TELEX: 25-3897, FAX: 312-349-5943; *Sls. Mgr.:* Carl Van Hecke

ANDREWS BEARINGS, Ina Bearing Company, Inc., New Cut Road, P.O. Box 570, Spartanburg, SC 29304, Tel: 803-583-4541, TWX: 810-282-2578

ANDROTEK/DMI, Box 29098, Columbus, OH 43229, Tel: 614-882-7821, FAX: 614-882-7824; *Sls. Mgr.:* Jim Shirely

ANGHEL LABORATORIES, INC., 3 Route 46 West, Fairfield, NJ 07006, Tel: 201-575-1116, TELEX: 883-193 Anghel UD, FAX: 201-575-9286; FSC No.: 59530; Empl.: 60; *Sls. Mgr.:* Richard Pechfelder

ANGO ELECTRONICS CORP., 16 North Third St., Harrison, NJ 07029, Tel: 201-484-1115, FAX: 201-484-0530; *Sls. Mgr.:* Brian K. Yuen ..... **C•1010**

ANGSTROHM

FAX: 215-296-0697

ANGSTROHM PRECISION, INC., A Sub of Vishay Intertechnology, 63 Lincoln Highway, Malvern, PA 19355, Tel: 215-644-1300, TWX: 510-668-5812; Empl.: 500; *Dist. Mgr.:* Iris Demeritt ..... **A•1874-1875, 2082**

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AL Huntsville, JWL Assocs. 205-883-1712
AZ Phoenix, Howe & Howe 602-264-7971
CA Los Alamitos, Reed Elctrns. 213-598-6676
CA Redwood City, James S. Heaton Co. .. 415-367-9000
CA San Diego, Vishay Res. Sys. Grp. 619-690-5112
CO Englewood, Comps. Sls. Inc. 303-779-8060
CT Wallingford, Comp Rep Assocs. 203-269-1145
FL Altamonte Springs, Semtronic Assocs. 305-831-8233
FL Clearwater, Semtronic Assocs. 813-461-4675
FL Ft. Lauderdale, Semtronic Assocs. 305-731-2484
GA Atlanta, JWL Assocs. 404-320-7643
ID Boise, N.R. Schultz Co. 208-377-8686
IL Rolling Meadows, Eagle Tech. Sls. 312-991-0700
IN Carmel, Shamrock Elctrn. Sls. 317-848-5265
KS Olathe, Technical Sls. Assocs. 913-829-2800
MD Lutherville, J.A. Doughterty Sls. Co. ... 301-321-7890
MA Westwood, Comp Rep Assocs. 617-329-6454
MI Plymouth, Jay Mktg. Assocs. 313-459-1200
MO St. Louis, Technical Sls. Assocs. 314-521-2044
NJ Flanders, K & R Engrg. Sls. Co. 201-584-5235
NM Albuquerque, Nelco Electronix 505-293-1399
NY Rochester, L-Mar Assocs. 716-381-9100
NC Charlotte, JWL Assocs. 704-541-5750
NC Raleigh, JWL Assocs. 919-787-4826
OH Aurora, EMA, Inc. 216-562-6104
OH Centerville, EMA, Inc. 513-433-2800
OR Beaverton, N. R. Schultz Co. 503-643-1644
PA Horsham, TMI 215-441-4300
PA Malvern, Vishay Resistive Sys. Grp. ... 215-644-1300
TX Dallas, Edward F. Aymond Co. 214-826-7620
TX Houston, Vishay Resistive Sys. Grp. .. 713-550-0568
UT Salt Lake City, Harris/CSI 801-974-5155
WA Bellevue, N. R. Schultz Co. 206-454-0300
PR Caguas, Comp. Rep. Assocs. 809-746-6550
Can Concord, Ont., Kaytronics, Inc. 416-669-2262
Can Kawata, Ont., Kaytronics, Inc. 613-564-0080
Can St. Laurent, Que., Kaytronics, Inc. 514-745-5800
Can Surrey, B.C., Kaytronics, Inc. 604-581-5005

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AZ Tempe, Shelley-Ragon, Inc. 602-894-2058
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CA Chatsworth, Shelley-Ragon, Inc. 818-998-3333
CA Chatsworth, TTI, Inc. 818-709-1010
CA Milipitas, TTI, Inc. 408-946-5577
CA San Diego, Shelley-Ragon, Inc. 619-453-7133
CA San Diego, TTI, Inc. 619-587-4888
CA San Jose, Shelley-Ragon, Inc. 408-432-0600
CA Santa Ana, TT I, Inc. 714-641-9393
CO Denver, TTI, Inc. 303-429-6806
CO Englewood, Shelley-Ragon, Inc. 303-762-0670
CT Wallingford, TT I, Inc. 203-284-7474
FL Orlando, TT I, Inc. 407-859-1000
FL Tampa, Shelley-Ragon, Inc. 813-623-6560
FL Tapa, Impala Elctrns., Inc. 813-885-4747
GA Norcross, TTI, Inc. 404-662-0911
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IL Lombard, Shelley-Ragon, Inc. 312-629-8833
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IA Cedar Rapids, Shelley-Ragon, Inc. 319-373-0525
MD Baltimore, RESCO/Baltimore 301-529-0500
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MA Wilmington, TT I, Inc. 508-658-4700
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MO Hazlewood, Shelley-Ragon, Inc. 314-454-0480
MO Independence, Shelley-Ragon, Inc. 816-254-3410
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NJ Mt. Laurel, TTI Inc. 609-234-6400
NY Farmingdale, Command Elctrns. Corp. 516-293-1212
NY Hauppauge, Mast Distrs., Inc. 516-273-4422
NY Medford, Shelley-Ragon, Inc. 516-447-2000
NY Ronkonkoma, TTI, Inc. 516-737-2000
NY Valley Stream, L & S Elctrns. 516-561-2474
OH Cleveland, Specialized Comps. Sls. ... 216-464-0405
OH Dayton, Micro Mil Div. 513-434-8231
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OR Beaverton, Shelley-Ragon, Inc. 503-641-1691
PA Malvern, Vishay Resistive Sys. Grp. ... 215-644-1300
TX Dallas, Shelley-Ragon, Inc. 214-349-2424
TX Ft. Worth, TT I, Inc. 817-831-8300
TX Ft. Worth, TTI, Inc. 817-595-3100
TX Houston, Texas Comp. Corp. 713-468-3882
WA Redmond, Shelley-Ragon 206-883-2220
WA Redmond, TTI, Inc. 206-882-0291
Can Concord, Ont., Kaytronics 416-669-2262
Can Kawata, Ont., Kaytronics 613-564-0080
Can Quebec, Kaytronics, Inc. 514-745-5800
Can Surrey , B.C., Kaytronics 604-581-5005

ANNULUS TECHNICAL INDUSTRIES, INC., P.O. Box 7407, 1296 Osprey Dr., Ancaster, Ontario, CAN L9G 4G4, Tel: 416-648-8100, FAX: 416-648-8102; Empl.: 16; *Sls. Mgr.:* Don MacAdam

ANORAD CORP., 110 Oser Ave., Hauppauge, NY 11788, Tel: 516-231-1995, TWX: 510-227-9894; Empl.: 280; *Sls. Mgr.:* Sam Singer

ANRITSU, 15 Thornton Rd., Oakland, NJ 07436, Tel: 201-337-1111, 800-255-7234, TELEX: 64-2141 ANRITSUOKLD, FAX: 201-337-1033; Empl.: 75; *Sls. Mgr.:* Mike Riley

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MA Nashua, Anritsu 603-888-0230
TX Dallas, Anritsu 214-991-8864

ANRITSU METER CO. OF AMERICA, 795 Franklin Ave., Franklin Lakes, NJ 07417, Tel: 201-848-0033, TELEX: 136011, FAX: 201-848-1845; Empl.: 4

ANRO ELCTRN. INDS. LTD., No. 1-670 Progress Ave., Scarborough, ON, Canada M1H 3A4, Tel: 416-439-6320, FAX: 416-439-7359; Empl.: 135; *Sls. Mgr.:* W. Welk

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ANSONICS, INC., P.O. Box 910, Halfway, OR 97834, Tel: 503-742-7475; Empl.: 6

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ANTENNA RESEARCH ASSOCIATES, 11317 Frederick Ave., Beltsville, MD 20705, Tel: 301-937-8888, TELEX: 374-6620; FSC No.: 23360; Empl.: 30; *Sls. Mgr.:* H.W. Rapalus

ANTENNA SPECIALISTS, The Allen Group, 30500 Bruce Industrial Pkwy., Cleveland, OH 44139, Tel: 216-349-8400, TELEX: 4332133 (AS INTL CLV), FAX: 216-349-8407; Empl.: 1000; *Sls. Mgr.:* Cleve Watkins-OEM; *Dist. Mgr.:* Bob Levy-Distr.

ANTEX DIVISION, 24 Tioga Way, P.O.Box 615, Marblehead, MA 01945, Tel: 617-631-7100, FAX: 617-631-8887; *Sls. Mgr.:* C. Loutrel; *Dist. Mgr.:* C. Loutrel

ANTEX ELECTRONICS CORP., 16100 S. Figueroa St., Gardena, CA 90248, Tel: 213-532-3092, FAX: 213-532-8509; Empl.: 53; *Sls. Mgr.:* Richard Gross; *Dist. Mgr.:* Richard Gross

ANTONA CORP., 1643 1/2 Westwood Blvd., Los Angeles, CA 90024-5603, Tel: 213-473-8995, FAX: 213-473-7112; *Sls. Mgr.:* Katherine Capanna

ANVIL CASES, INC., 4128 Temple City Blvd., Rosemead, CA 91770, Tel: 818-575-8614, 800-242-4466, 800-423-4279(outside CA), TWX: 910-587-4935; FSC No.: FNCM59288; Empl.: 180; *Sls. Mgr.:* Ron Phenicie

A. P. CIRCUIT, 256 Lincoln Ave., Brooklyn, NY 11208, Tel: 718-827-5991, TELEX: 428759, FAX: 718-235-4418 ..... **A•1687-1689**

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NJ Matawan, Reps Five 201-495-2315
OH Cleveland, Comtel Instrs. 216-442-8080
OH Dayton, Comtel Instrs. 513-298-7573

APEC FIBER OPTICS CORP., 1702-D Ponderosa, College Station, TX 77840, Tel: 409-693-5397, FAX: 409-693-1205; Empl.: 15; *Sls. Mgr.:* Mary Lynn Johnson; *Dist. Mgr.:* Mary Lynn Johnson

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CA Los Altos, KOLM Mktg. 415-948-2635
CT Guilford, Data Mark Inc. 203-453-0575
MD Elicott City, Nelson Elctrns. 301-747-7887

FL Orlando, Currie, Peak & Frazier, Inc. 407-855-0843
GA Duluth, Currie, Peak & Frazier, Inc. 404-497-9404
IL Buffalo, Torkelson Assocs. 312-520-0710,
IN Ft. Wayne, TX Sls. 219-489-4447
IA Cedar Rapids, Torkelson Assocs. 319-373-0200,
MD Ellicot City, Nelson Elctrns. 301-747-7887
MD Ellicott City, Nelson Elctrns. 301-747-7887
MN Minneapolis, Torkelson Assocs. 612-835-2414,
MA Woburn, Signal Sls. Engrg. 617-938-7872,
NJ Flanders, K & R Engrg. Sls. 201-584-5235,
NY Fairport, bbd Elctrns. 716-425-4101
NC Greensboro, Currie, Peak & Frazier Inc. 919-373-0380
IN Fort Wayne, TX Sales 219-489-4447
TX Dallas, Repmasters 214-247-6236
TX Sherman, Repmaster 214-247-6236
WI Waukesha, Torkelson Assocs. 414-784-7736,

Local Distributors
Can Mississauga, Ont., bbd Elctrns. 416-821-7800,

APM-HEXSEAL, 44 Honeck St., Englewood, NJ 07631, Tel: 201-569-5700, TELEX: 13-3403; FSC No.: 97539; Empl.: 34; *Sls. Mgr.:* Charles Lentini; *Dist. Mgr.:* Charles Lentini

APOLLO LASERS, INC., 20415 Nordhoff St., Chatsworth, CA 91311, Tel: 818-407-3000, TELEX: 66-2278, FAX: 818-882-5900; Empl.: 40; *Sls. Mgr.:* Dexter W. Gocha; *Dist. Mgr.:* Ralph Page

APOLLO MAGNETICS CORP., 2720 W. Beverly Blvd., Los Angeles, CA 90057, Tel: 213-381-2500, TWX: 910-321-4348, FAX: 213-384-4067; Empl.: 420; *Sls. Mgr.:* Charles Williams .... **D•1079**

APPLETON PAPERS INC., P.O. Box 359, Appleton, WI 54912, Tel: 414-734-9841, TELEX: 262752; Empl.: 3,500; *Sls. Mgr.:* Ken Nissen; *Dist. Mgr.:* John Conley

APPLIED CONTROLS CO., INC., 1275 Bloomfield Ave., Fairfield, NJ 07006-2828, Tel: 201-227-5454; FSC No.: 4A725; Empl.: 20; *Sls. Mgr.:* W. Merel

APPLIED DATA COMMUNICATIONS, 14272 Chambers Rd., Tustin, CA 92680, Tel: 714-731-9000, TELEX: 183823 ADC, FAX: 714-838-7172; Empl.: 50; *Sls. Mgr.:* Ben Smith

APPLIED DATA SYSTEMS, 409A East Preston St., Baltimore, MD 21202, Tel: 800-541-2003, 301-576-0335, FAX: 301-576-0338; Empl.: 6 .... **B•1050**

APPLIED ELECTRO TECHNLG., INTL., See STI-Control Components Div.

APPLIED ENGINEERING PRODUCTS, P.O. Box A-D, Amity Sta., New Haven, CT 06525, Tel: 203-387-5282, TWX: 710-465-1173, FAX: 203-387-7832; FSC No.: 19505; Empl.: 85; *Sls. Mgr.:* C. Goff; *Dist. Mgr.:* C. Goff

APPLIED INFORMATION SYSTEMS, INC., 500 Eastowne Dr., Suite 207, Chapel Hill, NC 27514, Tel: 919-942-7801, 800-334-5510, TELEX: 701365, FAX: 919-493-7563; *Sls. Mgr.:* Deborah U. Hopper

APPLIED MAGNETICS, 75 Robin Hill Rd., Goleta, CA 93117, Tel: 805-683-5353, TWX: 910-334-1195, FAX: 805-967-8227; FSC No.: 11935; Empl.: 9000; *Sls. Mgr.:* O. M. Fundingsland

APPLIED MICRO CIRCUITS CORP., 6195 Lusk Blvd., San Diego, CA 92121, Tel: 619-450-9333, TWX: 910-337-1136; FSC No.: 367 4112; Empl.: 235; *Sls. Mgr.:* Greg Barnhart

APPLIED MICROSYSTEMS CORP., 5020 148th Ave., N.E., P.O. Box 97002, Redmond, WA 98073-9702, Tel: 206-882-2000, 800-426-3925, TELEX: 185196APMCRO UT, FAX: 206-883-3049; Empl.: 200; *Sls. Mgr.:* Joe Gomula

APPLIED MICROWAVE DIV. EPSCO, See Epsco Microwave

APPLIED PLASTICS TECHNOLOGY, 45 Broadcommon Rd., Bristol, RI 02809, Tel: 401-253-0200; FSC No.: 9330; Empl.: 30; *Sls. Mgr.:* John A. MacIntyre Jr.

APPLIED POWER CONVERSION

FAX: 201-385-0702

APPLIED POWER CONVERSION, Technology Dynamics, Inc., 100 School St., Bergenfield, NJ 07621, Tel: 201-385-0500; Empl.: 50 .... **D•1620-1629**

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CT Branford, Abbott-Allison Co., Inc. 203-481-0405
MD Hagerstown, Stinson Assocs., Inc. 301-790-1193
NY Rochester, A.J. Electro Mktg. 716-426-3598
VA Reston, Stinson Assocs., Inc. 703-620-0088

APPLIED SOFTWARE TECH., INC., 1908 Cliff Valley Way, N.E., Atlanta, GA 30329, Tel: 404-663-8660; Empl.: 29; *Sls. Mgr.:* Jim A. Moss

APSCO, INC., 5976 Heisley Road, Mentor, OH 44060, Tel: 216-352-8961, TELEX: 284580, FAX: 216-354-7306; Empl.: 200; *Sls. Mgr.:* Robert G. Borgia

APTEK TECHNOLOGIES, INC., Aptek Microsystems, 700 N. W. 12th Ave., Deerfield Beach, FL 33442, Tel: 305-421-8450, TELEX: 441020, FAX: 305-421-8044; FSC No.: 36741; Empl.: 150; *Sls. Mgr.:* Dwain L. Jenkins, Exec. VP & GM

A.P.W. CO., INC., 72 W. Main, Rockaway, NJ 07866, Tel: 201-627-0643, FAX: 201-627-6396; Empl.: 16

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FAX: 516-333-8911

APX-ARSTAN PRODUCTS INTERNATIONAL INC., 99 Jericho Tpke., Jericho, NY 11753, Tel: 516-333-8100, TELEX: 4973964 (ARSTAN is answer back); Empl.: 300; *Sls. Mgr.:* Stan Shapiro .... **A•2244-2247; D•1618-1619**

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CA Santa Ana, S & A Tech. Sls. 714-250-0121
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GA Atlanta, Electro Sls. Inc. 404-394-1122
MA Framingham, Bob Mirabella 617-877-0884
NY N. Syracuse, R. F. Roux 315-458-9169
NC Raleigh, KZJ Comps. Sls. Co. 919-782-8100
OH Dayton, KW Elctrn. Sls. Inc. 513-890-2150
OH Shaker Hgts., KW Elctrn. Sls. Inc. 216-491-9177
PA Allison Pk., KW Elctrn. Sls. Inc. 412-487-4300
TX Dallas, Rem-Air Comps. Corp. 214-234-1069
TX Houston, John Dunkel 713-729-1670
WA Redmond, Elctrn. Mktg. Grp. 206-882-0962
WA Vancouver, Elctrn. Mktg. Grp. 503-684-5935

Local Distributors
NC Raleigh, Century Elctrns. 919-872-2203
PA Norristown, Century Elctrns. 215-631-5400

AQUALARM, Marine Safety Systems, Inc., 1151 D. Bay Blvd., Chula Vista, CA 92011, Tel: 619-575-4011, FAX: 619-423-4962; FSC No.: 2V373; Empl.: 8; *Sls. Mgr.:* John L. Hooper

ARCO ELECTRONICS, 9822 Independence Ave., Chatsworth, CA 91311, Tel: 818-882-8707, FAX: 818-882-6513; FSC No.: 84171; Empl.: 10; *Sls. Mgr.:* Randy Ryan

ARCOLECTRIC CORPORATION

FAX: 818-700-9541

ARCOLECTRIC CORP., 9001 Canoga Ave., Canoga Park, CA 91304, Tel: 818-700-1933; Empl.: 20; *Sls. Mgr.:* Carrie Donze; *Dist. Mgr.:* Carrie Donze .... **B•1130-1131, 1682-1683**

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MD W. Springfield, T. F. Cushing 413-788-7341
NJ Denville, Lashen Elctrns. 201-627-3783,
OR Eugene, Larsco 503-484-7491

ARC SYSTEMS, INC., 2090 Joshuas Path, Hauppauge, NY 11788, Tel: 516-582-8020, TELEX: 230199 SWIFT UR ARC, FAX: 516-582-8038; FSC No.: 67245; *Sls. Mgr.:* Robert Miller

AREMCO PRODUCTS, INC., Box 429, Ossining, NY 10562, Tel: 914-762-0685, TELEX: 13-7442, FAX: 914-762-1663; Empl.: 30; *Sls. Mgr.:* Brian Miles

A.R.F. PRODS., 2559 75th St., Boulder, CO 80301, Tel: 303-443-4844, FAX: 303-443-4846; Empl.: 10; *Sls. Mgr.:* Tersh Clark

ARGA CONTROLS, 35 E. Glenarm St., Pasadena, CA 91105, Tel: 213-682-3314, FAX: 818-799-9407; FSC No.: 50290; Empl.: 20; *Sls. Mgr.:* Linda Galman

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OK Tulsa, Kemp Engrg. Svcs. 918-663-4501
TX Addison, Kemp Engrg. Svcs. 214-931-7100
TX Houston, Kemp Engrg. Svcs. 713-466-1465

ARGENT ELECTRONICS, 3245 S. County Rd., 25A, Troy, OH 45373, Tel: 513-335-0031; FSC No.: 55901; Empl.: 20; *Sls. Mgr.:* Paul J. Gilmore

ARGO ELECTRONICS, INC., 5054 Bleecker St., Baldwin Park, CA 91706, Tel: 818-962-8422, FAX: 818-960-7312; Empl.: 12

ARGOS PRODS., 600 S. Sycamore St., Genoa, IL 60135, Tel: 815-784-5118; Empl.: 50; *Sls. Mgr.:* Ron Evers

ARGO TRANSDATA CORP., 1 Heritage Pk., Clinton, CT 06413-0554, Tel: 203-669-2233, FAX: 203-669-4316; Empl.: 15

ARIES ELECTRONICS, INC.

FAX: 201-996-3891

ARIES ELECTRONICS, Box 130, Frenchtown, NJ 08825, Tel: 201-996-6841, TWX: 510-235-3391; FSC No.: 51167; Empl.: 160; *Sls. Mgr.:* Frank Folmsbee ... **C•1272-1277**

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FL Altamonte Springs, APM Assocs. 305-859-6831
FL Ft. Lauderdale, APM Assocs. 305-565-0056
FL Tampa, APM Assocs. 813-886-2457
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WI Cedarburg, Bransky Sls. 414-377-6837
IL Highland Park, Bransky Sls. 312-433-2375
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MN Minneapolis, Holmgren Assocs. 612-786-7641
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MO Kansas City, Delltron Co. 816-436-6445
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ARIUM CORPORATION, 1931 Wright Circle, Anaheim, CA 92806-6052, Tel: 714-978-9531, TELEX: 754903 ARIUM UD, FAX: 714-978-3341; Empl.: 40; *Sls. Mgr.:* Dave Blakemore

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MD	Baltimore, PEI/Genesis	301-529-2200
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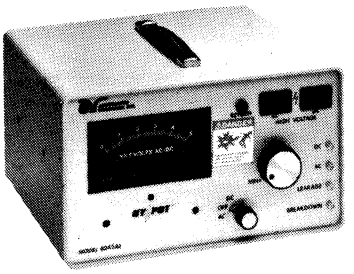

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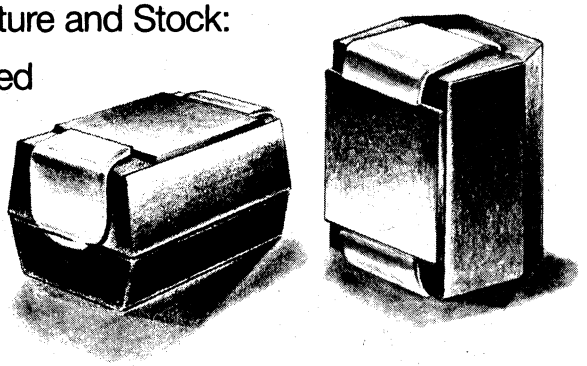

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PA	Paoli, Stitzer Assocs.	215-644-5500
TN	Knoxville, Cartwright & Bean	615-693-7450
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FL Pompano Bch., Hall-Mark 305-971-9280
GA Atlanta, Milgray 404-393-9666
GA Atlanta, Time Elctrns. 404-351-3345
GA Norcross, Arrow Elctrns. 404-449-8252
GA Norcross, Hall-Mark 404-447-8000
GA Norcross, Hamilton/Avnet Elctrns. 404-447-7500
GA Norcross, Pioneer Technlgs. 404-481-1711
GA Norcross, Time Elctrns. 404-448-4448
HI Honolulu, Indl. Elctrns. 808-533-6095
IL Bensenville, Hamilton/Avnet Elctrns. 312-860-7700
IL Bensenville, Voyager Elctrns. 312-860-1300
IL Chicago, Newark Elctrns. 312-784-5100
IL Elk Grove Vl, GBI/Goold Elctrns. 312-593-3222
IL Elk Grove Vl, Pioneer 312-437-9680
IL Schaumburg, Arrow Elctrns.
IL Wood Dale, Time Elctrns. 312-350-0610
IL Woodale, Hall-Mark 312-860-0239
IN Carmel, Hamilton/Avnet Elctrns. 317-844-9333
IN Ft. Wayne, Bell Inds./Graham Div. 219-423-3422
IN Indianapolis, Arrow Elctrns. 317-243-9353
IN Indianapolis, Bell Inds./Graham Div. 317-634-8202
IN Indianapolis, Hall-Mark 317-876-7165
IN Indianapolis, Pioneer 317-849-7300
IA Cedar Rapids, Arrow Elctrns. 319-395-7230
IA Cedar Rapids, Deeco Inc. 319-365-7551
IA Cedar Rapids, Hamilton/Avnet Elctrns. 319-362-4757
KS Lenexa, Hall-Mark 913-888-0523
KS Overland Pk., Hamilton/Avnet Elctrns. 913-888-8900
KS Wichita, Milgray Elctrns. 913-236-8800
KS Wichita, RSC Elctrns. 316-267-5213
MD Columbia, Arrow Elctrns. 301-995-0003
MD Columbia, Hall-Mark 301-381-2036
MD Columbia, Hamilton/Avnet Elctrns. 301-995-3500
MD Columbia, Time Elctrns. 301-964-3090
MD Gaithersburg, Pioneer Technlgs. 301-921-0660
MA Billerica, Hall-Mark 508-667-4129
MA Lexington, Pioneer 617-861-9200
MA Norwood, Gerber Elctrns. 617-769-6000
MA Peabody, Hamilton/Avnet Elctrns. 617-532-3701
MA Peabody, Time Elctrns. 617-532-6200
MA Woburn, Arrow Elctrns. 617-933-8130
MA Woburn, Sterling Elctrns. 617-938-6200
MI Ann Arbor, Arrow Elctrns. 313-971-8220
MI Ann Arbor, Wedermeyer Elctrns. Supp. Co. 313-665-8611
MI Grand Rapids, Hamilton/Avnet Elctrns. 616-243-8805
MI Livonia, Hall-Mark 313-462-1205
MI Livonia, Hamilton/Avnet Elctrns. 313-522-4700
MI Livonia, Pioneer 313-525-1800
MI Livonia, RS Elctrns. 313-525-1155
MN Eden Prairie, Hall-Mark 612-941-5778
MN Edina, Arrow Elctrns. 612-830-1800
MN Edina, Time Elctrns. 612-835-1250/2119
MN Minneapolis, Merit Elctrns. Corp. 612-546-5383
MN Minnetonka, Hamilton/Avnet Elctrns. 612-932-0600
MN Minnetonka, Pioneer 612-935-5444
MO Earth City, Hall-Mark 314-291-0362
MO Earth City, Hamilton/Avnet Elctrns. 314-344-1200
MO Kansas City, Walters Indl. Elctrns. Inc. 816-531-7015
MO St. Charles, Lectronix Inc. 314-946-6424
MO St. Louis, Arrow Elctrns. 314-567-6888
MO St. Louis, Time Elctrns. 314-391-6444
NE Lincoln, Scott Elctrn. Supp. Corp. 402-466-8221
NH Manchester, Arrow Elctrns. 603-668-6968
NH Manchester, Hamilton/Avnet Elctrns. 603-624-9400
NJ Cherry Hill, Hamilton/Avnet Elctrns. 201-575-3390
NJ Cherry Hill, Hamilton/Avnet Elctrns. 609-424-0110
NJ Clifton, J-Mar Elctrns. 201-772-6400
NJ Fairfield, Hall-Mark 201-882-9389
NJ Marion, Arrow Elctrns. 609-596-8000
NJ Marlton, Milgray 609-983-5010
NJ Mt. Laurel, Hall-Mark 609-235-1900
NJ Parsippany, Arrow Elctrns. 201-538-0900
NJ Pine Brook, Pioneer 201-575-3510
NJ Pinebrook, Time Elctrns. 201-882-4611/4616
NM Albuquerque, Arrow Elctrns. 505-243-4566
NM Albuquerque, Hamilton/Avnet Elctrns. 505-765-1500
NM Albuquerque, Sterling Elctrns. 505-345-6601
NY Binghamton, Pioneer 607-722-9300
NY Bohemia, Car-Lac Elctrn. Indl. Sls. 516-567-4200
NY Buffalo, Summit Distrs. Inc. 716-884-3450
NY E. Syracuse, Time Elctrns. 315-432-0355
NY Endwell, A.S.I. Elctrns. 607-754-3823
NY Fairport, Pioneer 716-381-7070
NY Farmingdale, Milgray Elctrns. Inc. 516-420-9800
NY Hauppauge, Arrow Elctrns. 516-231-1000
NY Hauppauge, Hamilton/Avnet Elctrns. 516-231-9800
NY Hauppauge, Time Elctrns. 516-273-0100

NY Liverpool, Arrow Elctrns. 315-652-1000
NY Melville, Arrow Elctrns. 516-694-6800
NY Rochester, Arrow Elctrns. 716-427-0300
NY Rochester, Hall-Mark 716-244-9290
NY Rochester, Hamilton/Avnet Elctrns. ... 716-475-9130
NY Rochester, Summit Distrs. Inc. 716-334-8110
NY Ronkonkoma, Hall-Mark 516-737-0838
NY Syracuse, Hamilton/Avnet Elctrns. 315-437-2641
NY Woodbury, Pioneer 516-921-8700
NC Charlotte, Pioneer Technlgs. 704-527-8188
NC Charlotte, Time Elctrns. 704-522-7600
NC Raleigh, Arrow Elctrns. 918-876-3132
NC Raleigh, Hall-Mark
NC Raleigh, Hamilton/Avnet Elctrns. Inc. 919-878-0819
OH Centerville, Arrow Elctrns. 216-248-3990
OH Cleveland, Hamilton/Avnet Elctrns. ... 216-831-3500
OH Cleveland, Milgray/Cleveland 216-587-3600
OH Cleveland, Pioneer 216-587-3600
OH Dayton, Hamilton/Avnet Elctrns. 513-439-6700
OH Dayton, Pioneer 513-236-9900
OH Dublin, Time Elctrns. 614-761-1100
OH Solon, Hall-Mark 216-349-4632
OH Westerville, Hamilton/Avnet Elctrns. .. 614-882-7004
OH Worthington, Hall-Mark 614-888-3313
OR Hillsboro, Wyle Labs/EMG 503-640-6000
OR Lake Oswego, Hamilton/Avnet Elctrns. 503-635-8831
OR Portland, Radar Elec. 503-232-3404
OR Portland, Time Elctrns. 503-684-3780/5523
OR Tigard, Arrow Elctrns. 503-684-1690
PA Horsham, Pioneer 215-674-4000
PA King of Prussia, Time Elctrns. 215-337-0900
PA Monroeville, Arrow Elctrns. 412-856-7000
PA Pittsburgh, Hamilton/Avnet Elctrns. ... 412-281-4150
PA Pittsburgh, Pioneer 412-782-2300
TX Austin, Arrow Elctrns. 512-835-4180
TX Austin, Hall-Mark 512-258-8848
TX Austin, Hamilton/Avnet Elctrns. 512-835-8911
TX Austin, Time Elctrns. 512-339-3051/8906
TX Austin, Wyle Labs/EMG 512-834-9957
TX Carrolton, Arrow Elctrns. 214-380-6464
TX Carrolton, Time Elctrns. 214-241-7441
TX Dallas, Hall-Mark 214-553-4300
TX Dallas, Sterling Elctrns. 214-243-1600
TX El Paso, Ideal Elctrns. 915-779-6647
TX Houston, Arrow Elctrns. 713-530-4700
TX Houston, Hall-Mark 713-953-3420
TX Houston, Sterling Elctrns. 713-627-9800
TX Houston, Time Elctrns. 713-530-0800
TX Houston, Wyle Labs/EMG 713-879-9953
TX Irving, Hamilton/Avnet Elctrns. 214-569-4100
TX Mansfield, Mouser Elctrns. 817-483-4422
TX Richardson, Wyle Labs./EMG 214-235-9953
TX Stafford, Hamilton/Avnet Elctrns. 713-780-1771
UT Salt Lake City, Hamilton/Avnet Elctrns. 801-972-2800
UT Salt Lake City, Stand. Supp. 801-486-3371
UT Salt Lake City, Wyle Labs/EMG 801-974-9953
UT W. Valley, Time Elctrns. 801-973-8181
UT W. Valley City, Hall-Mark 801-972-3446
WA Bellevue, Arrow Elctrns. 206-643-4800
WA Bellevue, Hamilton/Avnet Elctrns. 206-643-3950
WA Bellevue, Wyle Dist. Grp./Seattle Div. 800-426-2956
WA Bellevue, Wyle Dist. Grp./Seattle Div. 206-453-8300
WA Bellevue, Wyle Dist. Grp./Seattle Div. 800-563-9904
WA Redmond, Time Elctrns. 206-882-1600
WA Seattle, Radar Elctrns. 206-282-2511
WI Brookfield, Arrow Elctrns. 414-792-0150
WI New Berlin, Hall-Mark 414-797-9259
WI New Berlin, Hamilton/Avnet Elctrns. .. 414-784-4510

Systems Packaging

AL Huntsville, Hamilton/Avnet Elctrns. ... 205-837-7210
AL Huntsville, Pioneer Technlgs. Grp. Inc. 205-837-9300
AL Huntsville, Time Elctrns. ... 205-721-1133/837-1419
AZ Phoenix, Sterling Elctrns. Inc. 602-268-2121
AZ Phoenix, Wyle Dist. Grp./Phoenix Div. 602-866-2888
AZ Tempe, Arrow Elctrns. 602-968-4800
AZ Tempe, Hamilton/Avnet Elctrns. 602-231-5100
AZ Tempe, Time Elctrns. 602-967-2000
CA Agoura Hills, Time Elctrns. 818-707-2890/3657
CA Anaheim, Time Elctrns. 714-937-0911
CA Chatsworth, Arrow Elctrns./E. Bay 213-700-8668
CA Chatsworth, Avnet Elctrns. 213-700-8686
CA Chatsworth, Time Elctrns. 818-998-7200
CA Chatsworth Ave., Hamilton Electro Sls. 213-558-2323
CA Costa Mesa, Avnet Elctrns. 714-754-6150
CA Costa Mesa, Hamilton Electro Sls. 714-641-1850
CA Culver City, Hamilton Electro Sls. 213-558-2020
CA El Segundo, Wyle Dist. Grp./Los Angeles Div. 213-322-8100
CA Hayward, Arrow Elctrns./E. Bay 415-487-4600
CA Irvine, Wyle Dist. Grp./Irvine Div. 714-851-0911
CA Monrovia, Erik-A-Elctrns. 213-574-1020
CA Ontario, Hamilton/Avnet Elctrns. 714-989-4602
CA Sacramento, Hamilton/Avnet Elctrns. 916-920-3150
CA San Diego, Arrow Elctrns./E. Bay 619-656-4800
CA San Diego, Hamilton/Avnet Elctrns. ... 714-571-7500
CA San Diego, Time Elctrns. ... 619-586-1331/271-7011
CA San Diego, Wyle Dist. Grp./San Diego Div. 714-565-9171
CA Santa Clara, Wyle Dist. Grp./Santa Clara Div. 408-727-2500
CA Sunnyvale, Arrow Elctrns./E. Bay 408-754-6600
CA Sunnyvale, Hamilton/Avnet Elctrns. ... 408-743-3300
CA Sunnyvale, Time Elctrns. 408-734-9888
CA Torrance, Time Elctrns. 213-320-0880/6372
CA Tustin, Arrow Elctrns./E. Bay 714-838-5422
CO Aurora, Arrow Elctrns. 303-696-1111
CO Englewood, Hamilton/Avnet Elctrns. .. 303-740-1000
CO Englewood, Time Elctrns. 303-265-9535
CO Thornton, Wyle Dist. Grp./Denver Div. 303-457-9953
CT Cheshire, Time Elctrns. 203-271-3200/2541
CT Danbury, Hamilton/Avnet Elctrns. 203-797-1100
CT Norwalk, Pioneer 203-853-1515
CT S. Windsor, Car-Lac Elctrns. 203-282-0631/7757
CT Wallingford, Arrow Elctrns. 203-265-7741
CT Wallingford, Sterling Elctrns. 203-429-8200
FL Altamonte Springs, Pioneer/Florida ... 305-834-9090
FL Deerfield Bch., Arrow Elctrns. 305-429-8200
FL Ft. Lauderdale, Hamilton/Avnet Elctrns. 305-971-2900
FL Ft. Lauderdale, Time Elctrns.-Florida .. 305-974-4800
FL Lake Mary, Arrow Elctrns. 305-752-1480
FL Orlando, Time Elctrns.-Florida 305-841-6565
FL St. Petersburg, Hamilton/Avnet No. 25 813-576-3930
FL Winter Pk., Hamilton/Avnet Elctrns. ... 305-628-3888
FL Winter Pk., Milgray/Florida 305-647-5747
GA Atlanta, Milgray/Atlanta 404-393-9666
GA Atlanta, Time Elctrns. 404-351-3545/5071
GA Norcross, Arrow Elctrns. 404-449-8252
GA Norcross, Hamilton/Avnet Elctrns. 404-447-7500
GA Norcross, Pioneer/Atlanta 404-448-1711
GA Norcross, Time Elctrns. 404-448-4448/263-6407
HI Honolulu, Indl. Elctrns. Inc. 808-533-6095
IL Bensenville, Hamilton/Avnet Elctrns. .. 312-860-7700
IL Chicago, Newark Elctrns. 312-784-5100
IL Grove VL, Pioneer 312-437-9680
IL Schaumburg, Arrow Elctrns. 312-397-3440
IL Wood Dale, Time Elctrns. 312-350-0610/0854
IN Carmel, Hamilton/Avnet Elctrns. 317-844-9333
IN Ft. Wayne, Graham Elctrns. Supp. Inc. 219-423-3422
IN Indianapolis, Arrow Elctrns. 317-243-9353
IN Indianapolis, Graham Elctrns. Supp. Inc. 317-634-8202
IN Indianapolis, Pioneer/Indiana 317-849-7300
IA Cedar Rapids, Arrow Elctrns. 319-395-7230
KS Overland Pk., Hamilton/Avnet Elctrns. 913-888-8900
KS Overland Pk., Milgray Elctrns. 913-236-8800
MD Columbia, Arrow Elctrns. 301-995-0003
MD Columbia, Hamilton/Avnet Elctrns. 301-995-3500
MD Columbia, Milgray/Washington 301-621-6169
MD Columbia, Time Elctrns. 301-964-3090
MD Gaithersburg, Pioneer/Washington ... 301-921-0660
MA Lexington, Pioneer 617-861-9200
MA Norwood, Gerber Elctrns. 617-769-6000
MA Peabody, Hamilton/Avnet Elctrns. 617-532-3701
MA Peabody, Time Elctrns.-New England 617-532-6200
MA Woburn, Arrow Elctrns. 617-933-8130
MA Woburn, Sterling Elctrns. 617-938-6200
MI Ann Arbor, Arrow Elctrns. 313-971-8220
MI Grand Rapids, Hamilton/Avnet Elctrns. 616-243-8805
MI Livonia, Hamilton/Avnet Elctrns. 313-522-4700
MI Livonia, Pioneer/Michigan 313-525-1800
MN Edina, Arrow Elctrns. 612-830-1800
MN Edina, Time Elctrns. 612-835-1250/2119
MN Minneapolis, Merit Elctrns. Corp. 612-546-5383
MN Minnetonka, Hamilton/Avnet Elctrns. 612-932-0600
MN Minnetonka, Pioneer/Twin Cities 612-935-5444
MO Earth City, Hamilton/Avnet Elctrns. ... 314-344-1200
MO St. Charles, Lectronix Inc. 314-946-6424
MO St. Louis, Arrow Elctrns. 314-567-6888
MO St. Louis, Time Elctrns. 314-391-6444
NH Manchester, Arrow Elctrns. 603-668-6968
NH Manchester, Hamilton/Avnet Elctrns. 603-524-9400
NJ Cherry Hill, Hamilton/Avnet Elctrns. ... 609-424-0110
NJ Clifton, J-Mar Elctrns. 201-772-6400
NJ Fairfield, Hamilton/Avnet Elctrns. 201-575-3390
NJ Marlton, Arrow Elctrns. 609-596-8000
NJ Marlton, Milgray/Marlton 609-983-5010
NJ Parsippany, Arrow Elctrns. 201-538-0900
NJ Pine Brook, Pioneer 201-575-3510
NJ Pinebrook, Time Elctrns. 201-882-4611/4616
NM Albuquerque, Arrow Elctrns. 505-243-4566
NM Albuquerque, Hamilton/Avnet Elctrns. 505-765-1500
NM Albuquerque, Sterling Elctrns. 505-345-6601
NY Binghamton, Pioneer 607-722-9300
NY Bohemia, Car-Lac Elctrn. Indl. Sls. 516-567-4200
NY E. Syracuse, Time Elctrn. Sls. 315-432-0355
NY Fairport, Pioneer 716-381-7070
NY Farmingdale, Milgray Elctrns. 516-420-9800
NY Hauppage, Hamilton/Avnet 516-231-9800
NY Hauppage, Time Elctrn. Sls. 516-273-0100
NY Hauppauge, Arrow Elctrns. 516-231-1000
NY Liverpool, Arrow Elctrns. 315-652-1000
NY Melville, Arrow Elctrns. 516-694-6800
NY Rochester, Arrow Elctrns. 716-427-0300
NY Rochester, Hamilton/Avnet Elctrns. ... 716-475-9130
NY Syracuse, Hamilton/Avnet Elctrns. 315-437-2641
NY Woodbury, Pioneer 516-921-8700
NC Charlotte, Pioneer/Carolina 704-527-8188
NC Charlotte, Time Elctrns. 704-522-7600
NC Raleigh, Arrow Elctrns. 919-876-3132
NC Raleigh, Hamilton/Avnet Elctrns. 919-878-0819
OH Centerville, Arrow Elctrns. 513-435-5563
OH Cleveland, Hamilton/Avnet Elctrns. ... 513-433-0610
OH Cleveland, Milgray/Cleveland 216-447-1520
OH Cleveland, Pioneer/Cleveland 216-587-3600
OH Dayton, Hamilton/Avnet Elctrns. 513-433-0610
OH Dayton, Pioneer/Dayton 513-236-9900
OH Solon, Arrow Elctrns. 216-248-3990
OH Westerville, Hamilton/Avnet Elctrns. .. 614-882-7004
OR Hillsboro, Wyle Labs/EMG 503-640-6000
OR Lake Oswego, Hamilton/Avnet Elctrns. 503-635-8831
OR Portland, Time Elctrns. 503-684-3780/5523
206-454-8666,800-547-6523
OR Tigard, Arrow Elctrns. 503-684-1690
PA Horsham, Pioneer/Del. Valley 215-674-4000
PA King of Prussia, Time Elctrns.-Mid Atlantic 215-337-0900
PA Monroeville, Arrow Elctrns. 412-856-7000
PA Pittsburgh, Hamilton/Avnet Esctrns. 412-281-4150
TX Austin, Hamilton/Avnet Elctrns. 512-837-8911
TX Carrolton, Arrow Elctrns. 214-380-6464
TX Carrolton, Time Elctrns. 214-241-7441
TX Dallas, Sterling Elctrns. 214-243-7441
TX El Paso, Ideal Elctrns. 915-779-6647
UT Salt Lake City, Hamilton/Avnet 801-972-2800
UT Salt Lake City, Wyle Lambs/EMG... 801-974-9953
UT W. Valley, Time Elctrns. 801-975-8181/1631
WA Bellevue, Arrow Elect. 206-643-4800
WA Bellevue, Hamiton/Avnet Elctrns. 206-643-3950
WA Bellevue, Wyle Dist.Grp/Bal. of Washington 800-562-9904
WA Redmond,, Time Elctrns. 206-882-1600
WI Brookfield, Arrow Elctrns. 414-792-0150
WI New Berlin, Hamilton/Avnet Electrns. 414-784-4510

AUGAT, INC., Packaged Products Div., 33 Perry Ave., P. O. Box 659, Attleboro, MA 02703, Tel: 617-222-9635, TELEX: 710-391-0644

AUGAT/PYLON CO., INC., P.O. Box 2510, Attleboro Falls, MA 02763, Tel: 508-699-9800, TELEX: 948095; Empl.: 400; *Sls. Mgr.:* Gillis Mellon

AUGAT/RDI, 525 Randy Rd., Carol Stream, IL 60188, Tel: 312-682-4100, TWX: 910-252-2118, FAX: 312-682-4562; FSC No.: 53337; Empl.: 70; *Sls. Mgr.:* John Deichl, Mktg. Mgr.; *Dist. Mgr.:* John Deichl, Mktg. Mgr. .... **C•1288-1289**

Local Sales Offices & Reps

AL Huntsville, Alpha 205-533-0766
AZ Phoenix, Augat Sls.-AZ 602-224-6104
CA Los Angeles, Wiley Co. 213-666-1611
CA San Diego, Wiley Co. 619-571-2881
CA San Jose, Augat Sls. 408-249-8801
CO Denver, Spectrum Mktg. 303-480-9991
FL Orlando, Augat Sls. 407-352-2020
GA Tucker, Alpha 404-491-9430
IL Carol Stream, Reed Dvcs. 800-682-7333
IL Downers Grove, Rockford Controls ... 312-960-2046
IN Indianapolis, Luebbe Sls. Co. 317-845-7389
IA Marion, Ensco-Rep., Inc. 319-377-8551
KS Wichita, Ensco-Rep., Inc. 316-683-1070
MA Canton, Augat Sls. 617-762-3164
MI Livonia, Luebbe Sls. Co. 313-489-8828
MN St. Paul, Countryman 612-645-9151
MO Maryland Hts., Ensco-Rep., Inc. 314-423-3935
NC Kernersville, Wallace Elctrn. 919-996-2742
OH Cincinnati, Luebbe Sls. 513-530-0600
OR Beaverton, Augat Sls. 503-645-0644

PA	Trevose, P.S.A., Inc.	215-245-0513
SC	Kernersville, Wallace Elec. Sls.	919-996-2742
TN	Oak Ridge, Alpha Mktg.	615-482-4681
TX	Dallas, Augat Sls.	214-788-4211
TX	Houston, Augat Sls.	713-781-9343
UT	Murray, Butterworth Mktg.	801-268-2244
WA	Bellevue, Augat Sls.	206-451-9777
WI	Westbend, Rockford Controls	800-323-1042

Local Distributors

CA	Anaheim, Control Des.	714-821-1516
CA	Gardena, Calif. Switch & Signal	800-225-7924
CA	Los Angeles, Master Distr.	213-452-1229
CO	Englewood, Indl. Elctrns.	303-694-9444
FL	Altamonte Springs, Control Design	305-788-3220
IL	Arlington Heights, Lo Dan Elctrns.	312-398-5311
IL	Carol Stream, Lectro Comps.	312-690-0520
IL	Chicago, Newark Elctrns.	312-784-5100
IN	Ft. Wayne, Bell Inds.	219-423-3422
MA	Middleboro, Glynn Elec.	617-947-4262
MA	Peabody, Time Elec.	617-532-6200
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	Minneapolis, Control Des.	612-721-6555
MO	St. Louis, Time Elctrns.	314-391-6444
NJ	Oakton, Relay Specialties	201-337-1000
NY	Buffalo, Summit	716-887-2800
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, R. Baker Elctrns.	716-586-9164
OH	Akron, AESCO Elctrn. Inc.	216-762-8818
OH	Columbus, E/M Equip. Co.	614-236-0888
OH	Columbus, Elctrns. Mktg. Co.	614-299-4167
PA	Malvern, Control Des.	215-296-0150
TX	Dallas, Control Des.	214-358-1441
WI	Green Bay, A-A Elec.	414-499-0258
WI	West Allis, Marsh Elctrns.	414-475-6000

FAX: 612-550-4099

AULT, INCORPORATED, 1600 Freeway Blvd, Minneapolis, MN 55430, Tel: 612-560-9300; Empl.: 300; *Sls. Mgr.:* Greg Harris ..... **D•1640-1641**

Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
CA	Los Angeles, A-F Sls. Engrg. Inc.	213-681-5631
CA	Orange County, A-F Sls. Engrg. Inc.	714-641-2903
CA	San Diego, A-F Sls. Engrg. inc.	619-226-8424
CA	Santa Clara, Magna Sls.	408-727-8753
CO	Denver, William J. Purdy	303-790-2211
CT	Wallingford, Marathon Sls., LTD	617-875-3566
FL	Deerfield Bch., Sls. Engrg. Concepts Inc.	305-426-4601
GA	Atlanta, L & D, Inc.	404-455-3483
IL	Arlington Hgts., MSI	312-956-1000
IA	Des Moines, Beams Co.	515-255-1148
KS	Shawnee Mission, Beams Co.	913-631-0300
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Framingham, Marathon Sls., LTD	617-875-3566
MI	Plymouth, Jay Mktg. Assocs.	313-459-1200
MN	Minneapolis, Cahill, Schmitz & Cahill	612-646-7217
MO	St. Louis, Beams Co.	314-434-8448
NJ	Ocean, P. Saftler Assocs.	201-922-3014
NY	Lynbrook, P. Saftler Assocs.	516-593-7880
NC	Greensboro, L & D, Inc.	919-292-3201
OH	Cleveland, Lyons Corp.	216-659-9224
OH	Dayton, E. Lyons Co.	513-278-0714
OR	Portland, Jas. J. Bacher Co.	503-297-8744
PA	Philadelphia, All-Tech Mktg.	717-763-4126
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Richardson, R. F. Kimball Co.	214-231-3447
WA	Seattle, Jas. J. Backer Co.	206-285-1300
Can	Toronto, Deskin Sls.	416-475-1412

Local Distributors

CA	Cincinnati, Hughes Peters	513-351-2000
CA	Long Bch., Power Sys. Distrs.	213-597-6957
CA	Milpitas, Power Sys. Distrs.	408-263-1063
CA	Mountain View, USI Elctrn. Comps.	415-969-5420
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	Santa Monica, Distr. Specialists	213-393-9666
CA	Van Nuys, Natl. Electro Sls. Corp.	213-781-0505
MA	Sharon, Adcour	617-784-8123
MO	St. Charles, Finnigan Elctrns.	314-946-6201
UT	Salt Lake City, Std. Supp. Co.	801-453-3371
Can	St. Laurent, Que., Tech-Rep Elctrns., Ltd.	514-337-6046

AURIC CORP., 470 Frelinghuysen Ave., Newark, NJ 07114, Tel: 201-242-4100, FAX: 201-242-5796; Empl.: 55

AUSTRON, INC., P.O. Box 14766, Austin, TX 78761-4766, Tel: 512-251-2341, TWX: 910-874-1356, FAX: 512-251-9685; FSC No.: 24672; Empl.: 130; *Sls. Mgr.:* Ron Myers ..... **A•1348**

Local Sales Offices & Reps

AL	Huntsville, Sci. Devices - SE	205-536-1969
AZ	Scottsdale, Territorial Mktg.	602-994-8665
CA	Goleta, Thorsen Co.	805-964-8751
CA	Mtn. View, N.S. Westronics	415-960-1111
CA	Signal Hill, Thorson Co.	213-595-0361
CO	Englewood, Sierra Tech. Grp.	303-790-1700
FL	Coral Springs, Scientific Dvcs.-S.E.	305-755-4453
FL	Orlando, Sci. Devices - SE	305-841-8180
FL	Shalimar, Sci. Devices - SE	904-651-4407
GA	Snellville, Sci. Devices-SE	404-979-7971
IL	Elk Grove, Loren Green Assoc.	312-593-0282
IN	Indianapolis, Loren Green Assoc.	317-293-9827
MA	Reading, Scheinfein Assocs.	617-944-2304
MI	Union Lake, Ashby Assocs.	313-363-1100
MN	Minneapolis, Loren Green Assoc.	612-571-6666
NY	Frankfort, Kapital Instr. Sls.	315-894-4245
NY	Huntington, CDB Entprs.	516-692-5200
NC	Winston Salem, Sci. Devices-SE	919-765-5776
OH	Dayton, Ashby Assocs.	513-461-2668
OH	Lyndhurst, Ashby Assocs.	216-461-0826
OK	Park Hill, Scientific Dvcs.-S.W.	918-457-4888
OR	Beaverton, Cascade Data Mktg.	503-641-9266
PA	N. Wales, Sci. Devices - Phila.	215-699-7707
TX	Austin, Scientific Dvcs.-S.W.	512-442-6215
TX	Houston, Sci. Devices - Gulfcoast	713-864-1711
TX	Richardson, Sci. Devices - SW	214-231-8106
TX	San Antonio, Scientific Dvcs.-S.W.	512-736-3164
VA	Reston, Austron	703-471-7963
WA	Kirkland, Cascade Data Mktg.	206-747-6190

AUTODESK, 2320 Marinship Way, Sausalito, CA 94965, Tel: 415-332-2344, TELEX: 275946, FAX: 415-331-8093; Empl.: 399; *Sls. Mgr.:* Richard Cuneo, Dir. of Sls.; *Dist. Mgr.:* Rex Johnson

AUTOMATED PRODUCTION CONCEPTS, 63 Hillside Terrace, Wayne, NJ 07470, Tel: 201-831-8300, TELEX: 130120, FAX: 201-633-7755; Empl.: 4

AUTOMATED PROD. EQUIP. CORP., 142 Peconic Ave., Medford, NY 11763, Tel: 516-654-1197, TWX: 510-228-2120, FAX: 516-289-4735; FSC No.: 57216; *Sls. Mgr.:* Arthur Ayala

AUTOMATIC COIL CORP., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147, Tel: 305-696-6660, FAX: 305-696-0626; FSC No.: 03765; Empl.: 245 ..... **A•1198-1201, 1506-1509**

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AL	Huntsville, Hughes Assocs.	205-533-9108
CA	Huntington Beach, Mil-Com Sls.	714-840-2424
CA	Mtn. View, Fetty/Schoenduve	415-962-8330
CA	San Diego, Mil-Com Sls.	619-484-3402
CA	Thousand Oaks, Mil-Com Sls.	805-647-8569
FL	Pensacola, Hughes Assocs.	904-433-1787
GA	Norcross, Hughes Assocs.	404-662-1587
IL	Downers Grove, Rockford Controls Co.	312-360-2046
MS	Corinth, Hughes Assocs.	601-287-2915
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NY	E. Syracuse, Nycom	315-437-8343
NC	Cary, Hughes Assocs.	919-467-7029
OH	Medina, Rockford Controls Ohio, Inc.	216-725-3705
PA	McKees Rocks, Rockford Controls of Ohio	412-331-0306
TN	Jonesboro, Hughes Assocs.	615-753-2719
VA	Fairfax, Schibley Assocs., Inc.	703-591-3008

AUTOMATIC SWITCH CO., 50-60 Hanover Road, Florham Park, NJ 07932, Tel: 1-201-966-2000, TELEX: 136422, FAX: 1-201-966-2628; Empl.: 1,200; *Sls. Mgr.:* Wayne Bouchard

AUTOMATIC SYSTEMS DEVELOPERS, P.O. Box 3210, Industry St., Poughkeepsie, NY 12603, Tel: 914-473-5530, FAX: 914-454-2538; Empl.: 650; *Sls. Mgr.:* Stanley Bachman

AUTOMATIC TIMING & CONTROLS CO., 201 So. Gulph Rd., King of Prussia, PA 19406, Tel: 215-337-5500, 800-441-8245, TELEX: 84-6437; Empl.: 300; *Sls. Mgr.:* R. L. Swanson

AUTOMATION DISPLAYS INC., 3533 N. White Ave., Eau Claire, WI 54703, Tel: 715-834-9595, FAX: 715-834-9596; Empl.: 19

AUTOMATION ELCTRNS., R.J.A. Inds., Inc., 9640 Topanga Cyn Pl. Bldg. J, Chatsworth, CA 91311, Tel: 818-998-5124, FAX: 818-998-6654; Empl.: 25; *Sls. Mgr.:* Robert J. Aiani

AUTOMATION PRODS., INC., 3030 Max Roy, Houston, TX 77008, Tel: 713-869-0361, TELEX: 775-959, FAX: 713-869-7332

AUTOMATION UNLIMITED, Icon Corporation, 134 New Boston St., Woburn, MA 01801, Tel: 617-933-7288, FAX: 617-933-2042; *Sls. Mgr.:* Rich Farley; *Dist. Mgr.:* Kevin Bagaline

AUTOMOTION, INC., 683 Airport Blvd., Ann Arbor, MI 48108, Tel: 313-662-7771, FAX: 313-662-3707; Empl.: 20; *Sls. Mgr.:* David E. Drenning ..... **B•1234**

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CA	Laguna Hills, South Rep	714-951-1084
CT	Seymour, Sturdy Corp.	203-888-1480
IL	Chicago, Clarkson Co.	312-286-2314
MA	Wellesley Hills, Sturdy Corp.	617-235-2330
MN	Little Canada, Assured Sls.	612-482-1309
NH	Derry, Sturdy Corp.	603-434-8440
NY	Pittsford, Vordex, Inc.	716-586-8119
NC	Charlotte, H & A, Inc.	704-598-8599
OH	Dayton, Ray Stan Controls	513-962-2604
OR	Portland, Controltek, Inc.	503-641-0876
TX	Richardson, Control Dynamics	214-644-6945
WA	Spokane, Controltek, Inc.	509-922-2971

AUTOROLL MACHINE CORPORATION, 11 River St., Middleton, MA 01949, Tel: 508-777-2160, TELEX: 940250, FAX: 508-777-9453; Empl.: 120

AUTOSPLICE, INC., 59-12, 37th Ave, Woodside, NY 11377, Tel: 718-429-0500, TELEX: 420902, FAX: 718-429-1313; Empl.: 197; *Sls. Mgr.:* O. Nedelkovich

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CA	San Diego, Autosplice West	619-530-0077
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IL	Chicago, Schiffer Assoc.	312-847-2400
IN	Fort Wayne, Menze Sls.	219-747-5616
MA	Cambridge, Autosplice Northeast	617-494-8430

AUTOSWAGE PRODUCTS, 726 River Rd., Shelton, CT 06484, Tel: 203-929-1401, TELEX: 963-542; Empl.: 170; *Sls. Mgr.:* R. D'Autrechy

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AL	Montgomery, M.Y.A., Inc.	205-284-1948
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IN	Greensburg, H. K. Feaster Assocs.	812-663-5689
MO	Maryland Heights, Meiners Sls.	314-739-1114
NY	Pittsford, Production Mktg. Grp.	716-248-5835
SC	Fort Mills, Eagle Sales, Inc.	803-548-2222
TX	Arlington, Paine & Murray, Inc.	817-461-6331
WA	Bellevue, H.J. Sls. Co.	206-453-1957
Can	Candiac, Que., W. H. Elctrns. Registered	514-632-3685

AUTOTROL CORPORATION, P.O. Box 557, Crystal Lake, IL 60014, Tel: 815-459-3080, TELEX: 72-2417, FAX: 815-459-3227; Empl.: 140; *Sls. Mgr.:* Loris Thacker

AUTRONICS CORP., 314 E. Live Oak, Ste. A, Arcadia, CA 91006, Tel: 818-445-5470, TWX: 910-582-3216, FAX: 818-446-0014; FSC No.: 03972; Empl.: 95; *Sls. Mgr.:* Annabelle Cloud, Contracts Mgr.; *Dist. Mgr.:* Gary Noyes

AVA ELECTRONICS CORPORATION, P.O. Box 184, 4000 Bridge St., Drexel Hill, PA 19026, Tel: 215-284-2500, TELEX: 3711411, FAX: 215-259-8379; Empl.: 100; *Sls. Mgr.:* William McKinley; *Dist. Mgr.:* Michael Ward

AVA INSTRUMENTATION, INC., 8010 Highway 9, Ben Lomond, CA 95005, Tel: 408-336-2281, TELEX: 5101007906 AVA, FAX: 403-336-5049; FSC No.: 61933; Empl.: 7; *Sls. Mgr.:* Allan Hughes

AVANTEK, INC., 481 Cottonwood Dr., Milpitas, CA 95035-7492, Tel: 408-432-3080, TWX: 310-371-8717, FAX: 408-954-0633; Empl.: 3200; *Dist. Mgr.:* John Locke

Local Sales Offices & Reps

CA	Westlake Vl, Avantek, Inc.	805-373-3870
IL	Palatine, Avantek, Inc.	312-358-8963
MD	Cloumbia, Avantek, Inc.	301-381-2600

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AZ	Tempe, Sertek, Inc.	602-894-9405
CA	Sunnyvale, Penstock, Inc.	408-730-0300
CA	Westlake Vl, Sertek, Inc.	818-707-2872
FL	Largo, Applied Specialties of FL	813-530-7309
FL	Melbourne, Comp. Dists. Inc.	407-724-9910
GA	Norcross, Comp. Dists. Inc.	404-441-3320
IL	Palatine, Penstock Midwest	317-784-3870
MD	Beltsville, Applied Specialists, Inc.	301-792-2211
MA	Lexington, Sickles Distbn. Sls.	617-862-5100
NJ	Fairfield, Penstock-East	201-808-1414

NC Raleigh, Comp. Dists. Inc. 919-787-7311
TX Dallas, Thorson Distbg. Co. 214-233-5744
WA Bellevue, Penstock, Inc. 206-454-2371
Can Sertek, Inc. 818-707-2872

FAX: 203-354-8597

AVEL-LINDBERG INC., 5 Old Town Park Rd., Unit 47, New Milford, CT 06776, Tel: 203-355-4711; Empl.: 8; *Sls. Mgr.:* Melanie B. Roman ..... **A•2258-2259**

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CT Wallingford, Sager Elctrl. Supp. Co. 203-265-4600
MA Hingham, Sager Elctrl. Supp. Co. 617-749-6700
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AVEX ELECTRONICS, 1683 Winchester Rd., P.O. Box 1026, Bensalem, PA 19020, Tel: 215-638-1515, 800-345-1295, FAX: 215-638-9108; FSC No.: 58414; *Sls. Mgr.:* Mike Battery Batley; *Dist. Mgr.:* Mike Batley .... **D•1454-1456**

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KS Wichita, Ensco-Rep 316-683-1070
MO Maryland Hgts., Ensco Rep Inc. 314-423-3935
NE Countryside, Ensco Rep 913-384-0840

AVIBANK MANUFACTURING, INC., 210 S. Victory Blvd., Burbank, CA 91503, Tel: 818-843-4330, TWX: 910-498-2215; FSC No.: 84256; Empl.: 465; *Sls. Mgr.:* D. Ladin

FAX: 201-382-4996

AVIONIC INSTRUMENTS, 1414 Randolph Ave., Avenel, NJ 07001, Tel: 201-388-3500, TELEX: 844413; Empl.: 160; *Sls. Mgr.:* Bryce Wiedeman; *Dist. Mgr.:* Mike Barnaba ..... **D•1642-1644, 2166-2173**

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Unitron

FAX: 214-341-2099

AVTEL DIV., UNITRON INC., 10925 Miller Rd., Dallas, TX 75238, Tel: 214-340-8600, TELEX: 882511; FSC No.: 6130; Empl.: 75; *Sls. Mgr.:* R. L. Beutel ... **D•2175-2177**

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NC Charlotte, Bruster Lawing & Assocs. .. 803-831-1205
VA Midlothian, Bruster Lawing & Assocs. 804-794-3879

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FAX: 803-626-2442

AVX CORPORATION, Box 867, Myrtle Bch., SC 29577, Tel: 803-448-9411, TWX: 810-661-2252; FSC No.: 9K916; *Sls. Mgr.:* Allan Cole; *Dist. Mgr.:* Robert Burns ..... **A•1019-1023, 1778; B•1008**

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AL Huntsville, Beacon Elctrns. 205-881-5031
AZ Scottsdale, Interstate Mktg. 602-244-9050
CA San Diego, Interstate Mktg. 619-693-3220
CA San Jose, Quadrep Inc. 408-432-3300
CA Woodland Hills, Interstate Mktg. Assocs. 818-883-7606
CO Englewood, Thorson Rocky Mt. Inc. ... 303-779-3435
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FL Clearwater, Dyne-a-Mark 813-441-4702
FL Fort Lauderdale, Dyne-a-Mark 305-771-6501
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UT Salt Lake City, Thorson Rocky Mt. Inc. 801-973-7969
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AZ Phoenix, Wyle Elctrns. 602-249-2232
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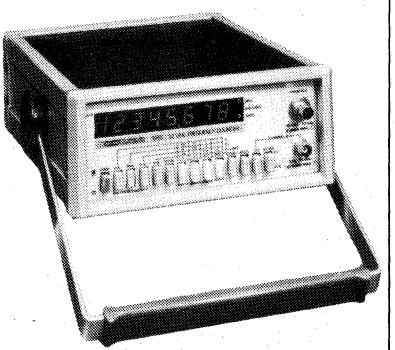

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BECKMAN INDUSTRIAL CORP., Cedar Grove Div., 89 Commerce Rd., Cedar Grove, NJ 07009, Tel: 201-239-6200, FAX: 201-857-9403

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CA	Santa Clara, Criterion Sls.	408-988-6300
CA	Van Nuys, Jones & McGeoy Sls.	818-994-6500
CO	Littleton, Simpson Assocs.	303-794-8381
CT	Cheshire, Datatrack Engrg., Inc.	203-271-1311
FL	Maitland, E.I.R., Inc.	407-660-9600
GA	Norcross, Elctrn. Sls., Inc.	404-448-6554
IL	Elk Grove Village, Carlson Elctrn. Sls. Co.	312-956-8240
IN	Indianapolis, Precision Elec. Comp.	317-842-3740
IA	Cedar Rapids, Carlson Elctrns.	319-378-1450
KS	Overland Park, Electri-Rep, Inc.	913-649-2168

BRILL ELECTRONICS
(415) 834-5888
610 E. 10th St., Oakland, CA 94606
COOPER INDUSTRIES **BELDEN**
(213) 452-8002
1220 Olympic Bl., Santa Monica, CA 90404

MD	Columbia, Robert Elctrn. Sls.	301-995-1900
MA	Taunton, Focus/Forsberg Sls., Inc.	508-824-3840
MI	Brighton, A.P. Assoc.	313-229-6550
MN	Minneapolis, Comstrand, Inc.	612-788-9234
MO	St. Louis, Electri-Rep	314-993-4421
NJ	Fairfield, Tech. Applications & Mktg., Inc.	201-575-4130
NM	Albuquerque, Reptronix, Ltd.	505-292-1718
NY	E. Syracuse, Ossmann Comp. Sls. Corp.	315-437-7052
NY	Henrietta, Ossmann Comp. Sls. Corp.	716-359-1200
NC	Raleigh, Tingen Tech. Sls.	919-878-4440
OH	Centerville, Omega Sls., Inc.	513-434-5507
OH	Shaker Hgts., Omega Sls., Inc.	216-751-9600
OR	Portland, Venture Elctrns., Inc.	503-624-0617
PA	Huntington, Omega Sls.	215-947-4135
TX	Austin, Norcom, Inc.	512-451-2757
TX	Dallas, Norcom, Inc.	214-386-4888
TX	Houston, Norcom, Inc.	713-778-0392
UT	Midvale, Simpson Assoc.	801-566-3691
WA	Bellevue, Venture Elctrns., Inc.	206-454-4594
WI	Milwaukee, Carlson Elctrn. Sls. Co.	414-476-2790
Can	Bramptom, Ont., Designtronics	416-793-5155
Can	Pointe Claire, Que., Designtronics	514-695-3124
Can	W. Vancouver, B. C., Blakewood Elctrn. Sys., Inc.	604-261-8099

BECKMAN INDUSTRIAL CORP., Emerson Electric Co., 3883 Ruffin Road, San Diego, CA 92123, Tel: 619-495-3200, TELEX: 249031 ..... **A•2083**

Local Sales Offices & Reps

CA	San Diego, Jim McGrath	619-495-3334
CA	San Diego, Michael Latham	619-495-3348
IL	Schaumburg, Tom Abrahamson	312-397-9390
NJ	Bridgeport, Stewart Hopkins	609-467-4220

BECKMAN INSTRS., HELIPOT DIV., See Beckman Instrs., Electro-Prods. Grp.

BEEDE ELECTRICAL INSTRUMENT CO., INC., S. Main St., Penacook, NH 03303, Tel: 603-753-6362, FAX: 603-753-6201; FSC No.: 06555; Empl.: 620; *Sls. Mgr.:* Brenda Beaudet; *Dist. Mgr.:* Gail Lyman Gould

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BEI

FAX: 619-931-1212

BEI MOTION SYSTEMS CO., Corporate Off., 2111 Palomar Airport Rd., Ste. 250, Carlsbad, CA 92009, Tel: 619-931-1500, TWX: 910-380-5402; Empl.: 11 ..... **B•1934**

Local Sales Offices & Reps

CA	San Rafael, BEI Motion Sys. Co.	415-492-2840
CA	Santa Ana, BEI Motion Sys. Co.	714-973-8510
CO	Westminster, BEI Motion Sys. Co.	303-426-1566
FL	Clearwater, BEI Motion Sys. Co.	813-791-6043
IL	Rockford, BEI Motion Sys. Co.	815-968-9528
MA	Wakefield, BEI Motion Sys. Co.	617-245-3851
MI	Plymouth, BEI Motion Sys. Co.	313-451-0359
NJ	Parsippany, BEI Motion Sys. Co.	201-984-5600
OH	Cincinnati, BEI Motion Sys. Co.	513-232-4545
OR	Beaverton, Thorson Co. NW	503-644-5900
PA	Exton, BEI Motion Sys. Co.	215-363-5444
TX	Hurst, BEI Motion Sys. Co.	817-284-4313
WA	Bellevue, Thorson Co. Northwest	206-455-9180
Can	Quebec, Willer Engrg., Ltd.	514-333-8555
Can	Willowdale, Willer Engrg., Ltd.	416-499-4421

BEI MOTION SYSTEMS CO., Computer Products Div., 1755 B La Costa Meadows Dr., San Marcos, CA 92069, Tel: 619-471-2600, TWX: 910-333-4534, FAX: 619-471-2675; *Sls. Mgr.:* Hank Robinson ..... **B•1934**

BEI MOTION SYSTEMS CO., Digital Products Div., P.O. Box 3838, Little Rock, AR 72203, Tel: 501-851-4000, TWX: 910-722-7384, FAX: 501-851-5476; Empl.: 103; *Sls. Mgr.:* Paul Barlock ..... **B•1934**

Refer to BEI Motion Sys. Co., Corporate Off., Carlsbad, CA for sales office information.

BEI MOTION SYSTEMS CO., Industrial Encoder Div., 7230 Hollister Ave., Goleta, CA 93117, Tel: 805-968-0782, TELEX: 888069, FAX: 805-968-3154; *Sls. Mgr.:* Glenn Avolio ..... **B•1934**

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BEI MOTION SYSTEMS COMPANY, Kimco Magnetics Division, 150 Vallecitos de Oro, San Marcos, CA 92069, Tel: 619-744-5671, TWX: 910-322-1168, FAX: 619-744-8815; Empl.: 43; *Sls. Mgr.:* George Beauchemin ..... **B•1934**

BEI MOTION SYSTEMS CO., Position Controls Div., 2280 Faraday Avenue, Carlsbad, CA 92008, Tel: 619-931-0200, TWX: 910-334-4903, FAX: 619-931-0772; *Sls. Mgr.:* Al Agent ..... **B•1934**

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BELDEN WIRE AND CABLE, Cooper Industries, P.O. Box 1980, Richmond, IN 47375, Tel: 317-983-5200, 800-BELDEN-1, TWX: 810-345-1393; Empl.: 3500; *Sls. Mgr.:* Rick Schneidewind, Dir. OEM Sls.; *Dist. Mgr.:* Bill Donahue ..... **C•1754, 1768-1819**

Local Sales Offices & Reps

CA	Irvine, Belden W. & C.	714-474-1200
GA	Atlanta, Belden W. & C.	404-934-6767
IL	Naperville, Belden W. & C.	312-717-7443
IN	Richmond, Belden W. & C.	317-983-5200
MA	Shrewsbury, Belden W. & C.	617-845-5000
TX	Dallas, Belden W. & C.	214-788-4300

bel BEL FUSE INC.

FAX: 201-432-9542

BEL FUSE, 198 Van Vorst St., Jersey City, NJ 07302, Tel: 201-432-0463; Empl.: 225; *Sls. Mgr.:* A. Sutta; *Dist. Mgr.:* E. Citarella ... **A•1510-1539, 2260-2261; B•1355-1358; D•1646-1647**

Local Sales Offices & Reps

CA	Irvine, Groh Assoc.	714-837-9871
FL	Maitland, D.J. Ellis & Assoc.,Inc.	407-645-1101

Fuses

AL	Huntsville, Beacon Elect.	205-881-5031
CA	Irvine, Groh Assocs.	714-837-9871
CA	Redwood City, James S. Heaton Co.	415-367-9000
FL	Maitland, Beacon Elect.	305-647-3498
FL	Boca Raton, Beacon Elec.	305-997-5740
IL	Chicago, MGA	312-775-1151
FL	Clearwater, Beacon Elect.	813-769-2378
FL	Melbourne, Beacon Elect.	305-724-8010
GA	Atlanta, Beacon Elect.	404-256-9640
ID	Boise, N.R. Schultz Co.	208-377-8686
MN	St. Paul, Northport Engrg.	612-457-8000
IN	Indianapolis, Insul. Reps., Inc.	317-251-1994
KS	Shawnee Mission, Lowell-Kangas Assoc.	913-631-3515
MD	Randallstown, Beacon North, Inc.	703-478-2480
MI	Brighton, A.P. Associates	313-229-6550
NH	Amherst, David A. Cowley Assoc.	603-673-7050
NY	Rochester, Tri-Tech Elec.	716-385-6500
NJ	New Brunswick, Winch Sls. Assocs.	201-613-1515
NC	Raleigh, Beacon Elect.	919-787-0330
OH	Cleveland, Arthur Baier Co.	216-461-6161
OR	Beaverton, N.R. Schultz Co.	503-643-1644
PA	Hatboro, J.S. Wurts Co.	215-674-3562
TN	Knoxville, Insul-Reps., Inc.	615-691-7586
VA	Sterling, Beacon North, Inc.	703-478-2480
WA	Bellevue, N.R. Schultz Co.	206-454-0300
PR	Hato Rey, Max Anderson Co., Inc.	809-751-2026
Can	Scarboro, Ont., Cantronics, Ltd.	416-297-8668

Delay Lines

AL	Hunstville, Beacon Elect.	205-881-5031
AZ	Scottsdale, SMS & Assoc.	602-998-0831
CA	Irvine, Groh Assoc.	714-837-9871
CO	Boulder, Front Range Mktg.	303-443-4780
FL	Longwood, D-Assocs., Inc.	407-830-8976
FL	Maitland, DJ Ellis & Assoc., Inc.	407-645-1101
CA	Redwood City, James S. Heaton Co.	415-367-9000
ID	Boise, N.R. Schultz Co.	208-377-8686

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GA Atlanta, Beacon Elect. 404-256-9640
KS Shawnee Mission, Lowell-Kangas Assoc. 913-631-3515
MD Randallstown, Beacon North, Inc. 703-478-2480
MI Brighton, A.P. Associates 313-229-6550
MN S. St. Paul, Northport Engrg. 612-457-8000
IN Indianapolis, Insul. Reps., Inc. 317-251-1994
NH Amherst, David A. Cowley Assocs. 603-673-7050
NJ E. Brunswick, Winch Sls. Assoc. 201-613-1515
MO St. Louis, Lowell-Kangas Assoc. 314-821-4050
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NY E. Rochester, Tri-Tech Elec. 716-385-6500
OR Beaverton, N.R. Schultz 503-643-1644
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NC Raleigh, Beacon Elect. 919-787-0330
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TX Dallas, Oeler & Menelaides 214-361-8876
UT Midvale, Front Range Mktg. 801-566-2500
VA Sterling, Beacon North, Inc. 703-478-2480
WA Bellevue, N.R. Schultz Co. 206-454-0300
TN Knoxville, Insul. Reps. 615-691-7586
PR Hato Rey, M. Anderson Co., Inc. 809-751-2020
Can Scarboro, Ont., Cantronics, Ltd. 416-297-8668

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FL Boca Raton, D & R 407-977-8751
PA Bristol, Aim Elctrns. 215-785-3500
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Scarborough, Ont., Carsten Elctrns. ... 416-495-7705
AL Huntsville, CDI 205-883-7501
CA Anaheim, Deco 714-630-8252
CA Chatsworth, West Valley Inds. 818-700-0700
CA City of Industry, Ital Elctrns. 818-968-8515
CA El Segundo, Force Elctrns. 213-772-1324
CA Hayward, Kea Elctrns. 415-887-2900
CA San Diego, Deco 213-693-1593
CA San Diego, Sigma Elctrns. 619-565-2000
CA San Jose, Force Elctrns. 408-943-1324
CA Santa Clara, Pyramid 408-727-9810
CT Norwalk, Cobra Comps. 203-847-6442
FL Ft. Lauderdale, CDI 305-971-4950
GA Norcrosss, CDI 404-441-3320
IN Indianapolis, Mar Elctrns. 317-633-6699
MD Columbia, DK Elctrns. 301-995-1950
MO St. Charles, Finnigan Elctrns. 314-946-6201
MA Marlboro, Hardware Specialty 617-481-8622
MN New Brighton, Chris Elctrns. 612-631-2647
NH Hudson, Bell Inds. 603-882-1133
NY Bohemia, Key Comps. 516-567-7500
NC Raleigh, CDI 919-787-7311
OR Beaverton, Comp. Resources 503-641-8488
PA Cornwall Hgts., Reliance Merchandising 215-638-8200
PA Harrisburg, Cumberland Elctrns. 717-232-9715
TX Dallas, Fuses Inc. 214-341-6407
VA Falls Church, CDI 703-241-8227
WA Kent, Pyramid 206-872-5800

BELL, FLOYD, INC., 897 Higgs Ave., Columbus, OH 43212, Tel: 614-294-4000, FAX: 614-291-0823; FSC No.: 56493; *Sls. Mgr.:* Tom Shain ..... **D•1026**

Local Sales Offices & Reps

IL Mt. Prospect, Robert Adams Sls. Co. .. 312-297-8733
MD Columbia, Tyler Griffin Co. 301-995-1215
PA Paoli, Tyler Griffin Co. 215-647-1550

BELL, F. W., INC., 6120 Hanging Moss Rd., Orlando, FL 32807, Tel: 407-678-6900, TWX: 810-853-3115, FAX: 407-677-5765; FSC No.: 18479; *Dist. Mgr.:* Edward S. Wilush ..... **B•1935; D•1138-1139, 1228-1229**

Local Sales Offices & Reps

CA Arcadia, Jim Robins Assocs. 818-574-0049
CA Milpitas, Maxim Elctrn. Sls. 408-946-6001
IL Palatine, Golbeck Milota 312-705-0602
MA Hingham, Shain Assoc. 617-740-2334
MO Grandview, Harris-Hanson Co. 816-763-6200
NJ Ridgewood, Ballou, Inc. 201-444-6990
OH Dayton, Electro Sls. Assocs. 513-426-5551
TX Carrollton, Seaton Corp. 214-380-0414

Local Distributors

AZ Phoenix, Jensen Tools & Alloys 602-968-6231
CA Arcadia, Jim Robins Assocs. 818-574-0049
CA Irwindale, Schafer Engrg. 818-960-5402
CA Milpitas, Maxim Elctrn. Sls. 408-946-6001
CA Pasadena, Pasadena Elctrns. 818-796-7481
CA San Marcos, Mitchell Instrs. 619-744-2690
CA Santa Ana, W.H.T. 714-754-6822
FL Indian Rocks Bch., P & R Instr. Supp. 813-596-8841
GA Atlanta, P.R. Instr. Supp. 404-391-9117
IL Chicago, W W Grainger Inc. 312-647-8900
IL Palatine, Golbeck Milota Assocs. 312-705-0602
MD Sparks, E I L Instrs. 502-454-3420
MA Hingham, Shain Assocs. 617-740-2334
MO St. Louis, Harris Hanson Co. 314-432-3611
NJ Ridgewood, Ballou, Inc. 201-444-6990
NY Rochester, Tranecat 716-458-4801
NY Whitehouse, Power Electro Supp. Co. 718-767-1447
OH Dayton, Electro Entprs. 513-426-5551
TX Dallas, Seaton Corp. 214-380-0414
WA Tacoma, Inspection Technlg. 509-759-9492

BELL INDS., J. W. Miller Div., 306 E. Alondra Blvd. P.O. Box 2859, Gardena, CA 90247-1059, Tel: 213-537-5200, FAX: 213-631-4217; FSC No.: 76493; Empl.: 30; *Sls. Mgr.:* Jack Pintar ..... **A•1202-1205**

Local Sales Offices & Reps

CA Campbell, Shur Sls. 408-374-5577
CA Gardena, Bidwell Sls. Assocs. 213-770-0300
CO Denver, West, Inc. 303-477-8180
FL Clearwater, HHP Assocs., Inc. 813-797-4447
FL Pompano Bch., HHP Assocs., Inc. 305-971-5750
FL Winter Park, HHP Assocs., Inc. 407-740-0320
IL Elk Grove VL, Levy, Grams & Lassers 312-364-7800
IN Indianapolis, Elctrn. Reps. 317-894-1414
IN Mishawaka, Elctrn. Reps., Inc. 219-259-9365
MA Burlington, Conti-Younger Assocs., Inc. 617-273-1582
MD Woodbine, DJC Elctrn. Sls. 301-795-7020
MI E. Detroit, Jack M. Thorpe Co. 313-779-6363
MN Eden Prairie, Electro Mark, Inc. 612-944-5850
NJ Englewood, Epstein & Siebel Assoc. .. 201-569-7600
OH St. Mary's, Thomas Shelby & Co., Inc. 419-394-3377
TX Ft. Worth, Chet Wells & Co. 817-284-0261
EXP Yonkers, New York, Roburn Agencies 914-968-1016
Can Montreal, Que., Bestec Elctrns., Ltd. ... 514-276-4477
Can Rexdale, Ont., Bestec Elctrns., Ltd. 416-674-1330

Local Distributors

CO Denver, Bell Industries/EDD 303-424-1985

BELLOFRAM CORPORATION, Pulpit Rock Rd., Pelham, NH 03076, Tel: 603-635-2103, 800-343-0039, TELEX: 94-9457; Empl.: 300; *Sls. Mgr.:* Donald Rudolph; *Dist. Mgr.:* Donald Rudolph

BELTING INDUSTRIES CO., INC., 20 Boright Ave., Kenilworth, NJ 07033, Tel: 201-272-8591, TELEX: 229854, FAX: 201-272-3825; Empl.: 125; *Sls. Mgr.:* Gene Hobson

BEMCO, 9908 San Fernando Rd., Pacoima, CA 91331, Tel: 818-899-5296, FAX: 818-897-6525; Empl.: 70; *Sls. Mgr.:* Glenn Elliott

BENCHMARK TECHNOLOGY, 200 S. Turnbull Canyon Rd., City of Industry, CA 91745, Tel: 818-333-1201, TWX: 910-584-1861; Empl.: 202; *Sls. Mgr.:* S. Dorren

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CA Palo Alto, Shaw-Tech 415-961-4775
CA Santa Ana, Bergquist Co. 714-542-3383
DE Wilmington, Electro Tech. Sls. 302-764-2189
DC Macrotech Assocs., Ltd. 301-766-1111
FL Clearwater, Tech-Rep 813-530-1619
IA Atkins, Bergquist 319-446-7456
IA Cedar Rapids, Bergquist 319-366-8733
MA Brookline, Harman Assocs. 617-232-6687
NY Lynbrook, P. Saftler Assocs. 516-593-7880
NY No. Syracuse, Leonard D. Allen 315-458-7470
OH Cleveland, Staff Co. 216-331-5100
OR Tigard, Elctrn. Comp. Sls. 503-245-2342
TX Lewisville, Bergquist 214-317-1502
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301

Local Distributors

AL Huntsville, Component Dist., Inc. 205-883-7501
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CA Hawthorne, Electrosonic 213-970-0997
CA Mtn. View, Energy Sls. 415-969-0800
CA San Diego, Southland Fasteners 619-578-6630
CO Aurora, JET Elctrns. 303-364-1000
FL Ft. Lauderdale, Components Dist. Inc. 305-973-6915
GA Norcross, Components Dist. Inc. 404-441-3320
IL Chicago, NEP Elctrns. 312-625-8400
MA Brookline, Harman Sls. 617-232-6687
NY Farmingdale, Addem Dist. 516-752-9303
NC Raleigh, Components Dist. Inc. 919-834-9465
TX Dallas, Components Dist. Inc. 214-694-0373
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BERK-TEK INC., 132 White Oak Road, New Holland, PA 17557, Tel: 717-354-6200, FAX: 717-354-7944; FSC No.: 19449; Empl.: 350; *Sls. Mgr.:* Brad Hubinek, Natl. Sls. Mgr.

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BERTAN ASSOCS., 121 New South Rd., Hicksville, NY 11801, Tel: 516-433-3110, TWX: 510-221-2144; FSC No.: 6130; Empl.: 140; *Sls. Mgr.:* Jim Donley ... **D•1649-1663**

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AL Huntsville, Currie, Peak, Frazier 205-536-1506
AZ Phoenix, Thor Engrg. 602-437-1463
CA Encino, King-Way Assoc. 818-788-4124
CA Los Altos, Cain-White & Co. 415-948-6533
CO Boulder, H. Bass Assocs. 303-530-7509
CT Farmington, Ray Perron & Co., Inc. 203-673-4825
GA Norcross, Currie, Peak, Frazier 404-449-7662
IL Arlington Hgts., Coombs Assocs. 312-439-9810
MD Randallstown, Beacon North 703-591-1300
MA Needham, Ray Perron & Co., Inc. 617-449-6162
MI Detroit, Geotronix, Inc. 313-559-2440
MN Minneapolis, Electronic Instrs. 612-374-5628
MO St. Louis, Acorn Elctrns., Inc. 314-644-2510
NH Dover, Ray Perron & Co., Inc. 603-742-2321
NM Albuquerque, Thorson/Desert States Co. 505-293-8555

NY Elmont, Crane & Egert Corp. 516-872-0800
NY Hicksville, Bertan Assocs., Inc. 516-433-3110
NY Liverpool, Northern Tech. Sls. Co. 315-451-1091
OH Cleveland, Geotronix 216-659-6100
PA Audubon, Holmes Assocs. 215-666-0636
TX Dallas, Automated Motion Control 214-340-4192
UT Bountiful, H. Bass Assoc. 801-295-7100
VA Fairfax, Beacon North 703-591-1300
WA Bellevue, Cain-White & Co., Inc. 206-462-2118
WI Milwaukee, Coombs Assocs. 414-351-6123
Can Downsview, Ont., Rayonics Sci., Inc. .. 416-736-1600

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BEST TECHNOLOGY INC., 400 Boren Ave. North, Seattle, WA 98109, Tel: 206-382-1300, FAX: 206-382-0186; Empl.: 8 ..... **B•1888**

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CO Westminster, Straube Assocs. 303-426-0890

BESWICK:COOPER U.K. LTD., Alert Works, Frome, United Kingdom BA11 1PP, Tel: (0373) 64311, TELEX: 449196 G, FAX: (0373) 73175

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B. G. LABORATORIES, INC., 75 Travis Ave., Binghamton, NY 13904, Tel: 607-722-2376, FAX: 607-722-4204; FSC No.: 26522; Empl.: 150; *Sls. Mgr.:* Marj Jayne

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MI St. Joseph, I. E. Hampton & Assocs. ... 616-983-0862
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OH Dayton, Shamrock Sls. 513-258-1227
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WA Redmond, Halbar Assocs. 206-882-0990
WI Theinsville, TFL Assoc. 414-242-6800

BIBCO, INC., 258 Territorial, Benton Harbor, MI 49022, Tel: 616-925-8445, FAX: 616-925-3081; Empl.: 150; *Sls. Mgr.:* J. Neil Iwan

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PA Media, Homer Smith Co. 215-543-2434
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BISHOP GRAPHICS, INC., 5210 Lewis Rd., Agoura, CA 91304, Tel: 818-991-2600, TELEX: 66-2400 BISHOP WKVG, FAX: 818-889-3744; Empl.: 140; *Sls. Mgr.:* Robert Reiss

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NC Cary, 20th Century Mktg. Inc. 919-481-3370
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OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
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WA Redmond, Eclipse Mktg. Grp. 206-885-6991
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Can Scarborough, Ont., Carsten Elec. Ltd. 416-495-9999

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CA Fountain Valley, Components Ctr. 714-979-0433
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VA Richmond, R. W. Mitscher Co., Inc. 804-745-0037
EXP CT, Stamford, Dage Corp. 203-324-3123

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BODINE ELECTRIC COMPANY, 2500 W. Bradley Pl., Chicago, IL 60618, Tel: 312-478-3515, TELEX: 25-3646; Empl.: 800; *Sls. Mgr.:* R. J. Stuchly; *Dist. Mgr.:* R. J. Stuchly ..... **B•1236**

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MN Mound, John F. Rynkar 612-472-4252
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NY Rochester, Application Specialists 716-586-6226
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TX Richardson, Control Dynamics 214-644-6945
VA McLean, J. S. Hsia 703-734-1739
WA Seattle, Drive Motor Control Sys. Co. 206-575-4172
EXP IL, Chicago, Export Dept., Bodine Elec. 312-478-3515
Can Vancouver, BC, Madison Indl. Equip. Ltd. 604-872-8155

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AL Mobile, Brownell Instrs. & Control Co. 205-479-5405
AZ Phoenix, Minarik Elec. Co. 602-233-3000
CA Carson, Power Trans. Specialties 213-631-7502
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CA Glendale, Minarik Elec. Co. 818-507-6500
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GA Tucker, Research Designs, Inc. 404-491-0745
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IL Rockford, Tek-Matic, Inc. 815-282-1775
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MA Somerville, Electro Sls. Co., Inc. 617-666-0500
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NY Rochester, B & B Motor & Control 716-424-7040
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NC Charlotte, Piedmont Motor &Control Ltd. 704-523-7121,
OH Dayton, Thal Mor Assoc., Inc. 513-298-9939
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Can Toronto, Renold Canada Ltd. 416-453-2190,
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BOGEN COMMUNICATIONS, INC.

FAX: 201-934-9832

BOGEN COMMUNICATIONS, INC., MPD Products, 50 Spring St, P.O. Box 575, Ramsey, NJ 07446, Tel: 201-934-8500, TWX: 710-990-5047; *Sls. Mgr.:* Christopher Wildfoerster ..... **C•1294**

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CA	San Diego, Tauber Assocs.	619-274-7242
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FL	Tampa, SRT Mktg.	813-884-4805
IL	Palatine, Technlg. Sls.	312-991-6600
IN	Indianapolis, Marketing Engrg.	317-872-5665
KS	Overland Park, Spectrum Sls.	913-648-6811
MA	Burlington, Conti Younger	617-273-1582
MI	Brighton, A. P. Assocs.	313-229-6550
MN	Eden Prarie, Electro Mark	612-944-5850
MO	St. Louis, Spectrum Sls.	314-731-5151
NJ	Berkeley Hgts., Cambridge Allen & Assocs.	201-464-0203
NY	Mendon, Tech-Mark, Inc.	716-624-3840
NC	Greensboro, Hile Sls., Inc.	919-288-1500
OR	Beaverton, Advanced Power Prods.	503-646-0994
PA	Philadelphia, Samuel K. Macdonald, Inc.	215-659-4414
TX	Dallas, Dunbar	214-239-7151
UT	Salt Lake City, Comp. Sls.	801-268-8440
WI	Waukesha, Technlg. Sls.	414-786-5015
Can	Ontario, White Radio Ltd.	416-632-6894

Local Distributors

AL	Huntsville, Resistacap, Inc.	205-883-4270
AZ	Scottsdale, Electro Mark	602-991-0110
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CA	Santa Clara, Cypress Elctrns., Inc.	408-980-2500
CA	Van Nuys, Nesco	213-781-0505
CO	Arvada, Denver Beta Wintronics	303-431-7161
FL	Boca Raton, Plainview Elctrns.	305-997-7705
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IN	Indianapolis, Bell Elctrns.	317-875-8200
IN	Indianapolis, Elctrn. Prod. Concepts	317-872-5665
MA	Canton, Impact Sls.	617-821-1500
MA	Danvers, Generation Elctrns.	617-777-4866
MA	Sharon, Adcour	617-784-8123
MI	Brighton, A. P. Sls.	313-227-3604
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BOMAR CRYSTAL, 201 Blackford Ave., Middlesex, NJ 08846, Tel: 201-356-7787, 800-526-3935, FAX: 1-201-356 7362; Empl.: 75; *Sls. Mgr.:* Steve Weinstein

BOMCO, See MuShield Co.

BONAR KARD-O-LITE, INC., 421 Feheley Dr., King of Prussia, PA 19406, Tel: 215-277-2910, FAX: 215-277-2956; Empl.: 30; *Sls. Mgr.:* Robert Gorra ..... **B•1132**

BOONTON

FAX: 201-584-3037

BOONTON ELECTRONICS CORP., 791 Route 10, Randolph, NJ 07869, Tel: 201-584-1077, TWX: 710-986-8215 BOONTRONICS; FSC No.: 04901; Empl.: 180; *Sls. Mgr.:* R. Morrell ..... **D•1231**

Local Sales Offices & Reps

AL	Huntsville, Sci. Devices	205-536-1969
AZ	Phoenix, Aztec Entprs.	602-944-9185
CA	North Hollywood, O'Halloran Assocs.	213-877-0173
CA	Palo Alto, O'Halloran Assocs.	415-969-1600
CO	Denver, Aztec Entprs.	303-779-5285
CT	Mt. Carmel, Sci. Devices	203-248-9361
FL	Orlando, Sci. Devices	305-841-8180
IL	Elmhurst, Sector Engrg. Sls., Inc.	312-530-7850
IN	Indianapolis, Sector Engrg. Sls., Inc.	317-842-1120
KS	Lenexa, Ramsey Assoc.	913-541-1007
MD	Lanhan, Sel-Tronics	301-731-8080
MA	Lexington, R. J. Sickles	617-862-5100
MN	Minneapolis, Sector Engrg. Sls., Inc.	612-593-1809
MO	Maryland Hgts., Ramsey Assoc.	314-878-5042
NJ	Teaneck, Sci. Devices	201-837-1004
NM	Albuquerque, Aztec Entprs.	505-262-1688
NY	Rochester, Sci. Devices	716-334-2445
NC	Winston-Salem, Sci. Devices	919-765-5776
OH	Centerville, Micro Sls.	513-433-8171
PA	Melrose Park, R. Meyers	215-224-1663
TX	Austin, Testech	512-327-7033
TX	Richardson, Testech	214-644-5010
UT	Ogden, Aztec Entprs.	801-621-1655
WA	Bellevue, Sci. Devices	206-747-5169
WI	Milwaukee, Sector Engrg. Sls., Inc.	414-352-8280

BOPLA ENCLOSURES, 7330 Executive Way, Frederick, MD 21701, Tel: 301-696-9300, FAX: 301-696-9494; FSC No.: 4Y520; Empl.: 35; *Sls. Mgr.:* Andy Kassman ..... **C•1012**

Local Sales Offices & Reps

CA	Irvine, Comp. Mktg. Assocs.	714-951-5950
FL	Tampa, FL Comp. Sls.	813-960-7044
IL	Chicago, Paddock Mktg./Sls.	312-452-7852
IN	Nobelsville, R & D Elctrns.	317-849-2026
MA	Needham, T.E.S.C.O.	617-444-7925
PA	Lancaster, Indl. Comps. Inc.	215-889-0650
VA	Reston, Colrud Corp.	703-620-6621
WA	Federal Way, K. R. Jensen Sls.	206-874-2772

Local Distributors

MA	Framingham, Now Elctrns.	617-872-5876
OR	Portland, Radar Elctrns.	503-232-3404
PA	Harrisburg, Cumberland Elctrns.	717-232-5999
PA	Lancaster, Peak Elctrns.	215-293-9000
WA	Seattle, Radar Elec.	206-282-2511

BORG-WARNER THERMOELECTRICS, BORG-WARNER CORP., See TECA, ThermoElectric Cooling America Corp.

BOSCH, ROBERT, CORP., 2800 S. 25th Ave., Broadview, IL 60153, Tel: 312-865-5200, TELEX: 23-5563, FAX: 312-865-6429; *Sls. Mgr.:* Dieter Bloecks; *Dist. Mgr.:* Dave Robson

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9281
AZ	Scottsdale, Luscombe Engrg.	602-949-9333
CA	Campbell, Luscombe Engrg.	408-370-2020
CA	Montrose, Luscombe Engrg.	818-249-9000
CA	Pasadena, Luscombe Engrg.	213-684-2000
CO	Longmont, Piper Sls.	303-651-2378
CT	Madison, Conti Younger Assocs.	203-245-1136
GA	Norcross, 20th Century Mktg.	404-446-1999
IL	Woodridge, Trend-Tronics, Inc.	312-985-0626
IA	Davenport, Rush & West Assocs.	319-388-9494
MA	Burlington, Conti Younger	617-273-1582
MA	Burlington, Conti-Younger Assocs.	617-273-1582
MI	Sterling Hgts., Geotronix	313-254-0520
MN	Minneapolis, H.M.R., Inc.	612-888-2122
MO	Ballwin, Rush & West Assocs.	319-394-7271
MO	St. Louis, Rush & West Assocs.	314-965-3322
NY	Liverpool, Bradnon Assocs.	315-652-3954
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Raleigh, 20th Century Mktg.	919-782-4624
OH	Richfield, Geotronix Inc.	216-659-6100
PA	Cornwells Hts., William Staats Co.	215-639-5231
PA	Norristown, Brandon Assocs.	215-278-0500
TN	Memphis, 20th Century Mktg.	901-756-4681
TX	Dallas, P.J. Scanlon Co.	214-231-4661
TX	Lewisville, Jim Hughes Co.	214-221-1536
WA	Mercer Island, Electronic Comp. Sls.	206-232-9301

BOSCHERT, INC., Computer Products/Boschert, 3797 Spinnaker Ct., Fremont, CA 94538, Tel: 415-657-6700, FAX: 415-683-6400 ..... **D•1684, 1699**

Refer to Computer Products, Inc., Fremont, CA, for sales offices, Reps. and Distributors.

BOSCHERT, INC., See Computer Products, Inc.

BOURNS

BOURNS, INC., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, Tel: 714-781-5050, TWX: 910-332-1252; Empl.: 6000; *Sls. Mgr.:* Dennis Lause; *Dist. Mgr.:* Vince Ingrao ..... **A•1876-1877, 2084-2087**

Local Sales Offices & Reps

AL	Huntsville, CSR Elctrns.	205-533-2444
AZ	Phoenix, Summit Sls.	602-998-4850
CA	Calabasas, Quad Rep. Inc.	818-887-4219
CA	Irvine, Quad Rep. Inc.	714-261-6706
CA	San Diego, Quad Rep.Inc.	619-560-8330
CA	San Jose, QuadRep, Inc.	408-946-4000
CO	Parker, Parker Webster	303-841-4888
FL	Altamonte Springs, Dyne-A-Mark	305-831-2097
FL	Clearwater, Dyne-A-Mark	813-441-4702
FL	Ft. Lauderdale, Dyne-A-Mark	305-771-6501
FL	Palm Bay, Dyne-A-Mark	305-727-0192
GA	Atlanta, CSR Elctrns.	404-396-3720
ID	Boise, Intermountain Technlg.	208-322-5022
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Technlg. Mktg. Corp.	219-432-5553
IA	Cedar Rapids, REP Assocs. Corp.	319-373-0152
KY	Louisville, Technlg. Mktg. Corp.	502-499-7808
MD	Baltimore, Micro-Comp.	301-247-0400
MA	Lexington, John E. Boeing Co.	617-862-2500
MI	Detroit, Rathburg Assocs.	313-882-1717
MN	Edina, Mel Foster	612-941-9790
MO	Bridgeton, Centech	314-291-4230
MO	Raytown, Centech	816-358-8100
NJ	Bellmawr, Thomas Assocs.	609-933-2600
NY	Ithaca, Bob Dean	607-257-1111
NY	Melville, Comtronic Assocs.	516-249-0505
NC	Raleigh, CSR Elctrns.	919-878-9200
OH	Richfield, Bear Mktg.	216-659-3131
OK	Oklahoma City, Ammon & Rizos	405-942-2552
OR	Portland, J. J. Backer	503-297-8744
OR	Salem, J. J. Backer	503-362-0717
TX	Austin, Ammon & Rizos	512-454-5131
TX	Dallas, Ammon & Rizos	214-644-5591
TX	Houston, Ammon & Rizos	713-781-6240
UT	Salt Lake City, Parker Webster	801-266-9939
VA	Huddleston, Micro-Comp	301-247-0400
WA	Seattle, J. J. Backer	206-285-1300

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AL	Huntsville, Hamilton/Avnet Elctrns.	205-837-7210
AL	Huntsville, Pioneer/Washington	205-837-9300
AL	Huntsville, Schweber	205-882-2200
AZ	Phoenix, Hall-Mark Elctrns.	602-243-6601
AZ	Phoenix, Schweber Elctrns.	602-997-4874
AZ	Phoenix, TTI	602-861-0222
AZ	Tempe, Bell Inds.	602-966-7800

AZ Tempe, Elctrn. Supp. 602-258-4769
AZ Tempe, Hamilton/Avnet 602-231-5100
CA Canoga Park, Schweber Elctrns. 213-999-4702
CA Chatsworth, Avnet Elctrns. 213-700-2600
CA Chatsworth, TTI 818-709-1010
CA Citrus Hts, Hall-Mark Elctrns. 916-443-7282
CA Compton, Harper S.I.D. 213-979-5090
CA Costa Mesa, Avnet Elctrns. 213-558-2313
CA Costa Mesa, Avnet Elctrns. 714-754-6111
CA Costa Mesa, Hamilton Elctrns. 714-641-4100
CA Culver City, Hamilton Electro Sls. 213-558-2121
CA Culver City, Hamilton Electro Sls. 213-558-2883/84
CA El Segundo, Hall-Mark Elctrns. 213-643-9101
CA Garden Grove, Bell Inds. 213-444-0301
CA Gardena, Bell Inds. 213-515-1800
CA Irvine, Schweber Elctrns. 714-863-0261
CA Irvine, Schweber Elctrns. 714-556-3880
CA Oakland, Brill Elctrns. 415-834-5888
CA Riverside, Elctrn. Supp. Corp. 714-787-9220
CA Roseville, Bell Inds. 916-969-3100
CA Sacramento, Hamilton/Avnet 916-920-3150
CA Sacramento, Schweber Elctrns. 916-929-9732
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, Elctrn. Supp. 619-278-5020
CA San Diego, Hall-Mark Elctrns. 619-268-1201
CA San Diego, Hamilton/Avnet 619-571-7500
CA San Jose, TTI 408-943-9155
CA Santa Ana, Teknopak 714-558-8840
CA Santa Clara, Schweber Elctrns. 408-496-0200
CA Santa Clara, Schweber Elctrns. 408-748-4700
CA Sunnyvale, Bell Inds. 408-734-8570
CA Sunnyvale, Hall-Mark Elctrns. 408-773-9990
CA Sunnyvale, Hamilton/Avnet 408-743-3300
CA Tustin, Hall-Mark Elctrns. 714-669-0681
CA Woodland Hills, Avnet Elctrns. 213-884-3322
CO Denver, Newark Elctrns. 303-757-3351
CO Englewood, Hall-Mark Elctrns. 303-790-1662
CO Englewood, Hamilton/Avnet 303-779-9998
CO Wheat Ridge, Bell Inds. 303-424-1985
CT Danbury, Hamilton/Avnet 203-797-2856
CT Danbury, Schweber Elctrns. 203-792-3500
CT Hamden, Almo Elctrns. Corp. 203-288-6556
CT Norwalk, Pioneer Std. 203-853-1515
CT Statford, TTI 203-375-1400
CT Wallingford, Midan Elctrns. 203-265-2077
FL Altamonte Springs, Pioneer Std. 305-834-9090
FL Altamonte Springs, Schweber Elctrns. 305-331-7555
FL Clearwater, Hall-Mark Elctrns. 813-530-4543
FL Dania, Summit Distrs. 305-920-6253
FL Ft. Lauderdale, Hall-Mark Elctrns. 305-971-9280
FL Ft. Lauderdale, Hamilton/Avnet 305-971-2900
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Ft. Lauderdale, Pioneer/Washington 305-771-7520
FL Hollywood, Schweber Elctrns. 305-927-0511
FL Largo, Graham Elctrns. 813-541-4434
FL Orlando, Hall-Mark 305-855-4020
FL Orlando, Hammond Elctrns. 305-849-6060
FL Orlando, Pioneer/Orlando 305-834-9090
FL Orlando, TTI 305-859-1000
FL St. Petersburg, Hall-Mark Elctrns. 813-576-8691
FL St. Petersburg, Hamilton/Avnet 813-576-3930
FL Winter Park, Hamilton/Avnet 305-628-3888
GA Norcross, Hall-Mark Elctrns. 404-447-8000
GA Norcross, Hamilton/Avnet 404-447-7500
GA Norcross, Hammond Elctrns. 404-449-1996
GA Norcross, Pioneer/Washington 404-448-1711
GA Norcross, Schweber Elctrns. 404-449-9170
GA Norcross, TTI 404-662-0911
IL Bensenville, Hall-Mark Elctrns. 312-860-3800
IL Bensenville, Hamilton/Avnet 312-860-8523
IL Chicago, Bell Inds. 312-982-9210
IL Chicago, Newark Elctrns. 312-638-4411
IL Elk Grove Village, Pioneer Std. 312-437-9680
IL Elk Grove Village, Schweber Elctrns. 312-364-3750
IL Palatine, Ohm Elctrns. 312-359-5500
IN Carmel, Hamilton/Avnet 317-844-9333
IN Fort Wayne, Graham Elctrns. 219-423-3422
IN Indianapolis, Graham Elctrns. 317-634-8202
IN Indianapolis, Pioneer Std. Elctrns. 317-849-7300
IN Lafayette, Graham Elctrns. 317-423-5564
IA Cedar Rapids, Bell Inds. 319-395-0730
IA Cedar Rapids, Hamilton/Avnet 319-362-4757
IA Cedar Rapids, Schweber Elctrns. 319-373-1417
KS Lenexa, Hall-Mark Elctrns. 913-888-4747
KS Overland Park, Schweber Elctrns. 913-492-2921
KS Overland Pk., Hamilton/Avnet Elctrns. 913-888-8900
MD Baltimore, Radio Elec. Svc. Co. 301-529-0500
MD Beltsville, Radio Elec. Svc. Co. 202-937-9100
MD Columbia, Hall-Mark Elctrns. 301-796-9300
MD Columbia, Hamilton/Avnet 301-995-3500
MD Gaithersburg, Almo Elctrns. Corp. 301-670-0090
MD Gaithersburg, Pioneer/Washington 301-921-0660
MD Gaithersburg, Schweber Elctrns. 301-840-5900
MA Bedford, Schweber Elctrns. 617-275-5100
MA Canton, Almo Elctrns. Corp. 617-821-1450
MA Lexington, Pioneer Std. 617-863-1200
MA Norwood, Gerber Elctrns. 617-769-6000
MA Woburn, Hall-Mark Elctrns. 617-935-9777
MA Woburn, Hamilton/Avnet 617-273-7500
MI Flint, RS Elctrns. 313-762-5800
MI Grand Rapids, Hamilton/Avnet 616-243-8805
MI Grand Rapids, RS Elctrns. 616-241-3483
MI Kalamazoo, RS Elctrns. 616-381-5470
MI Livonia, Hamilton/Avnet 313-522-4700
MI Livonia, Pioneer Std. Elctrns. 313-525-1800
MI Livonia, RS Elctrns. 313-525-1155
MI Livonia, Schweber Elctrns. 313-525-8100
MI Roseville, RS Elctrns. 313-779-2450
MI Wyandotte, RS Elctrns. 313-AV2-5880
MN Bloomington, Hall-Mark Elctrns. 612-854-3223
MN Eden Prairie, Schweber Elctrns. 612-941-5280
MN Edina, Schweber Elctrns. 612-941-5280
MN Minneapolis, Newark Elctrns. 612-331-6350
MN Minnetonka, Hamilton/Avnet 612-932-0600
MN Minnetonka, Pioneer Std. Elctrns. 612-935-5444
MO Earth City, Hamilton/Avnet 314-344-1200
MO Earth City, Schweber Elctrns. 314-739-0526
MO Maryland Hts, Hall-Mark Elctrns. 314-291-5350
NH Hudson, C&H Elctrns. 603-882-1133
NH Manchester, Schweber Elctrns. 603-625-2250
NJ Camden, General Radio 609-964-8560
NJ Cherry Hill, Hall-Mark Elctrns. 609-424-7300
NJ Cherry Hill, Hamilton/Avnet 609-424-0110
NJ Clifton, J-Mar Elctrns. 201-772-6400
NJ Fairfield, Hall-Mark Elctrns. 201-575-4415
NJ Fairfield, Hamilton/Avnet 201-575-3390
NJ Fairfield, Schweber Elctrns. 201-227-7880
NJ Pine Brook, Pioneer Std. 201-227-1262
NM Albuquerque, Bell Inds. 505-292-2700
NM Albuquerque, Hamilton/Avnet Elctrns. 505-765-1500
NY Bohemia, TTI 516-567-1500
NY Buffalo, Summit Distrs. 716-884-3450
NY E. Syracuse, Hamilton/Avnet 315-437-2647
NY Fairport, Pioneer-Harvey 716-381-7070
NY Hauppauge, Hamilton/Avnet 516-231-9800
NY Hauppauge, Mast Distrs. 516-273-4422
NY Hauppauge, Pioneer-Harvey 516-231-9200
NY Melville, Hamilton/Avnet 516-454-6000
NY Rochester, Hamilton/Avnet Elctrns. 716-475-9130
NY Rochester, Schweber Elctrns. 716-424-2222
NY Rochester, Summit Distrs. 716-334-8110
NY Ronkonkoma, Hall-Mark Elctrns. 516-737-0600
NY Vestal, Pioneer Std. 607-748-8211
NY Westbury, Schweber Elctrns. 516-334-7474
NC Charlotte, Pioneer/Washington 704-527-8188
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Hall-Mark Elctrns. 919-872-6286
NC Raleigh, Hall-Mark Elctrns. 919-872-0712
NC Raleigh, Hamilton/Avnet 919-878-0819
NC Raleigh, Schweber Elctrns. 919-876-0000
OH Beachwood, Schweber Elctrns. 216-464-2970
OH Cincinnati, Hall-Mark Elctrns. 513-563-5980
OH Cincinnati, Hughes-Peters 513-351-2000
OH Cleveland, Hamilton/Avnet 216-831-3500
OH Cleveland, Pioneer Std. 216-587-3600
OH Columbus, Graham Elctrns. 614-895-1590
OH Columbus, Hughes-Peters 614-294-5351
OH Dayton, Bell Inds. 513-434-8213
OH Dayton, Hamilton/Avnet 513-433-0610
OH Dayton, Pioneer Std. 513-236-9900
OH Dayton, Schweber Elctrns. 513-439-1800
OH Maumee, RS Elctrns. 419-893-0721
OH Solon, Hall-Mark Elctrns. 216-349-4632
OH Westerville, Hall-Mark Elctrns. 614-891-4555
OK Tulsa, Hall-Mark Elctrns. 918-665-3200
OK Tulsa, Schweber Elctrns. 918-622-8000
OR Beaverton, Almac Elctrns. 503-641-9070
OR Lake Oswego, Bell Inds. 503-241-4115
OR Lake Oswego, Hamilton/Avnet Elctrns. 503-635-8831
PA Horsham, Pioneer/Washington 215-674-4000
PA Horsham, Schweber Elctrns. 215-441-0600
PA Philadelphia, Almo Elctrns. Corp. 215-698-4000
PA Pittsburgh, Almo Elctrns. Corp. 412-931-5990
PA Pittsburgh, Pioneer Std. Elctrns. 412-782-2300
PA Pittsburgh, Schweber Elctrns. 412-782-1600
SC Greenville, Hammond Elctrns. 803-233-4121
TN Nashville, Graham Elctrns. 615-242-2682
TX Austin, Hall-Mark Elctrns. 512-258-8848
TX Austin, Hamilton/Avnet 512-837-8911
TX Austin, Harrison Equip. Co. 512-458-3555
TX Austin, Pioneer Std. Elctrns. 512-835-4000
TX Austin, Schweber Elctrns. 512-458-8253
TX Dallas, Hall-Mark Elctrns. 214-343-5000
TX Dallas, Hall-Mark Elctrns. 214-341-1147
TX Dallas, Harrison Equip. Co. 214-239-2750
TX Dallas, Pioneer Std. Elctrns. 214-386-7300
TX Dallas, Schweber Elctrns. 214-661-5010
TX El Paso, Ideal Indl. Elctrn. Supp. 915-779-6647
TX Fort Worth, TTI 214-429-1440
TX Houston, Hall-Mark Elctrns. 713-781-6100
TX Houston, Hamilton/Avnet 713-975-3501
TX Houston, Harrison Equip. Co. 713-879-2600
TX Houston, Pioneer Std. 713-988-5555
TX Houston, Pioneer Std. Elctrns. 214-386-7300
TX Houston, Schweber Elctrns. 713-784-3600
TX Irving, Hamilton/Avnet 214-659-4100
TX Stafford, Harrison Equip. 713-879-2600
UT Salt Lake City, Bell Inds. 801-972-6969
UT Salt Lake City, Hamilton/Avnet 801-972-2800
WA Bellevue, Almac Elctrns. 206-643-9992
WA Bellevue, Bell Inds. 206-747-1515
WA Bellevue, Hamilton/Avnet 206-643-3950
WI Brookfield, Schweber Elctrns. 414-784-9020
WI Mequon, Taylor Elec. 414-241-4321
WI Milwaukee, Electronic Expd. 414-228-8100
WI New Berlin, Hamilton/Avnet 414-784-4510
WI Oak Creek, Hall-Mark Elctrns. 414-761-3000
WI Waukesha, Bell Inds. 414-547-8879

BOURNS INSTRUMENTS INC., 1200 Columbia, Riverside, CA 92507, Tel: 714-781-5148, TWX: 910-332-6103; Empl.: 220; *Sls. Mgr.:* Dennis Dalbeck

BOWMAR INSTRUMENT CORP., Aerospace Div., 8000 Bluffton Rd., Ft. Wayne, IN 46809, Tel: 219-747-3121, TWX: 810-332-1510; FSC No.: 99479; Empl.: 215; *Sls. Mgr.:* Gary McClintick

BOWMAR INSTRUMENT CORP., Data Entry Division, 4640 126th Ave. N., Clearwater, FL 34622-4796, Tel: 813-573-2525, TWX: 810-863-0375, FAX: 813-573-1317; Empl.: 100; *Sls. Mgr.:* Walter Kunz

BOWMAR TELECOMMUNICATIONS DIV., 531 Main St., Acton, MA 01720, Tel: 508-263-8365, TWX: 710-347-1441, FAX: 617-263-3358; Empl.: 60; *Sls. Mgr.:* John Hyatt ..... **D•1379**

Local Sales Offices & Reps

CA Palo Alto, Mollard Mktg. 415-961-0456
CA Santa Ana, Brooks-Moore & Assocs. 714-541-2044
CO Commerce City, Meas. Consits. 303-286-1414
FL Lakeland, Curry Controls 813-646-5781
GA Atlanta, Cascade Controls 404-587-1368
IL Des Plaines, Lincoln, Hodges & Assocs. 312-297-3810
KS Overland Park, Barry Sls. 913-642-0270
LA Baton Rouge, Mid-South Sls. 504-924-0106
LA Lake Charles, Mid South Sls. 318-433-0356
LA Slidell, Mid-South Sls. 504-641-7480
MD Columbia, Tyler Griffin Co. 301-995-1215
MA Billerica, Eastronix, Inc. 508-670-2400
MI Livonia, Amtech Reps. 313-474-8300
MN Minneapolis, Waltam Sls. Co. 612-781-2778
MO St. Louis, Barry Sls. 314-821-2525
NJ Perth Amboy, Cosine, Inc. 201-442-3600
NM Albuquerque, Meas. Consits. 303-286-1414
NY Clarence, EIL/Trott Elctrns. 716-634-8500
NY Pittsford, EIL/Trott Elctrns. 716-586-8251
NC Charlotte, EIL/Trott Elctrns. 704-376-2237
OH Dayton, J. C. Hofstetter Co. 513-296-1010
OH Medina, J. C. Hofstetter Co. 216-241-4880
OR Portland, Frank Jackson Assocs. 503-645-8511
PA Hickory, J. C. Hofstetter Co. 412-356-2305
PA Paoli, Tyler Griffin Co. 215-647-1550
TN Knoxville, EIL/Trott Elctrns. 615-525-9871
TX Carrollton, Seaton Corp. 214-380-0414
UT Centerville, Measurement Consits. 801-298-3388
WA Redmond, Frank Jackson Assocs. 206-881-7277
WI Janesville, Lincoln, Hodges & Assocs. 608-754-4214,414-542-3087

Local Distributors

CA Los Angeles, EIL Instrs. 213-685-7020
CA Sunnyvale, EIL Instrs. 408-245-4320

BRILL ELECTRONICS
(415) 834-5888
610 E. 10th St. Oakland, CA 94606
BOURNS
(213) 452-8002
1220 Olympic Bl. Santa Monica, CA 90404

CO Denver, EIL Instrs. 303-534-4160
CT Middleton, EIL Instrs. 203-346-6646
FL Palm Bay, EIL Instrs. 407-725-8300
IL Bridgeview, EIL Instrs. 312-430-2292
IN Indianapolis, EIL Instrs. 317-545-1373
KY Louisville, EIL Instrs. 502-454-3420
MD Sparks, EIL Instrs. 301-771-4800
MA Burlington, EIL Instrs. 617-272-9450
NJ Pennsauken, EIL Instrs. 609-488-0474
NY Hauppauge, EIL Instrs. 516-231-6333
OH Dayton, EIL Instrs. 513-435-2134
PA Pittsburgh, E.I.L. 412-823-2255
TX Dallas, EIL Instrs. 214-931-1236
TX Houston, EIL Instrs. 714-271-3100
VA Springfield, EIL Instrs. 703-569-2611
WA Redmond, EIL Instrs. 206-882-3222

BP MICROSYSTEMS, 10681 Haddington, Ste. 190, Houston, TX 77043, Tel: 713-461-9430, 1-800-225-2102, TELEX: 1561477, FAX: 713-461-7413; Empl.: 7

BRADFORD ELECTRONICS, INC., 550 High Street, Bradford, PA 16701, Tel: 814-362-5700, TELEX: 914496, FAX: 814-362-5635; FSC No.: 24546; Empl.: 225; *Sls. Mgr.:* Gerald M. Miller; *Dist. Mgr.:* Jon Trabert ..... **A•1024-1025, 1879-1889**

Local Sales Offices & Reps

AL Huntsville, JWL Assocs. 205-883-1712
AZ Tempe, Bradford Sls. Off. 602-966-0291
CA Los Alamitos, Reed Elctrns. Mktg. 213-598-6676
CA Redwood City, J. S. Heaton Co. 415-367-9000
CA San Diego, Bradford Sls. Off. 619-690-5112
CO Colorado Springs, Bradford Sls. Off. ... 303-593-7529
CO Loveland, Bradford Sls. Off. 303-667-7500
CT Guilford, Kaelber & Mack 203-389-8643
FL Coral Springs, Graham Assocs. Inc. ... 305-775-6733
FL Melbourne, Graham Assocs., Inc. 407-773-6631
FL Palm Bch. Gdns., Graham Assocs. Inc. 407-622-4049
FL Winter Gdn., Graham Assocs. Inc. 407-656-9369
GA Atlanta, JWL Assocs. 404-320-7643
IL Skokie, IRI 312-967-8430
IN Ft. Wayne, Scott Elctrns. 219-489-5690
IN Indianapolis, Scott Elctrns. 317-841-0010
KS Shawnee Mission, Bradford Sls. Off. .. 913-432-9140
MD Glen Burnie, Tri-Mark 301-761-6000
MA Wakefield, Howard C. Jappe Co. 617-245-9359
MI Plymouth, Jay Mktg. Assocs. 313-459-1200
MN Bloomington, IRI 612-854-1120
NJ Fairlawn, Kaelber & Mack 201-797-7865
NY Commack, Kaelber & Mack 516-499-2924
NY Liverpool, Bradford Sls. Off. 315-457-1401
NC Pineville, JWL Assocs. 704-541-5750
NC Raleigh, JWL Assocs. 919-787-4836
OH Cincinnati, Scott Elctrns. 513-791-2513
OH Cleveland, Scott Elctrns. 216-473-5050
OH Dayton, Scott Elctrns. 513-294-0539
OH Reynoldsburg, Scott Elctrns. 614-863-1281
OR Beaverton, LD Elctrns. 503-684-5571
PA Horsham, TMI 215-441-4300
TX Dallas, E. F. Aymond Co. 214-826-7620
TX San Antonio, E. F. Aymond Co. 512-675-8339
WA Snohomish, LD Elctrns. 206-568-0511
WA Spokane, LD Elctrns. 509-922-4883
WI Milwaukee, IRI 414-259-0965
Can Scarborough, Ont., Bradford Elctrns., Inc. 514-483-3812

Local Distributors

AL Huntsville, Schweber Elctrns. 205-895-0480
AZ Phoenix, Schweber Elctrns. 602-997-4874
AZ Tempe, Acacia/VNR Elctrns. 602-894-2874
AZ Tempe, Bell Inds. 602-966-7800
AZ Tempe, Schweber Elctrns. 602-431-0030
AZ Tempe, Shelley-Ragon, Inc. 602-894-2058
AZ Tempe, T.T.I, Inc. 602-431-1191
CA Canoga Pk., Schweber Elctrns. 818-999-4702
CA Chatsworth, Shelley-Ragon, Inc. 818-998-3333
CA Chatsworth, T.T.I, Inc. 818-709-1010
CA Cypress, Bell Inds. 714-895-7801
CA Denver, T.T.I, Inc. 303-429-6806
CA Garden Grove, Bell Inds. 714-220-0681
CA Gardena, Bell Inds. 213-515-1800
CA Irvine, Acacia/VNR Elctrns. 213-971-2428
CA Irvine, Schweber Elctrns. 714-863-0254
CA Lakewood, Acacia/VNR Elctrns. 303-232-2882
CA Los Angeles, Bell Inds. 213-826-6778
CA Milpitas, T.T.I, Inc. 408-946-5577
CA Rocklin, Bell Inds. 916-652-0414
CA Sacramento, Schweber Elctrns. 916-929-9732
CA San Diego, Acacia/VNR Elctrns. 619-565-4365
CA San Diego, Neumann Elctrns. 619-695-3005
CA San Diego, Shelley-Ragon, Inc. 619-453-7133
CA San Diego, T.T.I, Inc. 619-587-4888
CA San Diego, Wyle Distbn. Grp. 619-565-9171
CA San Jose, Schweber Elctrns. 408-946-7171
CA San Jose, Shelley-Ragon, Inc. 408-432-0600
CA Santa Ana, T.T.I, Inc. 714-641-9393
CA Santa Clara, Wyle Distbn. Grp. 408-727-2500
CA Sunnyvale, Acacia/VNR Elctrns. 408-745-7200
CA Sunnyvale, Bell Inds. 408-734-8570
CA Thousand Oaks, Bell Inds. 805-499-6821
CA Wheat Ridge, Bell Inds. Inc. 303-424-1985
CO Denver, IEC 303-292-6121
CO Englewood, Shelley-Ragon, Inc. 303-762-0670
CT Danbury, Schweber Elctrns. 203-748-7080
CT Oxford, Schweber Elctrns. 203-264-4700
CT Wallingford, Almo Elctrns. Corp. 203-269-6801
CT Wallingford, Cronin Elctrns., Inc. 203-265-3134
CT Wallingford, T.T.I, Inc. 203-284-7474
FL Altamonte Springs, Schweber Elctrns. 305-331-7555
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Orlando, Hammond Elctrns. 305-849-6060
FL Orlando, T.T.I, Inc. 407-859-1000
FL Pompano Bch., Schweber Elctrns. 305-977-7511
FL Tampa, Shelley-Ragon, Inc. 813-623-6560
GA Norcross, Schweber Elctrns. 404-446-5842
GA Norcross, T.T.I, Inc. 404-662-0911
IL Elk Grove Vl, Bell Inds., Inc. 312-640-1910
IL Elk Grove Vl, Schweber Elctrns. 312-364-3750
IL Lombard, Shelley-Ragon, Inc. 312-629-8833
IN Ft. Wayne, Bell Inds., Inc. 219-423-3422
IN Indianapolis, Bell Inds., Inc. 317-875-8200
IA Cedar Rapids, Schweber Elctrns. 319-373-1417
KS Overland Pk., Schweber Elctrns. 913-492-2921
MD Columbia, T.T.I, Inc. 301-995-1331
MD Gaithersburg, M.S Elctrns. 301-921-0200
MD Gaithersburg, Schweber Elctrns. 301-840-5900
MD Jessup, Almo Elctrns. Corp. 301-953-2566
MD White Marsh, Resco/Baltimore, Inc. ... 301-529-0500
MA Bedford, Schweber Elctrns. 617-275-5100
MA Canton, Almo Elctrns., Inc. 617-821-1450
MA Needham, Cronin Elctrns., Inc. 617-449-5000
MA Wilmington, T.T.I, Inc. 508-658-4700
MA Woburn, Sterling Elctrns. 617-938-6200
MI Ann Arbor, Bell Inds., Inc. 313-971-9093
MI Livonia, Schweber Elctrns. 313-525-8100
MN Eden Prairie, T.T.I, Inc. 612-944-5080
MN Edina, Schweber Elctrns. 612-941-5280
MN St. Paul, Shelley-Ragon, Inc. 612-642-2828
MO Earth City, Schweber Elctrns. 314-739-0526
MO Independence, Shelley-Ragon, Inc. 816-254-3410
NJ East Brunswick, Almo Elctrns. Corp. .. 201-613-0200
NJ Fairfield, Schweber Elctrns. 201-227-7880
NJ Mt. Laurel, T.T.I, Inc. 609-234-6400
NJ Pinebrook, Schweber Elctrns. 201-227-7880
NM Albuquerque, Bell Inds., Inc. 505-292-2700
NY Bohemia, Justin Elctrns., Inc. 516-589-4000
NY Medford, LI, Shelley-Ragon, Inc. 516-447-2000
NY Rochester, Schweber Elctrns. 716-424-2222
NY Ronkonkoma, T.T.I, Inc. 516-737-2073
NY Valley Stream, LI, L & S Elctrns. 516-561-2474
NY Westbury, Schweber Elctrns. 516-334-7474
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Resco/Raleigh 919-781-5700
NC Raleigh, Schweber Elctrns. 919-876-0000
OH Beachwood, Schweber Elctrns. 216-464-2970
OH Columbus, Hughes-Peters, Inc. 614-294-5351
OH Columbus, T.T.I, Inc. 614-848-5770
OH Dayton, Bell Inds., Inc. 513-434-8231
OH Dayton, Bell Inds., Inc. 513-435-8660
OH Dayton, Schweber Elctrns. 513-439-1800
OK Tulsa, Schweber Elctrns. 918-622-8000
OR Beaverton, Shelley-Ragon, Inc. 503-641-1691
OR Lake Osego, Bell Inds., Inc. 503-241-4115
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PA Mars, Almo Elctrns. Corp. 412-931-5990
PA McKean, Advacom, Inc. 814-476-7774
PA Philadelphia, Almo Elctrns. Corp. 215-698-4009
PA Pittsburgh, Schweber Elctrns. 412-782-1600
TX Austin, Schweber Elctrns. 512-339-0088
TX Dallas, Schweber Elctrns. 214-661-5010
TX Dallas, Shelley-Ragon, Inc. 214-349-2424
TX Ft. Worth, T.T.I, Inc. 817-595-3100
TX Ft. Worth, T.T.I, Inc. 817-831-8300
TX Houston, Schweber Elctrns. 713-784-3600
UT Midvale, Bell Inds., Inc. 801-255-9611
VA Charlottesville, Viginia Elec. Comps., Inc. 804-296-4184
WA Redmond, Bell Inds., Inc. 206-885-9963
WA Redmond, Shelley-Ragon, Inc. 206-883-2220
WA Redmond, T.T.I, Inc. 206-882-0291
WI Milwaukee, Marsh Elec. Inc. 414-475-6000
WI New Berlin, Schweber Elctrns. 414-784-9020
WI Waukesha, Bell Inds., Inc. 414-547-8879
Can Alberta, Future Elctrns. 403-235-5325
Can British Columbia, Future Elctrns. 604-438-5545
Can Ontario, Future Elctrns. 613-820-8313
Can Ontario, Future Elctrns. 416-638-4771
Can Quebec, Future Elctrns. 514-694-7710
OR Beaverton, Acacia/VNR Elctrns. 503-646-3377

BRADFORD ELCTRNS., INC., Special Resistor Div., PO Box 1179, Robbinsville, NC 28771-1179, Tel: 704-479-6451; Empl.: 140; *Sls. Mgr.:* Larry Viar

BRADY, W. H., CO., Indl. Prods. Div., 2221 W. Camden Rd., Milwaukee, WI 53201, Tel: 414-351-6630, TELEX: 26-677, TWX: 910-262-3151, FAX: 1-800-292-2229; *Sls. Mgr.:* M. O. Williamson; *Dist. Mgr.:* M. O. Williamson

BRADY, W.H., CO. NAMEPLATE DIV., See Brady, W.H., Co., Elctrn. Prods. Div

BRADY, W. H., CO., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201, Tel: 414-355-8300, TELEX: 26-677, TWX: 910-262-3151, FAX: 414-354-0453; FSC No.: 85480; *Sls. Mgr.:* F. P. Yorio

BRAEMAR CORP., 11400 Rupp Drive, Burnsville, MN 55337, Tel: 612-890-5135; Empl.: 130; *Sls. Mgr.:* Ron Zylstra

BRAILSFORD & CO., 670 Milton Rd., Rye, NY 10580, Tel: 914-967-1820, FAX: 914-967-1836; Empl.: 25

BRAND DIELECTRICS, INC., Route 203, N. Windham, CT 06256, Tel: 203-423-6321; Empl.: 5; *Sls. Mgr.:* Philip Harvey

BRANDEN, T. G., CORP., 15822 S.W. Upper Bns. Fry. Rd., Lake Oswego, OR 97035, Tel: 503-620-7571; Empl.: 8; *Sls. Mgr.:* Curt Norby

BRANDT ELECTRONICS, INC., 815 E. Middlefield Road, Mountain View, CA 94043, Tel: 415-967-4944, FAX: 415-967-9105; FSC No.: 57837; Empl.: 52; *Sls. Mgr.:* Frank D. Brandt

Local Sales Offices & Reps

AZ Phoenix, Tech Sls. Inc. 602-246-1614
CA Saratoga, E. Reid Miller 408-257-6927
CO Boulder, Herb Bass Assoc. 303-530-7509
FL Orlando, Honeyco 407-299-1000
GA Warner Robins, DeBona Consultant Assoc. 912-922-6560
IL Wauconda, Cudahy Sls. Co. 312-526-2484
MD Ellicott City, Nelson Elctrns., Inc. 301-747-7887
MA Chelmsford, B.B.C., Inc. 508-452-7211
MO St. Louis, AME Sls., Inc. 314-962-9771
NY East Syracuse, Emtech Assoc. 315-437-6410
NY Wantagh, BYTEC Rep. 516-781-7400
TX Richardson, Vector Sls. 214-234-4291
WA Everett, Huntley 206-337-5594

BRANMAG, INC., 908 Niagara Falls Blvd., North Tonawanda, NY 14120, Tel: 716-693-5994, FAX: 416-856-4802; FSC No.: 9V968; Empl.: 6; *Sls. Mgr.:* B. Veljkovic

BRAXTON MFG., Echo Lake Rd. N., P.O. Box 429, Watertown, CT 06795, Tel: 203-274-6781, TWX: 710-477-0621, FAX: 203-274-9195; Empl.: 115; *Sls. Mgr.:* Richard Rosa

BREEZE-ILLINOIS, TransTechnology Corp., 8800 Allen Rd., Peoria, IL 61615-1584, Tel: 309-693-3300, TWX: 510-390-3691, FAX: 303-693-3308; Empl.: 280; *Sls. Mgr.:* Stanley Profiri; *Dist. Mgr.:* Stanley Profiri

Brentek International

BRENTEK INTERNATIONAL, INC., 526 Windsor St., Reading, PA 19601, Tel: 215-375-7200; Empl.: **2**; *Sls. Mgr.:* Roberta Breneman

Local Sales Offices & Reps

IL Schaumburg, Martan, Inc. 312-303-5660
MA Burlington, Anacon Sls. 617-272-9080
MN Minneapolis, Scott Elctrns. 612-929-2985
NJ Hackensack, L-Tron Assocs. (East) ... 201-342-8033
NY Pittsford, L-Tron Assocs. 716-385-7520
PA Reading, Brentek Int'l,Inc. 215-375-7200
WI Grafton, Martan, Inc. 414-377-6640

Local Distributors

CA San Diego, Industrial Computer Source 800-523-2320
MN Minneapolis, Control Design Supply ... 612-721-1628
NY Glen Head, Livera-Polk Assocs. 516-759-9300
WI Germantown, Professional Control Corp. 414-251-3000
Can Mississauga,Ont., Transduction 800-268-0427

BREN-TRONICS, INC., 10 Brayton Ct., Commack, NY 11725, Tel: 516-499-5155, TELEX: 22-1213 TTCUR, FAX: 516-499-5504; FSC No.: 51828; Empl.: 75; *Sls. Mgr.:* Don Fagon

FAX: 201-778-2792

BRIM ELECTRONICS, P.O. Box 336 E, Fair Lawn, NJ 07410, Tel: 201-796-2886; FSC No.: 57834 ..... **C•1820-1829**

Local Sales Offices & Reps

AZ	Phoenix, Mactronix	602-998-1848
MA	Stow, GH Assocs.	617-897-1741
MA	Stow, R G Assocs.	617-897-7146
EXP	NY, N.Y.C., Robum Agencies	212-989-5939

Local Distributors

AL	Dothan, Carmichael Whls. Supp.	205-793-7066
CA	Canoga Park, Tim-Co. Sls.	213-992-5040
CA	San Diego, Shanks & Wright	619-239-0176
CT	Manchester, IMS	203-649-4415
CT	Waterbury, Century Elec.	203-755-0405
FL	Lake Mary, Electronic Fasteners	305-321-4000
KS	Topeka, Acme Radio Supp. Co.	913-235-1363
LA	New Orleans, Radio Parts	504-581-5959
MA	Billerica, Eastern Video Sys.	617-667-0009
MA	Lexington, Wholesale Elect. Supp.	617-862-3590
MA	Springfield, Electro-Term	413-734-6469
MA	Waltham, Linear Elect.	617-894-7300
NH	Dover, American Radio Corp.	603-742-6800
NJ	Hackensack, Milcor	201-489-1313
NY	LIC, H.L. Dalis	212-361-1100
NY	N.Y.C., Center Indl.	212-YU9-6363
OK	Tulsa, Radio, Inc.	918-587-9123
RI	Newport, J & S Elctrn. Distb.	401-847-2977
TN	Knoxville, Bondurant Bros. Co.	615-573-9151
TX	Texarkana, Lavender Elec.	501-773-4631
TX	Texarkana, McCulloch Elctrns.	214-792-6923
VT	Cavendish, C S Svc. & Supp. Co.	802-226-7582
VA	Norfolk, Todd Elec.	804-855-3111
WA	Seattle, Amateur Radio Supp.	206-767-3222

BRIntec® Corporation

FAX: 710-440-2248

BRINTEC CORP., Brand-Rex Cable Systems Division, 1600 W. Main St., Willimantic, CT 06226-1128, Tel: 203-456-8000, TELEX: 99-4444; FSC No.: 71124; Empl.: 1000

BRISTOL BABCOCK INC., 1100 Buckingham St., Watertown, CT 06795, Tel: 203-575-3000, 800-243-3576, TELEX: 962417, FAX: 203-754-1477; Empl.: 600; *Sls. Mgr.:* Carlos Batista

BROOKS ELECTRONICS, 4001 N. American St., Philadelphia, PA 19140, Tel: 215-228-4433, FAX: 215-227-7687; Empl.: 70; *Sls. Mgr.:* G. Brooks; *Dist. Mgr.:* G. Brooks

BROOKS INSTRUMENT DIV., Emerson Elec. Co., 407 W. Vine St., Hatfield, PA 19440, Tel: 215-362-3500, TELEX: 4975082, FAX: 215-362-3745; Empl.: 1500

BROOKS POWER SYSTEMS, 1810 Byberry Rd., Bensalem, PA 19020, Tel: 215-244-0264, 1-800-523-1551, FAX: 215-244-0160; Empl.: 90; *Sls. Mgr.:* Joan LaRocca

BRUEL & KJAER INSTRS. INC., 185 Forest St., Marlboro, MA 01752-3093, Tel: 508-481-7000, TWX: 710-347-1187, FAX: 508-485-0519; Empl.: 200

Local Sales Offices & Reps

CA	Foster City, Bruel & Kjaer Instrs.	415-574-8100
CA	Orange, Bruel & Kjaer Instrs.	714-978-8066
GA	Marietta, Bruel & Kjar Instrs.	404-422-5200,
IL	Hoffman Estates, Bruel & Kjaer Instrs.	312-358-7582
MD	Gaithersburg, Bruel & Kjaer Instrs.	301-948-0494
MA	Marlborough, Bruel & Kjaer Instrs.	508-481-7737
MI	Livonia, Bruel & Kjaer Instrs.	313-522-8600
NJ	West Caldwell, Bruel & Kjaer Instrs.	201-227-6100
OH	Milford, Bruel & Kjaer Instruments	513-831-8878
TX	Irving, Bruel & Kjaer Instrs.	214-751-1700,
WA	Seattle, Bruel & Kjaer Instrs.	206-324-5905,

BRUNING COMPUTER GRAPHICS, P.O. Box 3020, 777 Arnold Dr., Martinez, CA 94553, Tel: 415-372-7568, TWX: 910-481-5951 ZETAPLOTS MART; FSC No.: 52893; Empl.: 200; *Sls. Mgr.:* Gary Hasenfus

BRUSH FUSES INC., 2070 Maple St., Des Plaines, IL 60018, Tel: 312-299-2211, TELEX: 726-453, FAX: 312-299-2272; FSC No.: 72076;F15160E; Empl.: 200

For nearest sales office, phone 1-800-245-4501 (in Ohio, 1-800-245-4497)

BRUSH INDUSTRIES INC., 3rd & Reagan Sts., P.O. Box 638, Sunbury, PA 17801-0638, Tel: 717-286-5611, 800-233-0362, FAX: 717-286-2649; FSC No.: 19418; Empl.: 100; *Sls. Mgr.:* Murray L. Clayman

BTU INTERNATIONAL, INC.:BTU SYSTEMS DIVISION, 23 Esquire Rd., N. Billerica, MA 01862, Tel: 508-667-4111, TELEX: 94-7489, FAX: 508-667-4111; Empl.: 600; *Sls. Mgr.:* Dave Barry/Michael Ortengrer

BUBBL-TEC, 6805 Sierra Ct., Dublin, CA 94568, Tel: 415-829-8705, TWX: 910-389-6890; Empl.: 19; *Sls. Mgr.:* Bob Nelson

BUCHANAN, Div. Amerace, Newburgh Road, Hackettstown, NJ 07940, Tel: 201-852-1122; FAX: 201-852-7342

BUCKEYE STAMPING CO., 555 Marion Rd., Columbus, OH 43207, Tel: 614-445-8433, FAX: 614-445-8224; Empl.: 85; *Sls. Mgr.:* Jim Willcox ..... **C•1013**

Local Sales Offices & Reps

CA	Irvine, Vale Elctrns. Assocs.	714-551-4821
CA	Pasadena, P. Nurches Co.	213-681-8957
CA	Santa Clara, Engrg. Assocs.	408-988-5001
CO	Denver, Moss Mktg.	303-455-7205
FL	Indian Rock Bch., PAR Assocs., Inc.	813-596-8841
GA	Atlanta, Par Assoc.	404-391-9117
IL	Mt. Prospect, Robert Adams Sls.	312-297-8733
KS	De Soto, Midtec Assoc.	913-441-6565
MD	Columbia, Tyler Griffin Co.	301-995-1215
MA	Belmont, Elctrn. Comps. & Svc.	617-484-8680
MN	Minneapolis, A. J. Warner Co.	612-729-7371
MO	Florissant, Midtec Assocs., Inc.	314-837-5200
NJ	Ocean, P. Saftler Assocs.	201-922-3014
NM	Albuquerque, Moss Mktg.	505-292-7505
NY	Fulton, P. Saftler Assocs.	315-592-7184
NY	Lynbrook, P. Saftler Assoc.	516-593-7880
OH	Beechwood, Elctrn. Sls. Masters, Inc.	800-321-1848
OH	Columbus, McFadden Sls.	614-761-3177
OK	Tulsa, Advance Tech. Sls.	918-664-0482
OR	Forest Grove, Doran Sls. Assocs., Inc.	503-357-3333
PA	Paoli, T. Griffin Co.	215-647-1550
TX	Austin, Advance Tech. Sls.	512-440-7677
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
WA	Redmond, Doran Sls. Assocs., Inc.	206-885-1885

Local Distributors

CA	Los Angeles, Elect. Switches	213-664-1141
CA	Redwood City, Hi-Cor	415-368-3849
GA	Atlanta, Lakeland Engrg. Equip.	404-696-7334
MI	Ann Arbor, Wedemeyer Elctrns.	313-665-8611
MN	Albuquerque, Ideal Elctrn. Supp.	505-345-7887
NY	Hauppauge, Broadline Elctrn. Dist.	516-231-4100
OR	Portland, Radar Elec.	503-232-3404
TX	El Paso, Ideal Indl. Elctrn.	915-779-6647
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053

BUD INDUSTRIES, INC., 4605 E. 355th St., Willoughby, OH 44094-0431, Tel: 216-946-3200, FAX: 216-951-4015; FSC No.: 71218; Empl.: 200; *Sls. Mgr.:* Bill DeRoche; *Dist. Mgr.:* B. K. Haas

BUEHLER PRODUCTS, INC., P. O. Box 33400, Raleigh, NC 27606, Tel: 919-469-8522, TWX: 510-924-2474; Empl.: 400; *Sls. Mgr.:* D. Frank Slightom

BUGGIE H. H., See Caton Connector Corp.

BULBTRONICS, INC., 45 Banfi Plaza East Coast, Farmingdale, NY 11735, Tel: 516-249-2272, 1-800-654-8542 Eastern Reg. FAX: 516-249-6066; Empl.: 60; *Sls. Mgr.:* Elaine Gray, V.P. Sls.; *Dist. Mgr.:* Diana Jacobson, V.P. Mktg.

BULBTRONICS, INC., 1260 N. Hancock St. Ste. 106, Anaheim, CA 92807, Tel: 714-693-0533, FAX: 714-693-0814

BULOVA WATCH CO., See Frequency Control Prods., Inc., American Time Prods. Div.

BUMPER PRODUCTS CORP., 14 King St., P.O. Box 45, Mt. Holly, NJ 08060, Tel: 609-261-8100, 800-541-2500, FAX: 609-261-7300; *Sls. Mgr.:* Ed Rosenthal

BUNTING MAGNETICS CO., 500 So. Spencer Rd., Newton, KS 67114, Tel: 316-284-2020, 800-835-2526, TELEX: 437264, FAX: 316-283-4975; Empl.: 100; *Sls. Mgr.:* Robert J. Bunting

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GA	Atlanta, Murphy and Cota	404-875-2525
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KS	Mission, Mertens Co.	913-432-9323
MA	Topsfield, Peak Sls.	508-887-3868
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MO	St. Louis, Mertens Co.	314-993-6600
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OH	Cleveland, Anderson-Bolds, Inc.	216-229-4700
OH	Worthington, Anderson-Bolds Inc.	614-885-3933
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IN	Indianapolis, Liberty Sls.	317-888-8396
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MO	St. Charles, Buckman & Assocs.	314-947-4727
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OH	Richfield, Geotronix	216-659-6100
OR	Portland, McLaren, Inc.	503-297-2248
PA	Allison Pk., Geotronix	412-487-1770
PA	Blue Bell, Comp. for Elctrns.	215-825-3939
TX	Dallas, Dunbar Assocs.	214-239-7151
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IL	O'Fallon, J & J Entprs.	618-632-8221
MA	Lowell, R.G. Assocs.	617-458-9802
MA	Marshfield, R.G. Assocs.	617-837-3290
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NJ	Scotch Plains, Annlectro Tech. Rep., Inc.	201-396-8310
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OR	Portland, Topp Engrg.	503-244-7265
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TX	Houston, Chauvin Engrg. Co.	713-668-4770
TX	Houston, Spectra Sls. Corp.	713-270-8212
TX	Richardson, Spectra Sls. Corp.	214-234-3600
VA	Alexandria, Analectro Tech. Rep., Inc.	703-922-4317
WA	Bellevue, Topp Engrg. Sls. Co.	206-747-5400

Local Distributors

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IL	Arlington Hgts., Coombs & Assocs. ...	312-439-9810
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NY	Hicksville, L-Tronix	516-935-0220
TX	Houston, Prime Tech. Sls.	713-894-4161

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IL	Arlington, Coombs & Assocs.	312-439-9810
MA	Wellesley Hills, Target Elctrns.	617-235-2545
NY	Hicksville, L-Tronix	516-935-0220
OR	Wilsonville, Micro Power	503-694-5353
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Can	Ontario, RD Assocs.	416-444-0959

CALIFORNIA EASTERN LABS. INC., 3260 Jay St, Santa Clara, CA 95054, Tel: 408-988-3500, TELEX: 346393, TWX: 171197; Empl.: 100

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FAX: 619-279-8139

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TX	San Antonio, Data Mktg. Assocs.	512-342-3031
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Can	Ottowa, Ont., A.I.M.	613-722-8286

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CA	San Diego, El Dorado Sls.	619-549-2202
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NC	Raleigh, KZJ Comp.	919-782-8100
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OH	Cleveland, Arthus H. Baier	212-461-6161
OH	Dayton, Arthur H. Baier	513-276-4128
PA	Sellersville, Tech-Com Mktg.	215-453-0711
TX	Dallas, Merino Sls.	214-233-6002
VA	Baltimore, Conroy Sales	301-296-2444
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CA	San Gabriel, Calmark Corp.	818-287-0451
CA	San Jose, Calmark Corp.	408-434-1615
CO	Lakewood, Cristee-Meade	803-232-0287
CT	Bethel, Livera-Polk Assocs. Inc.	203-748-4639
FL	Winter Springs, Sunland Assocs.	305-365-9533
IL	Elk Grove, Parcom Inc.	312-228-6360
KS	Lenexa, Midtec Assocs.	913-541-0505
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MN	Minneapolis, Stan Clothier Co.	612-944-3456
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Madison, Livera-Polk Assocs.	201-377-3220
NY	Cooperstown, Fitzelle Assocs.	607-547-9333
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NC	Matthews, Arthur, Harris & Assocs.	704-845-1085
OH	Miamisburg, Electronics, Inc.	513-866-3340
OH	Rocky River, Electronic Comps.	216-331-5330
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TX	Houston, Zonk & Assocs.	713-579-7777
TX	Richardson, Zonk Assocs.	214-238-7651
WA	Snohomish, LD Elctrns. Inc.	206-568-0511
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CA	Buena Park, Cypress Elctrns.	714-521-5230
CA	Fremont, Terminal Sls. Corp.	415-656-7722
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CO	Denver, Solder Tec.	303-623-5000
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OH Dayton, Shamrock Elex. Sls. 513-258-1727
OR Beaverton, N.R. Schultz Co. 503-643-1644
PA Prospect Pk., Elf Sls. 215-534-3340
RI Cumberland, Intercoastal Comp. Sls. .. 508-584-1880
TX Dallas, D.J. Sls. 214-783-8876,214-783-7319
WA Bellevue, N. R. Schultz Co. 206-454-0300, 206-455-1601
Can Montreal, Que., Shelley Newman 514-486-6984

Local Distributors

AL Huntsville, Component Dist., Inc. 205-883-7501
AZ Scottsdale, Horizon Comps., Inc. 602-483-1112
CA Anaheim, Tary Elctrns. 714-630-2464
CA Costa Mesa, P.K.C. 714-556-7007
CA Granada Hills, Acort Inds. 818-700-2991
CA Industry, Ital Elctrns. 818-968-8515
CA Irvine, Kelex Elctrns. 714-863-1230
CA Manhattan Beach, Prime Electro Prods. Co. 213-379-3642
CA San Carlos, Logan Elctrns. 415-594-0700
CA Santa Ana, Vision Elctrns. 714-261-6777
CA Santa Clara, Rancor/RCI 408-986-8990
CA Sunnyvale, PSC, Inc. 408-773-1333
CO Denver, Component Dist., Inc. 303-799-4916
CT Bridgeport, Park Dists. 203-366-7200
CT Wallingford, Midstate Elctrns. 203-265-9900
FL Clearwater, Component Dist., Inc. 813-796-0466
FL Longwood, Intertec Comps. Inc. 305-834-7777
GA Smyrna, ERC Parts Inc. 404-352-1626
HI Honolulu, Integrated Circuit Supp. 808-839-1966
IL Addison, Belford Elctrns. 800-323-1231
IL Lisle, Components, Inc. 312-852-7707
IL Northbrook, Classic Comp. Supp. 312-272-9650
MD Jessup, Treeko Sls., Inc. 301-937-8260
MA Canton, EPC Elctrns. 617-821-2111
MA Lowell, Pilgrim Elctrns. 617-454-9889
MA Marlborough, Hardware Specialty Co. 617-481-8622
MA N. Adams, Shine Elctrns. 413-664-9933
MA Newton, In-Stock Prods. 617-870-5750
MI Livonia, LWC Dists. 313-464-7700
MN Eden Prairie, Custom Computer Cable 612-941-5651
MN New Brighton, Parts One 612-633-8079
NH Hudson, Interconnect of N.E. 603-883-1515
NH Londonderry, Comps. North 603-437-5845
NH Nashua, Brevan Elctrns. 603-889-7230
OR Woodburn, Contech 503-981-3807
PA Essington, Tri-Com 215-521-3080
RI Warwick, ARC Elctrns. 401-732-4038
TN Nashville, Randolph & Rice 615-255-5601
TX Dallas, EDC 214-257-0322

CARSON MANUFACTURING CO., INC., 5453 N. Rural St., P.O. Box 20464, Indianapolis, IN 46220, Tel: 317-257-3191, FAX: 317-254-2667; Empl.: 85

CARTER MANUFACTURING CORPORATION, 237 Sugar Road, Bolton, MA 01740, Tel: 508-779-5501, FAX: 508-779-6166; FSC No.: 03929; Empl.: 30; *Sls. Mgr.:* Leo T. Nichols, VP Sls.

CARTER MOTOR, 400 Stagecoach Trail, Warren, IL 61087-0647, Tel: 815-745-2100, FAX: 815-745-2135; *Sls. Mgr.:* John W. Smith III

CASEMAKER, Stebco Industries, Inc., 1020 West 40th Street, Chicago, IL 60609, Tel: 312-254-1221, TWX: 910-221-2470, FAX: 312-254-4030; FSC No.: 36-2405334; Empl.: 25; *Sls. Mgr.:* Allen E. Terman

CASSO-SOLAR, P.O. Box 163, U.S. Route 202, Pomona, NY 10970, Tel: 914-354-2500, TELEX: 475-4099, FAX: 914-362-1856; Empl.: 50; *Sls. Mgr.:* T. Corl

CATALYST RESEARCH
A DIVISION OF MINE SAFETY APPLIANCES COMPANY

FAX: 301-321-9584

CATALYST RESEARCH, Mine Safety Appliances Co., Inc., 1421 Clarkview Rd., Baltimore, MD 21209, Tel: 301-296-7000, Ext. 304, TELEX: 898095; FSC No.: 00681; Empl.: 400; *Sls. Mgr.:* Edward S. Hatch, Jr.; *Dist. Mgr.:* Edward S. Hatch, Jr. ..... **D•1459-1472**

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg. 205-830-0498
CA Los Angeles, Power Partners 213-215-0800
CA San Diego, Power Partners 800-468-5400
CA San Jose, M.T.S.R.& Co. 408-288-8862
CA Santa Barbara, Power Partners 800-468-5400
FL Brandon, R.C.Simon & Co. 813-689-6524
FL Lighthouse Point, R. C. Simon & Co. .. 305-941-2757
GA Norcross, Montgomery Mktg. 404-447-6124
IL Palatine, T-Squared Assocs. 312-991-2144
KS Overland Pk., Electri-Rep 913-649-2168
MA Burlington, Anacon Sls. Assocs., Inc. .. 617-272-9080
MI Farmington Hills, W. R. Hummon & Assoc. Inc. 313-474-0661
MN Minneapolis, Hei-Lite Sls. 612-861-6051
MO St. Louis, Electri-Rep 314-993-4421
NJ Springfield, F.F. Sylvester Assocs. 201-376-3324
NC Cary, Montgomery Mktg. 919-467-6319
OH Dayton, J. C. Hofstetter Co. 513-296-1010
OH Medina, J. C. Hofstetter Co. 216-241-4880
OR Hillsboro, TAC Assocs. 803-648-6110
PA Hickory, J.C.Hofstetter 412-356-2305
NC Raleigh, Montgomery Mktg. 919-851-0010
VA Richmond, Glasscock Assocs. 804-740-0063
WI Milwaukee, Key Entprs., Inc. 414-453-9462

Local Distributors

MD Savage, Pyttronic 301-792-0780

CATEL TELECOMMUNICATIONS, 4050 Technology Pl., Fremont, CA 94537, Tel: 415-659-8988, TWX: 910-338-2263; Empl.: 150

CATON

FAX: 617-585-2973

CATON CONNECTOR CORP., Jones River Indl. Pk., 20 Wapping Rd., Kingston, MA 02364, Tel: 617-585-4315; FSC No.: 52196; Emp.: 28; *Sls. Mgr.:* D. Galambos ..... **C•1300-1304**

Local Sales Offices & Reps

CA Tarzana, High Voltage Sls. 818-881-9194
FL Altamonte Springs, Krebs Myton & Assoc. 305-788-9333
IL Carol Stream, Chemistry, Ltd. 312-690-1736
MA Tewksbury, Sequal Assocs. 617-851-4010
NM Albuquerque, Westfahl & Assocs. 505-881-0995
NY Glen Head, Livera Polk 516-759-9300
OH Cincinnati, Delta Sales 513-271-5444
OR Portland, SPS Elctrns. 503-297-6919
PA Trevose, PSA, Inc. 215-245-0513
TX Plano, Zeus Engrg. 214-423-2027
WA Redmond, SPS ELctrns. 206-323-4140
Can Thornhill, Ont., RFQ, Ltd. 416-881-1976

CITIZEN

FAX: 213-828-0846

CBM AMERICA CORP., 2020 Santa Monica Blvd. Ste. 410, Santa Monica, CA 90404, Tel: 213-828-8245, TELEX: 182508; Empl.: 20; *Dist. Mgr.:* Robin Pierce ..... **D•1082-1083**

Local Distributors

CA Los Angeles, MFI 213-826-8133
IL Chicago, Micro Business Elec. 312-539-2994
NY Hewlett, Metropolitan Sls. 516-599-7900
OH Centerville, IPD 513-433-2800
TX Dallas, R Squared Elctrns. 214-406-1117
Can Toronto, Ont., TLS 416-479-1911

CCD IMAGING, Fairchild Weston Systems, Inc., 1801 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-433-2500; *Sls. Mgr.:* Jim Johnson

C-COR ELCTRNS., 60 Decibel Rd., State College, PA 16801, Tel: 814-238-2461, TWX: 510-670-3513; FSC No.: 12775; Empl.: 650; *Sls. Mgr.:* J. Hastings

CDRL DATA, INC., 21642 North 9th Ave., Suite 103, Phoenix, AZ 85027-2823, Tel: 602-582-8844, FAX: 602-582-2199; FSC No.: 56060; Empl.: 25; *Sls. Mgr.:* James J. Edwards

CDS - COLORADO DATA SYS., 3301 W. Hampden, Unit C, Englewood, CO 80110, Tel: 303-762-1640, 800-CDS-ATE1, TWX: 910-933-0193, FAX: 303-781-0253; Empl.: 80; *Sls. Mgr.:* Bob Frodoe

CEAG ELECTRIC CORP., 1324 Motor Pkwy., Hauppauge, NY 11788, Tel: 516-582-4422, FAX: 516-582-4922; FSC No.: 57973; Empl.: 200; *Sls. Mgr.:* Lois Meyer

CEC, 330 W. Taft Ave., Orange, CA 92665, Tel: 714-637-2970; Empl.: 50

CEC INSTRUMENTS, Imo Industries Inc., 955 Overland Ct., San Dimas, CA 91773, Tel: 714-394-4481, TELEX: 200445 RCA, FAX: 818-351-0557; Empl.: 200; *Sls. Mgr.:* Lon Acheson

CELCO, 70 Constantine Dr., Mahwah, NJ 07430, Tel: 201-327-1123, TWX: 710-988-1018; FSC No.: 05954; Empl.: 25; *Sls. Mgr.:* P. S. Christaldi

CELESCO TRANSDUCER PRODS., INC., 7800 Deering Ave., Canoga Pk., CA 91304-5005, Tel: 818-884-6860, TELEX: 499-8137; *Sls. Mgr.:* Bart Gudmundson

CELESTION INDUSTRIES, INC., 89 Doug Brown Way, Holliston, MA 01746, Tel: 508-429-6706, TELEX: 948417, FAX: 508-429-2426; *Sls. Mgr.:* Barry Fox

CELL-CON INCORPORATED

FAX: 215-363-8719

CELL-CON, INC., 305 Commerce Dr., Exton, PA 19341, Tel: 215-363-8552; Empl.: 14; *Sls. Mgr.:* Gene Kiley ..... **D•1473**

CENTECH CORPORATION, 200 W. 88th St., Minneapolis, MN 55420, Tel: 612-881-8245, TWX: 431-0015-L8M, FAX: 612-881-4137; *Sls. Mgr.:* Norton G. Saude

CENTENT CO., 3879 S. Main St., Santa Ana, CA 92707, Tel: 714-979-6491; Empl.: 12; *Sls. Mgr.:* A. Freimanis

CENTRALAB, See Mepco/Centralab

CENTRAL DATA CORP., 1602 Newton Dr., Champaign, IL 61821, Tel: 217-359-8010, FAX: 217-359-6904; Empl.: 60; *Sls. Mgr.:* Earl Jacobson; *Dist. Mgr.:* Steve Nagele

CENTRONIC, INC., Morgan Crucible Co., Electronics Div., 1829 B DeHavilland Dr., Dept. E , Newbury Park, CA 91320-1702, Tel: 805-499-5902, FAX: 805-499-7770; FSC No.: 63334; Empl.: 20; *Sls. Mgr.:* George Pankau; *Dist. Mgr.:* Lou McCall

C.E. PRECISION ASSEMBLIES, INC., 101 S. McKemy Ave., Chandler, AZ 85226, Tel: 602-940-0740, FAX: 602-961-4754; FSC No.: 67810; Empl.: 10; *Sls. Mgr.:* Henry Richards

CERAMASEAL, Box 260, New Lebanon, NY 12125, Tel: 518-794-7800, TELEX: 14-5442, FAX: 518-794-8080; FSC No.: 07601; Empl.: 89; *Sls. Mgr.:* Gene D. Sawin

Local Sales Offices & Reps

AL	Huntsville, Physimetrics	205-553-7591
AZ	Phoenix, J. F. Hurlbut Co.	602-952-9497
CO	Golden, J. F. Hurlbut Co.	303-279-7796
FL	Orlando, Physimetrics	407-894-8081
GA	Atlanta, Physimetrics	404-955-0155
IL	Downers Grove, Physics Equip.	312-810-9414
IL	Mt. Prospect, Automation Equip. Co.	312-398-7550
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Baltimore, R. A. Wafer Assoc.	301-744-1133
MA	Boston, P-J Engrg. Sls.	617-783-0510
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Piscataway, Eastern Metro Assocs.	201-752-9292
NY	Farmington, R.M. Scanlon Assoc.	716-924-7450
NY	Plainview, Eastern Metro Assocs.	516-931-1414
NY	Syracuse, R.M. Scanlon Assoc.	315-437-1271
NY	W. Hempstead, Eastern Metro Assocs.	516-292-1131
NC	Charlotte, JWL Assoc.	704-541-5750
PA	Clairton, Kurt J. Lesker Co.	412-233-4200
PA	Feasterville, Knowles Assocs.	215-322-7100
TN	Knoxville, Physimetrics	615-966-7553
TX	Richardson, Spectra Sls.	214-234-3600
UT	Salt Lake City, J. F. Hurlbut	801-595-8818
WA	Seattle, J.J. Assocs.	206-246-6619

CERAMAWIRE, Box 1084, Cranford, NJ 07016, Tel: 201-276-1170; Empl.: 4; *Sls. Mgr.:* Edward Hamilton

CERAMIC DEVICES INC., 8145 Ronson Rd., San Diego, CA 92111, Tel: 619-560-7575, FAX: 619-560-4906; Empl.: 40; *Sls. Mgr.:* Linda Parrish

CERAMIC MAGNETICS, INC., 87 Fairfield Rd., Fairfield, NJ 07006, Tel: 201-227-4222, TELEX: 138 730, FAX: 201-227-6735; Empl.: 90

CERA-MITE CORP., 1327 Sixth Ave., Grafton, WI 53024, Tel: 414-377-3500, TELEX: 62916271, FAX: 414-377-7309; Empl.: 215; *Sls. Mgr.:* Claude Marquardt

CERMETEK MICROELECTRONICS INC., 1308 Borregas Ave., Sunnyvale, CA 94088-3565, Tel: 408-752-5000, TWX: 910-379-6931, FAX: 408-752-5004; Empl.: 50; *Sls. Mgr.:* Gilbert Chacon

C.G. INSTRUMENTS, 434 Windsor Pk. Dr., Dayton, OH 45459, Tel: 513-434-7643, FAX: 513-434-7643; Empl.: 5; *Sls. Mgr.:* Dale K. Mann

CGRS MICROTECH, P.O. Box 102L, Langhorne, PA 19047, Tel: 215-757-0284; Empl.: 5; *Sls. Mgr.:* J. Swope; *Dist. Mgr.:* J. Swope

CGTI, 2 Windward Ave., White Plains, NY 10605, Tel: 914-949-3719, TWX: 710-568-1305; Empl.: 170; *Sls. Mgr.:* G. N. Snider

CHABIN CORP., 890 Fortress St., Chico, CA 95926, Tel: 916-891-6410, TWX: 910-536-1001; *Sls. Mgr.:* Peter Tunis

CHACE PRECISION METALS, INC., 1704 Barnes St., Reidsville, NC 27320, Tel: 918-342-2381, FAX: 919-342-4012; Empl.: 170; *Sls. Mgr.:* Pat J. Urban

CHA INDUSTRIES, 3565 Haven Avenue, Menlo Park, CA 94025, Tel: 415-363-8011, TELEX: 334426, FAX: 415-363-8061; *Sls. Mgr.:* Jack Patten

CHALCO ENGRG. CORP., Chalco Industries, Inc., 15126 S. Broadway, Gardena, CA 90248-1898, Tel: 213-321-0121, 213-323-5525, TWX: 910-346-7026, FAX: 213-323-0405; Empl.: 95; *Sls. Mgr.:* Steven Kierman, Dir. Sls.

Champion Technologies, Inc.

FAX: 312-451-7585

CHAMPION TECHNOLOGIES, INC., 2553 N. Edgington, Franklin Park, IL 60131, Tel: 312-451-1000, TELEX: 4880104, ESYLNK: 62931824; Empl.: 175; *Sls. Mgr.:* John Keilman ..... **A•1360**

Local Sales Offices & Reps

FL	Clearwater Bch., Perrott Assocs.	813-443-8414
FL	Orlando, Perrott Assocs.	407-288-7748
FL	Orlando, Perrott Assocs.	305-298-7748
GA	Duluth, Advanced Components Mktg.	404-447-5499
IN	Fort Wayne, R. O. Whitesell	219-432-5591
IN	Indianapolis, R. O. Whitesell	317-359-9283
IA	Cedar Rapids, R. F. Welert Co.	319-377-1575
MD	Glen Burnie, Third Wave Solutions	301-787-0220
MA	Natick, Wayland Engrg. Sls.	617-655-6080
MI	Southfield, R. O. Whitesell Assoc.	313-559-5454
MI	St. Joseph, R. O. Whitesell Assoc.	616-983-7337
MN	Minneapolis, Microelectronics Sls.	612-829-0948
MO	St. Louis, Abrams Assoc.	314-569-0447
NY	Great Neck, Trionic Assoc.	516-466-2300
NY	Rochester, Ossmann Comp. Sls.	716-442-4460
NY	Syracuse, Ossmann Comp. Sls.	315-437-7052
NC	Charlotte, Quantum Mktg.	704-365-4538
OH	Cincinnati, R. O. Whitesell	513-521-2290
OH	Cleveland, R.O. Whitesell & Assoc.	216-447-9020
OH	Columbus, R. O. Whitesell	614-888-9396
OH	Dayton, R. O. Whitesell	513-298-9546
OK	Tulsa, H. J. Daly Co.	918-494-7711
OR	Tigard, Elctrn. Sources	503-684-0040
PA	Glenside, Koebert Assoc.	215-887-2310
PA	Pittsburgh, R. O. Whitesell	412-963-6161
TX	Austin, Electra Reps.	512-339-1163
TX	Dallas, Electra Reps.	214-248-3852
UT	West Valley City, Thorson Co.	801-973-7969
WA	Bellevue, Electronic Sources	206-451-3500
WI	Milwaukee, KMA Sls. & Co.	414-259-1771
EXP	IL, Franklin Pk., Motorola	312-451-1000

Local Distributors

AL	Huntsville, Hallmark Elctrns.	205-837-8700
AL	Huntsville, Pioneer Elctrns.	205-837-9300
AZ	Phoenix, Hallmark Elctrns.	602-437-1200
AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tempe, Western Microtechnlg.	602-948-4240
CA	Canoga Pk., Hallmark Elctrns.	818-716-7300
CA	Cupertino, Western Microtechnlg.	408-725-1660
CA	Garden Grove, Bell Inds.	714-220-0681
CA	Gardena, Bell Inds.	213-515-1800
CA	Reseda, Jan Dvcs.	818-708-1100
CA	Roseville, Bell Inds.	916-969-3100
CA	San Diego, Hallmark Elctrns.	619-268-1201
CA	San Jose, Hallmark Elctrns.	408-946-0900
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Thousand Oaks, Bell Inds.	805-499-6821
CA	Torrance, Hallmark Elctrns.	213-217-8410
CA	Tustin, Hallmark Elctrns.	714-669-0662
CO	Englewood, Hallmark Elctrns.	303-790-1662
CO	Wheatridge, Bell Inds.	303-424-1985
CT	Norwalk, Pioneer Elctrns.	203-853-1515
CT	Wallingford, Hallmark Elctrns.	203-269-0100
FL	Altamonte Springs, Pioneer Elctrns.	305-834-9090
FL	Clearwater, Hallmark Elctrns.	305-428-8877
FL	Ft. Lauderdale, Pioneer Elctrns.	305-771-9280
FL	Orlando, Hallmark Elctrns.	305-855-4020
FL	Pompano Bch., Hallmark Elctrns.	305-971-9280
GA	Norcross, Hallmark Elctrns.	404-447-8000
GA	Norcross, Pioneer Elctrns.	404-448-1711
IL	Elk Grove VL, Bell Inds.	312-640-1910
IL	Elk Grove VL, Pioneer Elctrns.	312-437-9680
IL	Wooddale, Hallmark Elctrns.	312-860-3800
IN	Indianapolis, Bell/Graham	317-634-8202
IN	Indianapolis, Pioneer Elctrns.	317-849-7300
KS	Lenexa, Hallmark Elctrns.	913-888-4747
MD	Columbia, Hallmark Elctrns.	301-988-9800
MD	Gaithersburg, Pioneer Elctrns.	301-921-0660
MA	Billerca, Hallmark Elctrns.	617-935-9777
MA	Lexington, Pioneer Elctrns.	617-861-9200
MI	Livonia, Pioneer Elctrns.	313-525-1800
MN	Bloomington, Hallmark Elctrns.	612-854-3223
MN	Minnetonka, Pioneer Elctrns.	612-935-5444
MO	Earth City, Hallmark Elctrns.	314-291-5350
NJ	Cherry Hill, Hallmark Elctrns.	609-424-7300
NJ	Fairfield, Hallmark Elctrns.	201-575-4415
NJ	Pinebrook, Pioneer Elctrns.	201-575-3510
NM	Albuquerque, Alliance Elctrns.	505-292-3360
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Bayshore, Brookdale Elctrns.	516-242-8033
NY	Fairport, Pioneer Elctrns.	716-381-7070
NY	Ronkonkoma, Hallmark Elctrns.	516-737-0600
NY	Vestal, Pioneer Elctrns.	607-748-8211
NY	Woodbury, Pioneer Elctrns.	516-921-8700
NC	Charlotte, Pioneer Elctrns.	704-527-8188
NC	Raleigh, Hallmark Elctrns.	919-872-0712
OH	Cincinnati, Stotts-Friedman Co.	513-574-7701
OH	Cleveland, Pioneer Elctrns.	216-587-3600
OH	Dayton, Bell Inds.	513-434-8231
OH	Dayton, Pioneer Elctrns.	513-236-9900
OH	Dayton, Stotts-Friedman Co.	513-298-5555
OH	Solon, Hallmark Elctrns.	216-349-4632
OH	Westerville, Hallmark Elctrns.	614-891-4555
OK	Tulsa, Hallmark Elctrns.	918-665-3200
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Horsham, Pioneer Elctrns.	215-674-4000
PA	Pittsburgh, Pioneer Elctrns.	412-782-2300
TX	Austin, Hallmark Elctrns.	512-258-8848
TX	Austin, Pioneer Elctrns.	512-835-4000
TX	Dallas, Hallmark Elctrns.	214-343-5037
TX	Dallas, Pioneer Elctrns.	214-386-7300
TX	Houston, Hallmark Elctrns.	713-781-6100
TX	Houston, Pioneer Elctrns.	713-988-5555
UT	Salt Lake City, Bell Inds.	801-972-6969

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CHANNEL INDUSTRIES, 839 Ward Dr., Santa Barbara, CA 93111, Tel: 805-967-0171, TELEX: 658416, FAX: 805-683-3420; Empl.: 75

CHANNEL MICROWAVE, TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, Scotland DD2 1TY, Tel: 44-382-561509, TELEX: 76266, FAX: 44-382-562643; Empl.: 30

CHAPMAN CORP., P.O. Box 10700, 125 Presumpscot St, Portland, ME 04104, Tel: 207-773-4726, TELEX: 493 1536 CHAP UI, FAX: 207-775-7369; Empl.: 42; *Sls. Mgr.:* David Hall

CHARLES RIVER DATA SYSTEMS, INC., 983 Concord St., Framingham, MA 01701, Tel: 508-626-1000, TELEX: 681-7373, FAX: 508-626-1046; Empl.: 170; *Sls. Mgr.:* David Greer; *Dist. Mgr.:* David Greer

CHASSIS-TRAK, See General Devices

CHATHAM CONTROLS, 33 River Rd., Chatham, NJ 07928, Tel: 201-635-8892; FSC No.: 04814; Empl.: 11

CHATSWORTH DATA CORPORATION, 20710 Lassen St., Chatsworth, CA 91311, Tel: 818-341-9200; Empl.: 65; *Sls. Mgr.:* Hank Boehm ..... **D•1232**

CHAUVIN ARNOUX, Chauvin Arnoux-France, 5 Faraday Dr., Dover, NH 03820, Tel: 603-749-6434, FAX: 603-742-2346

CHEMREX INC., ResTech Prods. Div., 6120 E. 58th Ave., Commerce City, CO 80022, Tel: 303-289-5651, FAX: 303-289-5283; *Sls. Mgr.:* Michael P. Manegold

CHEMTRONICS INC., 681 Old Willets Path, Hauppauge, NY 11788, Tel: 516-582-3322, 800-645-5244, TELEX: 968567, FAX: 516-582-3046; FSC No.: 21267; Empl.: 112; *Sls. Mgr.:* Louis Friedman; *Dist. Mgr.:* Scott Friedman

CHENANGO INDUSTRIES, INC., 200 Stage Road, Vestal, NY 13850, Tel: 607-748-1572, TWX: 510-252-0899, FAX: 717-879-4220; *Sls. Mgr.:* Rick Hammond

FAX: 714-838-4742

CHEROKEE INTERNATIONAL, INC., Core Industries, 2841 Dow Avenue, Tustin, CA 92680-7211, Tel: 714-544-6665, TWX: 510-101-0493; Empl.: 350; *Sls. Mgr.:* Lonnie Friend ..... **D•1674-1679**

Local Sales Offices & Reps

CA Santa Clara, Cindel, Inc. 408-988-8331
CO Longmont, Butler Tech. Sls. 303-651-7703
FL Boca Raton, Naylor Assoc. 407-482-5649
AL Huntsville, Naylor Assoc. 205-882-0068
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Local Sales Offices & Reps

AL	Huntsville, Advanced Comps. Mktg.	205-881-5493,
CA	Valencia, C&N and Assocs.	805-254-5844
FL	Boca Raton, Sales Specialists	305-395-5371
FL	Largo, Sales Specialists	813-530-5545
GA	Doraville, Advanced Comps. Mktg.	404-448-7025,
IL	Chicago, Berndt Assoc.	312-283-0713
IN	Carmel, Berndt Assoc.	317-884-0114
MA	Bolton, Key Sales Assocs.	617-779-2780
MI	Royal Oak, Hilltronics	313-435-0920,
MN	Minneapolis, H.M.R.	612-920-8200
MO	Bridgeton, Cen Tech, Inc.	314-291-4230
MO	Raytown, Cen Tech, Inc.	816-358-8100
OH	Richfield, Geotronix	216-659-6100
OH	Trotwood, Geotronix Inc.	513-854-5939
PA	Allison Park, Geotronics, Inc.	412-487-1770
PA	Newtown Square, W. Reeves Assoc.	215-356-7500
TX	Dallas, J. B. Guenther	214-691-8500
UT	Sandy, GTM Assocs.,Inc.	801-483-4103
WA	Seattle, H. Levinson	206-323-5100
WI	Milwaukee, Berndt Assoc.	414-545-8400
EXP	NJ, Oradell, Sylvan Ginsbury	201-261-3200

Local Distributors

CA	Culver City, EV Roberts	213-870-9561
CA	Hayward, KEA Elctrns.	415-887-2900
CA	Laguna Hills, Opto Plus	714-380-8654
CA	San Carlos, Control Design Supp.,Inc.	408-996-9197
CT	Wallingford, Sager Elctrns.	203-265-4600
FL	Miami, Elctrn. Equip.	305-871-3500
IL	Chicago, Bell Indus.	312-982-9210
IN	Indianapolis, Graham Elctrns.	317-634-8486
IN	Indianapolis, Meunier Elec. Supp.	800-638-6437
MD	Rockville, All American Transistor	301-251-1205
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Norwell, Bordewieck Eng. Sls.	617-659-4915
MI	Ann Arbor, Wedemeyer Elctrn.	313-665-8611
MN	Minneapolis, Stark Elctrns.	612-332-1325
MO	St. Louis, Van Sickle Radio Elect.	314-621-5000
NJ	Mt. Laurel, D.F. Assocs.	609-234-5324
NY	Buffalo, Summit Distr.	716-884-3450
OH	Columbus, Hughes Peters	614-294-5351
OK	Tulsa, Altair	918-665-0523
TX	Houston, Altair	713-462-2410
TX	Richardson, Altair	214-231-5166
WA	Seattle, Radar Elec.	206-282-2511
Can	Willowdale, Ont., Electro Sonic	416-494-1666

GENERAL INSTRUMENT

FAX: 312-262-7819

C.P. CLARE CORP., 3101 W. Pratt Blvd., Chicago, IL 60645, Tel: 312-262-7700, TELEX: 210075; Empl.: 2400; *Sls. Mgr.:* Dermot Brereton; *Dist. Mgr.:* Dermot Brereton ..... **B•1410, 1442-1443**

Local Sales Offices & Reps

AL	Huntsville, Electramark Assocs.	205-830-4400
AZ	Scottsdale, Summit Sls.	602-998-4850
CA	El Toro, Gen. Instr., Clare Div.	714-586-0650
CA	Los Angeles, Reed Elctrn. Mktg.	213-598-6676
CA	San Diego, Gary Chilcote Assocs.	619-728-7678
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
CO	Broomfield, Western Region Mktg.	303-469-8088
CT	Waterbury, ConnTech-Ranan	203-754-2823
FL	Altamonte Springs, Sls. Engrg. Concepts	407-682-4800
FL	Deerfield Beach, Sls. Engrg. Concepts	305-427-7338
FL	Tampa, Sls. Engrg. Concepts	813-854-2859
GA	Norcross, Electramark	404-446-7915
IN	Indianapolis, Schank Elctrn. Mktg.	317-842-6204
IA	Cedar Rapids, Lorenz Sls. Inc.	319-377-4666
KS	Merriam, Lorenz Sls. Inc.	913-384-6556
MD	Randallstown, Beacon North Inc.	703-478-2480
MA	Needham Heights, Kanan Assocs.	617-449-7400
MI	Troy, Schank Elctrn. Mktg.	313-588-2040
MN	Eden Prairie, High Technlg. Sls. Assocs.	612-944-7274
MO	St. Louis, Lorenz Sls.	314-997-4558
NE	Lincoln, Lorenz Sls.	402-475-4660
NJ	Palisades Park, Janco Technlg.	201-941-4008
NY	Hicksville, General Instr., Clare Div.	516-933-3645
NY	Rochester, Electra Sls. Corp.	716-427-7860
NY	Syracuse, Electra Sls. Corp.	315-463-1248
NC	Raleigh, Zucker Assocs.	919-782-8433
OH	Cleveland, Baehr, Greenleaf & Assoc.	216-892-1770
OH	Dayton, Baehr-Greenleaf & Assocs.	513-439-0724
OR	Portland, Westmark Elctrns. Inc.	503-641-8780
PA	Erdenheim, Omni Sls.	215-233-4600
PA	Evans City, Baehr-Greenleaf & Assocs.	412-776-2151
TX	Dallas, Electra Reps	214-248-3852
TX	Houston, Electra Reps	512-339-1163
UT	Salt Lake City, Western Region Mktg.	801-486-1646
VA	Sterling, Beacon North, Inc.	703-478-2480
WA	Seattle, Westmark Elctrns. Inc.	206-281-4025
Can	Toronto, Ont., Generl Instr. Of Can., Ltd.	416-789-7831

CLARKE-HESS COMMUNICATIONS RESEARCH CORP., 220 West 19th St., New York, NY 10011, Tel: 212-255-2940, TELEX: 238667-RAPID NYK, FAX: 212-675-2451; FSC No.: 34423; Empl.: 14 ..... **D•1234-1235**

Local Sales Offices & Reps

AL	Huntsville, Teqspec	205-883-6699
CT	Manchester, ICS Assocs.	203-649-3765
FL	Cocoa Bch., Teqspec	305-783-3444
FL	Palm Harbor, Teqspec	813-785-2276
GA	Norcross, Teqspec	404-242-7215
GA	Snellville, Teqspec	404-972-7955
IL	Chicago, Pat Lind Elctrns.	312-726-3513
IN	Indianapolis, Pat Lind Elctrns.	317-632-7444
MA	Westford, ICS Assocs.	617-692-3545
MN	Circle Pines, Pat Lind Elctrns.	612-786-5770
NC	Winston-Salem, Teqspec	919-765-5553
OR	Wilsonville, Syntek	503-682-2750
TX	Houston, Scientific Sls.	713-645-6218
TX	Richardson, Scientific Sls.	214-231-6541
WI	Milwaukee, Pat Lind Elctrns.	414-224-0146

HAWKER CLAROSTAT

FAX: 603-742-0481

CLAROSTAT MFG. CO., INC., Hawker Siddeley, PLC., 3 Washington St., Dover, NH 03820, Tel: 603-742-1120,800-872-0042, TELEX: MCI 6713344; FSC No.: 12697; Empl.: 600; *Sls. Mgr.:* Al Pepin (OEM); *Dist. Mgr.:* Al Tapscott ..... **A•1918-1919, 2088-2091; B•1009, 1940-1941**

Local Sales Offices & Reps

AZ	Phoenix, More Sls.	602-265-9201
AR	Little Rock, J. Y. Schoonmaker	501-375-2168
CA	Costa Mesa, Gravley & Assoc. Inc.	714-852-9994
CA	Los Altos, Ewing-Foley	415-941-4525
CO	Englewood, Delltron Co.	303-741-2122
CT	Weston, Northeast Reps.	203-239-2507
FL	Pompano Beach, HHP Assocs., Inc.	305-971-5750
FL	Winter Park, HHP Assocs., Inc.	305-740-0320
GA	Atlanta, Millar Elctrns.	404-634-3350
IL	Rolling Meadows, Sumer, Inc.	312-991-8500
IN	Fort Wayne, Needler Sls.	219-447-2123
IN	Indianapolis, Needler Sls.	317-255-8056
NH	Home Off., Clarostat	603-742-1120, 1-800-872-0042
NY	Fairport, Leonard D. Allen	716-377-3500
NY	Manhasset, Win-Cor Elctr. Sls.	516-627-9474
NY	Syracuse, L. D. Allen	315-437-8387
NC	Raleigh, Millar Elctrns.	919-828-8840
OH	Dayton, K.W. Elctrn. Sls.	513-890-2150
OH	Shaker Hgts., K.W. Elctrn. Sls.	216-491-9177
OK	Oklahoma City, J. Y. Schoonmaker	214-349-1650
OR	Beaverton, Electronic Sources, Inc.	503-627-0838
PA	Allison Park, K.W. Elctrn. Sls.	412-487-4300
TX	Dallas, J. Y. Schoonmaker	214-349-1650
UT	Sandy, Delltron Co.	801-942-4678
WA	Bellevue, Elctrn. Sources, Inc.	206-451-3500
WI	Brookfield, Sumer	414-784-6641

CLARY CORP., Precision Instrs. Div., 320 W. Clary Ave., San Gabriel, CA 91776, Tel: 818-287-6111, TWX: 910-589-3369, FAX: 818-286-7216; Empl.: 70; *Sls. Mgr.:* Stewart Nowak; *Dist. Mgr.:* Chris Dean

CLAUSS CUTLERY CO., Alco Industries, 223 N. Prospect St., Fremont, OH 43420, Tel: 419-332-7344, FAX: 419-332-8077; Empl.: 90; *Sls. Mgr.:* Thomas D. Reinert; *Dist. Mgr.:* Thomas D. Reinert

CLEAN ROOM PRODS., 1800 Ocean Ave., Ronkonkoma, NY 11779-6528, Tel: 516-588-7000, TELEX: 645151; Empl.: 110; *Sls. Mgr.:* Robert S. Kearton

CLEVELAND CRYSTALS, Box 17157, Euclid, OH 44117, Tel: 216-486-6100, TWX: 810-421-8031, FAX: 216-486-6103; FSC No.: 8K400; Empl.: 46; *Sls. Mgr.:* P. D. Marlowe

CLIFTON PRECISION, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018, Tel: 215-622-1000, TWX: 510-669-9782, FAX: 215-623-6344; FSC No.: 86197; Empl.: 1000; *Sls. Mgr.:* C.Scalles ..... **B•1238**

Local Sales Offices & Reps

AZ	Phoenix, Clifton Precision	602-242-0910
CA	Canoga Pk, Clifton Precision	818-347-0603
CA	Cupertino, Clifton Precision	408-996-7507
CA	Los Gatos, Luscombe Engrg. Co.	408-370-2020,
CA	Ontario, Clifton Precision	714-983-9374
CA	San Clemente, Clifton Precision	714-492-6904
CO	Denver, Motion Technlg.	303-757-3003
FL	Longwood, Boetto Corp.	407-331-1771
MA	W. Newton, Larcom Inc.	617-244-2053
MN	Eden Prairie, PWC, Inc.	612-934-1409
MO	St. Louis, Midwest Meridian	314-878-4441
OR	Tigard, Vantage Corp.	503-620-3280,
PA	Clifton Heights, Eastern Sls.	215-622-1000
TX	Garland, Carey, McMahill & Assocs.	214-681-1414
MI	Grand Rapids, Midwest Meridian	616-698-7391
WA	Bellevue, Vantage Corp.	206-455-3460,

CLIMATRONICS, 140 Wilbur Pl, Bohemia, NY 11716, Tel: 516-567-7300, TELEX: 5101007669; Empl.: 46; *Sls. Mgr.:* David Gilmore

CLIPLITE, See Visual Communications

CLOVER ELCTRNS., INC., 568 Corinth Rd., PO Box 972, Newnan, GA 30264, Tel: 404-251-5323, FAX: 404-251-7542; Empl.: 50; *Sls. Mgr.:* Patricia A. Walker

CML MACARR, A Marine Electric Systems Co., 50 Canal St., P.O. Box 1135, Clifton, NJ 07014-1135, Tel: 201-471-6800, TELEX: 139 039; FSC No.: 00062; Empl.: 100; *Sls. Mgr.:* Gary Mandell ..... **D•1009**

Local Sales Offices & Reps

WI	Prembine, The Winn Agy.	715-324-6129
MI	Detroit, Bill Teplitz Associates	216-439-3265
OH	Cincinatti, Teplitz Assocs.	513-481-1648
OH	Cleveland, Teplitz Assocs.	216-439-3265
Can	Montreal, Metrone	514-483-2323,

CMV SOFTWARE SPECIALISTS INC., 5009 W. 12th St., Sioux Falls, SD 57106, Tel: 605-338-6645

COAST COIL CO., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016, Tel: 213-936-6188, TELEX: 686103 AMI SPACE ASA; FSC No.: 05254; Empl.: 50

COASTCOM, P.O. Box 27068, Concord, CA 94527, Tel: 415-825-7500, TWX: 910-481-5781; FSC No.: 415 682-2015; Empl.: 100; *Sls. Mgr.:* Thomas M. Hresko, Nat'l Dir. Sls.

COAX CONNECTION, 1736 Front St., Yorktown Hgts., NY 10598, Tel: 914-962-2303, 800-431-2103, FAX: 914-962-2296; FSC No.: 13-3289669 ..... **C•1308**

COAXIAL DYNAMICS, 15210 Industrial Parkway, Cleveland, OH 44135, Tel: 1-800-COAXIAL, FAX: 216-267-3142; Empl.: 40; *Sls. Mgr.:* R. J. Scott; *Dist. Mgr.:* J. R. Ittel

COAXITUBE CORP., 245 Naylor Mill Rd., Salisbury, MD 21801, Tel: 301-546-3911, FAX: 301-546-3913; Empl.: 10

COBER ELECTRONICS, 102 Hamilton Ave., Stamford, CT 06902, Tel: 203-327-0003, TWX: 710-474-3371, FAX: 203-359-6319; FSC No.: 28909; Empl.: 100; *Sls. Mgr.:* Saul Haffner

CODAR TECHNOLOGY, INC., 1500 Kansas Ave., Bldg. 2E, Longmont, CO 80501, Tel: 303-776-0472, TELEX: 4947090 Codar, FAX: 303-776-1806; Empl.: 60; *Sls. Mgr.:* D. Mac Donald

CODENOLL TECHNOLOGY CORP., 1086 N. Bwy., Yonkers, NY 10701, Tel: 914-965-6300, TELEX: 646159; Empl.: 104; *Sls. Mgr.:* Paul A. O'Brien; *Dist. Mgr.:* Paul A. O'Brien

CODY ELECTRONICS, INC., 2284-C Ringwood Ave., San Jose, CA 95131, Tel: 408-432-7570, FAX: 408-432-1891; Empl.: 30; *Sls. Mgr.:* Patrick Sargent

COGNITRONICS, 25 Crescent St., Stamford, CT 06906, Tel: 203-327-5307, TWX: 710-474-3523, FAX: 203-327-2002; Empl.: 140; *Sls. Mgr.:* Vincent Harrison

COHERENT COMMUNICATIONS SYS. CORP., 60 Commerce Dr., Hauppauge, NY 11788, Tel: 516-231-1550, TELEX: WUI 96-1439, FAX: 516-231-0018; Empl.: 150; *Sls. Mgr.:* William Hendrix

COHERENT GENERAL, INC., Picker Rd., Sturbridge, MA 01566, Tel: 508-347-2681, TELEX: 95-1806, FAX: 508-347-5134; Empl.: 200; *Sls. Mgr.:* William H. Shiner

COHERENT, INC., P.O. Box 10321, Palo Alto, CA 94303, Tel: 415-493-2111, TELEX: 34-8304, FAX: 415-493-1566; Empl.: 1625; *Sls. Mgr.:* Paul Crosby

COHU, INC., Elctrns. Div., 5755 Kearny Villa Rd., San Diego, CA 92123, Tel: 619-277-6700, TELEX: 910-335-1244, FAX: 619-277-0221; FSC No.: 05157; Empl.: 165; *Sls. Mgr.:* Jeff Tyler

COILCRAFT, 1102 Silver Lake Rd., Cary, IL 60013, Tel: 312-639-2361, TELEX: 216378, TWX: 910-651-2251, FAX: 312-639-2366; Empl.: 1200; *Sls. Mgr.:* Larry Thompson ..... **A•1225-1230**

Local Sales Offices & Reps

AZ	Lake Havasu City, T. J. Mktg.	602-453-3233
CA	San Jose, Westron	408-997-7332
FL	Lauderhill, Innovative Mktg.	305-485-6869
KS	Olathe, Advanced Tech. Sls.	913-782-8702
MA	Braintree, Coilcraft	617-848-9194
MI	Clark Lake, Dick Trull	517-529-9285
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NC	Raleigh, Rick Burns Assoc.	919-876-2224
TX	El Paso, Coilcraft	915-592-7891
VA	Lynchburg, M & S Mfg. Svcs.	801-272-5643
WA	Kirkland, DMI, Inc.	206-823-4798
Can	Oakville, Ont., Haltronics	800-387-7955

COIL-Q CORP., 340 Bronxville Rd., Bronxville, NY 10708, Tel: 914-337-4775; Empl.: 12

COIL WINDING EQUIPMENT CO., R.R. Plaza, P.O. Box 660, Oyster Bay, NY 11771, Tel: 516-922-5660, TELEX: 14-3128, FAX: 516-922-5029; Empl.: 25; *Sls. Mgr.:* Joseph Pizzonia

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COLBER CORP., 26E Buffington St., Irvington, NJ 07111, Tel: 201-371-9500, TWX: 710-995-4416; Empl.: 50; *Sls. Mgr.:* Roberta Bryner ..... **A•1920-1921**

Local Sales Offices & Reps

IN	Fort Wayne, Walter W. Bieberich	219-432-2537
TN	Fairview, Walter W. Bieberich	615-799-0120

COLE HERSEE CO., 20 Old Colony Ave., Boston, MA 02127-2467, Tel: 617-268-2100, TELEX: 94-0901, FAX: 617-268-9490; *Sls. Mgr.:* Wesley L. Peterson

COLE INSTRUMENT CORP

FAX: 714-241-9061

COLE INSTRUMENT CORP., 2650 S. Croddy Way, Santa Ana, CA 92704, Tel: 714-556-3100, TELEX: 678421; FSC No.: 31946; Empl.: 60; *Sls. Mgr.:* P. Hanson ..... **B•1702**

Local Sales Offices & Reps

AL	Huntsville, Brandel-Stephens	205-883-0445,
AZ	Scottsdale, Advent Comps.	602-481-0044
CA	Anaheim, Gabriel & Assocs.	714-666-0660
FL	Deerfield Bch., Brandel-Stephens	305-427-5441,
FL	Orlando, Brandel-Stephens	305-427-5441,
GA	Atlanta, Brandel-Stephens	404-261-7579,
IN	Ft. Wayne, Naunas Sls. Co.	219-432-4792,
MD	Gaithersburg, Carwithen Assocs.	301-921-9545,
MA	Norwood, Tom Maguire & Assocs.	617-551-0500,
MN	Minneapolis, Design Technlg. Inc.	612-424-7605,
MO	St. Louis, Harris & Hanson	314-432-3611
NY	Scottsville, Floring & Assocs., Inc.	716-889-4614,
NC	Greensboro, Brandel-Stephens	919-274-6952,
PA	West Chester, TCA	215-692-6853,
TX	Dallas, Control Components Inc.	214-458-8877

COLLINS AVIONICS DIVISIONS, Rockwell Intl., 400 Collins Rd. NE, Cedar Rapids, IA 52498, Tel: 319-395-1000, TELEX: 464-421, TWX: 910-525-1321; Empl.: 4,325; *Sls. Mgr.:* R.N. Thorpe

Collmer Semiconductor

FAX: 214-233-0481

COLLMER SEMICONDUCTOR, INC., 14368 Proton Rd., Dallas, TX 75244, Tel: 800-527-0251, 214-233-1589, TWX: 910-860-5462; Empl.: 50; *Sls. Mgr.:* Gene Uecker ..... **A•2170-2177; D•1681**

Local Sales Offices & Reps

CA	Playa Del Rey, Corcoran Assocs.	213-823-4589
TX	Dallas, Collmer Semiconductor Inc.	800-527-0251
IL	Des Plaines, Electron Mktg. Corp.	312-298-2330
IN	Ft. Wayne, Arete Sls. Inc.	219-423-1478
IN	Greenwood, Arete Sls. Inc.	317-882-4407
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505
CA	S. Mission Viejo, Collmer Semiconductor Inc.	714-582-2188
MA	N. Burlington, Omni-Rep	617-245-4511
MN	Minneapolis, Loren Green Assocs.	612-571-6666
CA	San Jose, Comtech Mktg.	408-294-5445
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666
NJ	Nutley, Falk-Baker Assocs.	201-661-2430
NY	Clark Mills, KLM Garner	315-853-6126
NY	Pittsford, KLM Garner	716-381-8350
NC	Cary, Tec Rep Svcs., Inc.	919-467-6444
NC	Charlotte, Tec Rep Svcs. Inc.	704-342-3900
OH	Beachwood, Elctrn. Salesmasters	216-831-9555
OR	Portland, Elctrn. Engrg. Sls.	503-639-3978
PA	Hatboro, Electro Rep	215-674-4421
RI	Cumberland, Omni-Rep	401-438-3423
TN	Brentwood, Tec Rep Svcs. Inc.	615-832-0449
CO	Golden, J. F. Hurlbut Co.	303-279-7796
TX	Austin, Barry Sls., Inc.	512-837-3616
TX	Houston, Barry Sls., Inc.	713-784-5860
CT	Madison, Omni-Rep	203-421-4561
FL	Oldsmar, Boggs & Assocs.	813-855-1812
TX	Richardson, Barry Sls., Inc.	214-234-0255
VA	Richmond, Glasscock Assocs.	804-740-0063
FL	W. Palm Bch., Boggs & Assocs.	305-478-8062
WA	Redmond, Elctrn. Engrg. Sls.	206-883-3374
WI	Waukesha, Electron Mktg. Corp.	414-547-1505
GA	Alphretta, Tec Rep Svcs., Inc.	404-594-8973

Local Distributors

IN	Carmel, Altex Elctrns., Inc.	317-848-1323
IL	Chicago, NEP Elctrns., Inc.	312-625-8400

COLORADO CRYSTAL CORP

FAX: 303-667-3500

COLORADO CRYSTAL CORP., 2303 W. 8th St., Loveland, CO 80537, Tel: 303-667-9248; FSC No.: 33096; Empl.: 105; *Sls. Mgr.:* David Lind ..... **A•1361-1363**

Local Sales Offices & Reps

CA	Calabasas, Shel Schreiber Assocs.	818-703-8083
CA	Los Altos, Kolm Mktg. Assoc.	415-948-2635
IA	Cedar Rapids, Barnes Midwest Sls.	319-393-9790
KS	Overland Park, Barnes Midwest Sls.	913-469-9688
MA	Randolph, Bengal	617-961-4120
OR	Beaverton, L. D. Elctrns.	503-649-6177
TX	Austin, Oeler & Menelaides	512-453-0275
TX	Dallas, Oeler & Menelaides	214-361-8876
TX	Houston, Oeler & Menelaides	713-682-7001
WA	Snohomish, L.D. Elctrns.	206-568-0511

COLORADO DATA SYSTEMS, INC., 3301 W. Hampden Ave., Unit C, Englewood, CO 80110, Tel: 303-762-1640, TWX: 910-933-0193, FAX: 303-781-0253; Empl.: 80; *Sls. Mgr.:* Robert L. Frodge

COLORADO VIDEO, INC., Box 928, Boulder, CO 80306, Tel: 303-530-9580, TWX: 910-940-3248, FAX: 303-530-9569; Empl.: 26; *Sls. Mgr.:* N. H. Bennett

COLORGRAPHIC COMMUNICATIONS CORP., New Peachtree Rd., P.O. Box 80448, Atlanta, GA 30366, Tel: 404-455-3921, FAX: 404-458-0616; Empl.: 50; *Sls. Mgr.:* Elyse Mintz

COLT ELECTRONICS CO., INC., 15301 West 109th St., Lenexa, KS 66219, Tel: 913-888-1673, FAX: 913-888-3666; *Sls. Mgr.:* Michael S. Lynn

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COMPUMOTOR CORPORATION, 1179 N. McDowell Blvd., Petaluma, CA 94952, Tel: 707-778-1244

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TX Lewisville, Automated Dynamics 214-221-0052

COMPUTER DEVICES, 34 Linnell Cir., Nutting Lake, MA 01865, Tel: 508-663-4980, TELEX: 949398; Empl.: 30; *Sls. Mgr.:* Sandra R. Clark

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COMPUTER INSTRUMENTS DIV., 100 Madison Ave., Hempstead, NY 11550, Tel: 516-483-8200, TWX: 510-222-4189, FAX: 516-483-8327; Empl.: 50; *Sls. Mgr.:* B. Peskin

COMPUTER MAINTENANCE CORP., 405 Murray Hill Pkwy, East Rutherford, NJ 07073, Tel: 201-896-0707, FAX: 201-896-8503; Empl.: 105; *Sls. Mgr.:* Arthur Young

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COMPUTER PERIPHERALS INC., 667 Rancho Congo Blvd., Newbury Pk., CA 91320, Tel: 805-499-5751, 800-854-7600, TELEX: 759299CPI, FAX: 805-498-8848; Empl.: 100; *Sls. Mgr.:* Davius Antia; *Dist. Mgr.:* Mike Krunic

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AL Huntsville, FM Assocs. 205-882-0689
AZ Xcottsdale, Williams Assocs. 602-947-4297
AR El Dorado, Kemp Engrg. 501-862-5869
CA Santa Clara, Manco 408-496-6611
CO Commerce City, Williams Assocs. 303-289-5647
CT Manchester, J&J Assocs. 203-645-8312
FL Orlando, FM Assocs. 407-851-5710
GA Norcross, FM Assocs. 404-446-0033
IL Park Ridge, Conrardy Co. 312-692-2226
IN Fishers, Carter McCormic & Pierce ... 317-842-9277
IA Des Moines, Beams 515-255-1148
KS Shawnee Mission, The Beams Co. 913-631-0300
LA Chalmette, Power Products Inc. 504-254-0851
MD Linthicum, KD Assocs. 301-859-5151
MD Towson, HL Frey Corp. 301-821-0058
MA Winchester, J&J Assocs. 617-729-5770
MI Farmington Hills, Carter McCormic & Pierce 313-477-7700
MO St. Louis, The Beams Co. 314-434-8448
NM Albuquerque, Williams Assocs. 505-255-1638
NC High Point, FM Assocs. 919-884-3939
OH Berea, Carter McCormic & Pierce 216-826-0400
OH Englewood, Carter McCormic & Pierce 513-836-0951
OK Tulsa, Kemp Engrg. 918-663-4501
OR Portland, Controltex Inc. 503-641-0876
PA Pittsburgh, Carter McCormic & Pierce 412-826-3800
PA Wayne, Mahar Assocs. 215-687-5350
TX Addison, Kemp Engrg. Inc. 214-931-7100
UT Salt Lake City, Williams Assocs. 801-486-6511
VA Richmond, Computer Environmental II 804-264-2528

Local Distributors

AL Hueytown, S&W Minicomputer Inc. 205-491-7777
AK Bethel, Basic Business Svcs. 907-543-3140
AZ Phoenix, Aspen Power Inc. 5602-937-4784
AZ Phoenix, Keystone Electro Sls. 602-995-3005
AR Springdale, Nelson Elec. Supp. Co. 501-751-5471
CA Brisbane, FYE Medical 415-468-1430
CA San Francisco City, Elec. Supp. 415-864-3888
CA San Mateo, Elesco 415-347-7721
CO Commerce City, Waco Elctrns. 303-289-5647
FL Boca Raton, Escom 305-994-4446
FL Miami, Advanced Network Prods. 305-891-2058
FL Miami, Alpeco Intl. 305-592-2985
FL Miami, Power Place 305-885-6746
FL Orlando, Veytec Inc. 305-849-6391
FL St. Petersburg, Comp/Power 813-866-0649
GA Clarkston, Power Place 404-299-1220
GA Tucker, Veytec 404-496-0989
IL Chicago, Thomas Computer 312-647-0880
IL Park Ridge, Condisco 312-692-2226
KS Cimarron, Resources Unltd. 316-855-3244
MD Landover, Generator Sys. Inc. 301-322-4777
NH Londonderry, Power Sys. Dist. 603-434-2371
NJ Eatontown, Syntrex 201-542-1500
NY Hauppauge, Manchester Equip. 516-435-1199
NC Wilkesboro, Interconnect Prods. Svc. .. 919-667-3356
OH Defiance, Northwest Elec. Control 419-782-9479
OR Beaverton, Micro Power Elctrns. 503-626-7086
OR Bellevue, North Coast Elec. 503-281-8888
OR Portland, North Coast Elec. 503-228-5111
PA Camp Hill, Diversified Data 717-761-0670
PA Seneca, Seneca Chemical & Supp. 814-676-1222
RI Newport, AP Sys. 401-847-6472
TN Hendersonville, Indl. Battery 615-525-2941
TN Westmoreland, Radco 615-841-3276
TX Euless, Power Place 817-267-3202
TX Houston, Professional Tool Box 713-789-5215
TX Rockdale, K&K Elctrns. 512-446-3773
TX San Antonio, Computer Room Technlgs. 512-675-3117
TX Stafford, Timers & Controls Inc. 713-240-4610
UT West Valley City, ESP Plus Inc. 801-973-8904
VA Richmond, Chappel Agy. 804-288-3621

COMPUTER PRODUCTS, INC., Measurement & Control Div., 2900 Gateway Dr., Pompano Beach, FL 33069, Tel: 305-974-5500, TELEX: 510-956-9895; Empl.: 170

COMPUTER PRODUCTS™
POWER CONVERSION

FAX: 415-683-6452

COMPUTER PRODUCTS INC., Power Conversion, 3785 Spinnaker Ct., Fremont, CA 94538, Tel: 415-657-9837; FSC No.: 62125; Empl.: 2000; *Sls. Mgr.:* Norm S. Berkowitz, Pres. PCA Sls.; *Dist. Mgr.:* Edward N. Bennett, Dir. Distbn. Opers. ..... **D•1536, 1683-1701**

Local Sales Offices & Reps

AZ Scottsdale, Summit Sls. 602-998-4850
CA Santa Ana, Jones & McGeoy Sls. 714-547-6466
CA Santa Clara, Criterion Sls. 408-988-6300
CO Aurora, Electrodyne 303-695-8903
CT New Milford, Alpha-Omega Sls. 203-354-2923
FL Oviedo, Conley & Assocs. 407-365-3283
IL Itasca, Janus, Inc. 312-250-9650
IN Indianapolis, SAI Mktg. Corp. 317-545-1010
KS Leawood, Dy-tronix, Inc. 913-339-6333
KS Wichita, Dy-tronix, Inc. 316-838-0884
MD Cloumbia, Third Wave Solutions, Inc. 301-290-5990
MA North Reading, Alpha Omega Sls. 508-664-1118
MI Fenton, SAI Mktg. Corp. 313-750-1922
MN Minneapolis, Stan Clothier Co. 612-944-3456
MO Bridgeton, Dy-tronix, Inc. 314-291-4777
NM Albuquerque, Summit Sls. 505-345-5003
NY Binghamton, Empire Tech. Assocs. ... 607-772-0651
NY Rochester, Empire Tech 719-381-8500
NY Skaneaieles, Empire Tech 315-685-5703
NC Raleigh, Zucker Assocs., Inc. 919-782-8433
OH Columbus, SAI Mktg. Corp. 614-451-0778
OH Dayton, SAI Mktg. Corp. 513-435-3181
OH Warrensville Hgts., SAI Mktg. Corp. 216-591-0530
OK Tulsa, Ammon & Rizos 918-749-6116
OR Beaverton, Micro Sls., Inc. 503-645-2841
PA Erdenheim, Omni Sls., Inc. 215-233-4600
TX Austin, Ammon & Rizos 512-454-5131
TX Houston, Ammon & Rizos 713-781-6240
TX Richardson, Ammon & Rizos 214-644-5591
UT Salt Lake City, Electrodyne, Inc. 801-264-8050
WA Bellevue, Micro Sls., Inc. 206-451-0568
WI Waukesha, Janus, Inc. 414-542-7575
Can Etobicoke, Que., Bytewide Mktg., Inc. .. 416-675-1868
Can Ottawa, Ont., Bytewide Mktg. 613-728-0031
Can West Vancouver B.C., Blakewood Elctrns. Sys., Inc. 604-261-8099

Local Distributors

AL Huntsville, Bell Inds. 205-837-1074
AL Huntsville, Marshall Inds. 205-881-9235
AL Huntsville, Schweber Elctrns. 205-895-0480
AZ Phoenix, Marshall Inds. 602-496-0290
AZ Phoenix, Schweber Elctrns. 602-997-4874
AZ Tempe, Anthem 602-966-6600
AZ Tempe, Bell Inds. 602-996-7800
CA Canoga Park, Schweber Elctrns. 818-999-4702
CA Chatsworth, Anthem 818-700-1000
CA Chatsworth, Marshall Inds. 818-407-4100
CA El Monte, Marshall Inds. 818-459-5500
CA Garden Grove, Bell Inds. 714-895-7801
CA Gardena, Bell Inds. 213-515-1800
CA Irvine, Anthem/Lionex 714-768-4444
CA Irvine, Marshall Inds. 714-458-5301
CA Irvine, Schweber Elctrns. 714-863-0200/213-537-4321
CA Los Angeles, Bell Inds. 213-826-6778
CA Milpitas, Marshall Inds. 408-943-4600
CA N. Hollywood, B. J. Wolfe Entprs. 213-877-5518
CA Rocklin, Bell Inds. 916-969-3100
CA Sacramento, Anthem 916-624-9744
CA Sacramento, Schweber Elctrns. 916-929-9732
CA San Diego, Anthem 619-453-9005
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, Marshall Inds. 619-578-9600
CA San Diego, Schweber Elctrns. 619-450-0454
CA San Jose, Anthem 408-295-4200
CA San Jose, B.J. Wolfe Entprs. 408-371-3443
CA San Jose, Schweber Elctrns. 408-432-7171
CA Sunnyvale, Bell Inds. 408-734-8570,408-773-1100
CA Thousand Oaks, Bell Inds. 805-499-6821
CO Englewood, Anthem 303-790-4500
CO Englewood, Schweber Elctrns. 303-799-0258
CO Thornton, Marshall Inds. 303-451-8383
CO Wheat Ridge, Bell Inds. 303-424-1985
CT Meriden, Anthem 203-237-2282
CT Oxford, Schweber Elctrns. 203-264-4700
CT Wallingford, Marshall Inds. 203-265-3822
FL Altamonte Springs, Marshall Inds. 407-767-8585
FL Altamonte Springs, Schweber Elctrns. 407-331-7555
FL Deerfield Bch., Bell Inds. 305-421-1997
FL Ft. Lauderdale, Marshall Inds. 305-977-4880
FL Largo, Bell Inds. 813-541-4434
FL Ovieda, Aztech Elctrns. 407-365-2241
FL Pompano Bch., Schweber Elctrns. 305-977-7511
FL St. Petersburg, Marshall Inds. 813-576-1399
GA Norcross, Bell Inds. 404-662-0923
GA Norcross, Marshall Inds. 404-923-5750
GA Norcross, Schweber Elctrns. 404-449-9170
IL Elk Grove, Bell Inds. 312-640-1910
IL Elk Grove, Schweber Elctrns. 312-364-3750
IL Elk Grove Vl, Anthem 312-640-6066
IL Schaumburg, Marshall Inds. 312-490-0155
IL Urbana, Bell Inds. 217-328-1077
IN Ft. Wayne, Bell Inds. 219-424-3422
IN Indianapolis, Bell Inds. .. 317-875-8200,317-299-5487
IN Indianapolis, Marshall Inds. 317-297-0483
IA Cedar Rapids, Bell Inds. 319-395-0730
IA Cedar Rapids, Schweber Elctrns. 319-373-1417
KS Lexena, Marshall Inds. 913-492-3121
KS Overland Park, Schweber Elctrns. 913-492-2922
MD Columbia, Anthem 301-995-6640
MD Columbia, Aztech Elctrs. 301-995-6800
MD Gaithersburg, Marshall Inds. 301-840-9450
MD Gaithersburg, Schweber Elctrns. 301-840-5900
MA Andover, Bell Inds. 508-474-8880
MA Bedford, Schweber Elctrns. 617-275-5100
MA Wilmington, Anthem 617-657-5170
MA Wilmington, Jaco Elctrns. 617-273-1860
MA Wilmington, Marshall Inds. 617-658-0810
MI Ann Arbor, Bell Inds. 313-971-9093
MI Livonia, LWC Distrs. 313-464-7700
MI Livonia, Marshall Inds. 313-525-5850
MI Livonia, Schweber Elctrns. 313-525-8100
MN Edina, Schweber Elctrns. 612-941-5280
MN Plymouth, Marshall Inds. 612-559-2211
MO Bridgeton, Marshall Inds. 314-291-4650
MO Earth City, Schweber Elctrns. 314-739-0526
NH Hudson, Bell Inds. 603-882-1133
NH Manchester, Schweber Elctrns. 603-625-2250
NJ Fairfield, Anthem 201-227-7960
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Fairfield, Schweber Elctrns. 201-227-7880
NJ Mt. Laurel, Marshall Inds. 609-234-9100
NM Albuquerque, Bell Inds. 505-292-2700
NY Farmingdale, Bell Inds. 516-752-9303
NY Hauppauge, Anthem 516-273-1660
NY Hauppauge, Marshall Inds. 516-273-2424
NY Johnson City, Marshall Inds. 607-798-1611
NY Rochester, Marshall Inds. 716-235-7620
NY Rochester, Schweber Elctrns. 716-424-2222
NY Westbury, Schweber Elctrns. 516-334-7474
NC Raleigh, Century Elctrns. 919-782-2116
NC Raleigh, Marshall Inds. 919-878-9882
NC Raleigh, Schweber Elctrns. 919-876-0000
OH Beachwood, Schweber Elctrns. 216-464-2970
OH Dayton, Bell Inds. 513-434-8231
OH Dayton, Marshall Inds. 513-898-4480
OH Dayton, Schweber Elctrns. 513-439-1800
OH Solon, Marshall Inds. 216-248-1788
OH Westerville, Marshall Inds. 614-891-7581
OK Tulsa, Norvell Elctrns. 918-254-8606
OK Tulsa, Schweber Elctrns. 918-622-8000
OR Beaverton, Almac Elctrns. 503-629-8090
OR Beaverton, Anthem 503-643-1114
OR Beaverton, Marshall Inds. 503-644-5050
OR Lake Oswego, Bell Inds. 503-635-6500
PA Horsham, Anthem 215-443-5150
PA Horsham, Schweber Elctrns. 215-441-0600
PA Norristown, Century Elctrn. Comps. ... 215-631-5400
PA Pittsburg, Schweber Elctrns. 412-963-6804
PA Pittsburgh, Marshall Inds. 412-963-0441
TX Austin, Marshall Inds. 512-837-1991
TX Austin, Norvell Elctrns. 512-837-5555
TX Austin, Schweber Elctrns. 512-339-0088
TX Carrollton, Marshall Inds. 214-233-5200
TX Dallas, Norvell Elctrns. 214-233-0020
TX Dallas, Schweber Elctrns. 214-661-5010
TX Houston, Marshall Inds. 713-895-9200
TX Houston, Norvell Elctrns. 713-777-1666
TX Houston, Schweber Elctrns. 713-784-3600
TX Richardson, Bell Inds. 214-690-0466
UT Salt Lake City, Anthem 801-973-8555
UT Salt Lake City, Bell Inds. 801-255-2477
UT Salt Lake City, Marshall Inds. 801-485-1551
WA Bellevue, Almac Elctrns. 206-643-9992
WA Bellevue, Bell Inds. 206-885-9963

WA Bothell, Marshall Inds. 206-747-9100
WA Redmond, Anthem 206-881-0850
WA Spokane, Almac Elctrns. 509-924-9500
WI New Berlin, Schweber Elctrns. 414-784-9020
WI Waukesha, Bell Inds. 414-547-8879
WI Waukesha, Marshall Inds. 414-797-8400
Can Brampton, Ont., Zentronics 416-451-9600
Can Calgary, Alta., Future Elctrns. 403-235-5325
Can Downsview, Ont., Future Elctrns. 416-638-4771
Can Edmonton, Alta., Future Elctrns. 403-438-2858
Can Montreal, Que., Zentronics 514-737-9700
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Richmond, B.C., Zentronics 604-273-5575
Can Saskatoon, Saskatchewan, Zentronics 306-955-2202
Can Ste. Foy, Que., Future Elctrns. 418-682-5775
Can Vancouver, B.C., Future Elctrns. 604-294-1166
Can Winnipeg, Mani., Future Elctrns. 204-786-7711
Can Winnipeg, Mani., Zentronics 204-694-1957

COMPUTER SYSTEM ASSOCS., 7564 Trade St, San Diego, CA 92121, Tel: 619-566-3911, TELEX: 333693, FAX: 619-566-0581; Empl.: 15; *Sls. Mgr.:* Bill Reed; *Dist. Mgr.:* Bill Reed

COMPUTER SYSTEM PRODUCTS, 14305 21st Ave. N, Minneapolis, MN 55447, Tel: 612-476-6866, 800-422-2537, FAX: 612-476-6966; Empl.: 50; *Sls. Mgr.:* Tom Quanbeck; *Dist. Mgr.:* Tom Quanbeck

COMPUTERWARE, INC., 8480-I Tyco Rd., Vienna, VA 22180, Tel: 703-821-8200, FAX: 703-821-1746; Empl.: 18; *Sls. Mgr.:* John Dargo

COMPUTERWISE, 302 N. Winchester, Olathe, KS 66062, Tel: 913-829-0600, TELEX: 705337, FAX: 913-829-0810; Empl.: 20; *Sls. Mgr.:* William W. Brown; *Dist. Mgr.:* William W. Brown

COMPUTROL:AN AEG CO., 239 Ethan Allen Hwy., Ridgefield, CT 06877, Tel: 203-431-2000, TELEX: 643358, FAX: 203-431-2090; Empl.: 91; *Sls. Mgr.:* C. R. Wolfe

COMPUTRON DISPLAY SYSTEMS, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107, Tel: 818-791-5600, FAX: 818-791-9788; FSC No.: 07126; Empl.: 300; *Sls. Mgr.:* R. Van Horn; *Dist. Mgr.:* Kathy Privett ..... **B•1053**

COMSPEC DIGITAL PRODUCTS INC., 2313 W. Sam Houston Pkwy. N.S. 145, Houston, TX 77043, Tel: 713-461-4487, FAX: 713-461-8846; Empl.: 15; *Sls. Mgr.:* T. A. Paine; *Dist. Mgr.:* T. A. Paine

comstron corporation

FAX: 516-756-1167

COMSTRON CORP., 10 Hub Dr., Melville, NY 11747, Tel: 516-756-1100, TWX: 310-497-3525; Empl.: 120; *Sls. Mgr.:* William J. Meditz ..... **A•1365, 1691; D•1236**

Local Sales Offices & Reps

AL Huntsville, Saber Assoc. 800-327-0853
AZ Phoenix, Odyssey I 602-246-8846
CA Anaheim, Blair Assocs. 714-220-1201
CA Santa Clara, Ward Davis Assocs. 408-245-3700
CA Woodland Hills, Southern CA Tech. Sls. 818-704-9087
CO Denver, Odyssey I 602-246-8846
FL Melbourne, Saber Assocs. 800-327-0853
KS Lenexa, Dytec South 913-888-0215
MD Rockville, Creative Mktg. 301-251-4100
MD Rockville, Creative Mktg. Assocs. 301-251-4100
MN New Hope, Baltz Assocs. 612-546-8520
MO Maryland Hgts., Dytec South 314-739-0665
NJ Teaneck, Sci. Dvcs. East 201-837-1004
NM Albuquerque, Odyssey I 602-246-8846
NY Melville, Carnes Assocs. 516-694-1600
NY Whitney Pt., TAE-Rep 607-692-3705
PA Horsham, Eastern Instrumentation of PA 215-355-7700
PA Springhouse, Eastern Instrumentation of PA 215-355-7700
Can Ottawa, Ont., AIM Elctrns. 613-722-8286

COMTECH MICROWAVE CORP., Comtech Corp., 63 Oser Ave., Hauppauge, NY 11788, Tel: 516-435-4646, TELEX: 221-234 CMTCH; FSC No.: 31196; *Sls. Mgr.:* J. Tardi

COM/TECH SYSTEMS, INC., 10 Halyard Rd., Valley Stream, NY 11581-2813, Tel: 516-791-1175; Empl.: 10

COMTEC INFORMATION SYSTEMS, INC., 53 John St., Cumberland, RI 02864, Tel: 401-724-8500, TWX: 710-387-1171; Empl.: 60; *Sls. Mgr.:* R. A. Hamilton

COM-2, INC., 1556 Woodland Dr., Saline, MI 48176, Tel: 313-429-9027, FAX: 313-429-1902; Empl.: 70; *Sls. Mgr.:* Sande Strieter

CONAP, INC., 1405 Buffalo St., Olean, NY 14760, Tel: 716-372-9650, TWX: 510-245-2769; Empl.: 130

CONCEPT INDUSTRIES, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, Tel: 213-699-0918, 800-255-2666, FAX: 213-692-8947; Empl.: 25; *Sls. Mgr.:* Rosemary Martinez; *Dist. Mgr.:* Kathy Sawyer

CONCORD ELECTRONICS CORPORATION, 30 Great Jones St., New York, NY 10012, Tel: 1-212-777-6571, TWX: 710-581-4930, FAX: 1-212-995-0161; FSC No.: 18310; Empl.: 225; *Sls. Mgr.:* Josie Wheaton ..... **C•1312-1313, 1617**

Local Distributors

AL Huntsville, Century Fasteners 205-883-5344
AZ Tucson, PSN Distrbn. 602-623-9800
AR Little Rock, Carlton-Bates 501-562-9100
CA Mission Hills, Coast Air 818-898-2288
CA San Jose, Bisco 408-996-8420
CO Denver, CSID/Integrated 303-292-5538
CT Danbury, Heilind 208-797-8600
DE New Castle, Electronics Exchange 302-322-5401
FL Sanford, Electronic Fasteners 407-321-4000
GA Norcross, Atlanta Hardware Specialty 404-449-3000
HI AIEA, Newark Elctrns. 808-487-8951
ID Coeurd' Alene, A-I Consolidated 208-765-3280
IL Franklin Park, Bisco 312-451-1230
IN Indianapolis, Mar Elctrns. 317-633-6699
IA Cedar Rapids, Dee Elctrns. 319-365-7551
KS Wichita, RSC Elex 216-267-5213
KY Bowling Green, Crescent Elctrns. 502-842-2444
LA New Orleans, Radio Pts. 504-581-5959
MD Gaithersburg, MS Elctrns. 301-921-0200
MA Billerica, MS Inserts 508-670-5600
MI Farmington Hills, Advent Elctrns. 313-477-1650
MN New Brighton, Chris ELctrns. 612-631-2647
MS Jackson, Newark Elctrns. 601-956-3834
MO St. Charles, Finnegan Elctrns. 314-946-6201
NE Omaha, Omaha Elctrns. 402-341-3440
NV Reno, Richco 702-323-4939
NH Nashua, Brevan 603-889-7230
NJ Kenilworth, Federated Purchasers 201-272-0505
NM Albuquerque, Electronic Pts. 505-293-6161
NY Bohemia, Car-Lac 516-567-4200
NC Raleigh, Century Elec. Comp. 919-782-2116
OH Dayton, Stotts-Friedman 513-298-5555
OK Tulsa, Altair 918-252-5781
OR Beaverton, Comp. Resources 503-641-8488
PA Philadelphia, PEI Genesis 215-673-0400
RI Pawtucket, Major Edwards 401-725-7400
SC Charleston, Wholesale Indl. Elex 803-577-6388
TN Knoxville, Industrial Elect 615-573-7135
TX Richardson, Aero Glen 214-234-0984
UT Salt Lake City, Kimball Elctrns. 801-328-2075
VT Colchester, Hooker Elctrns. 802-864-0885
VA Springfield, Southern Fasteners 703-922-8048
WA Redmond, Olander 206-881-3488
WV Beckley, State Elec. 304-256-2219
WI Grafton, Lakeview Elex 414-377-8250
EXP Taipei, Taiwan, Gold-Tek Elec. Co. 20-717-2302
Can Mississauga, Ont., Rush Elctrns. 416-677-7280

The Condenser Products Corporation

FAX: 904-799-0221

CONDENSER PRODUCTS CORP., 2131 Broad St., Brooksville, FL 34609, Tel: 904-796-3561; Empl.: 30; *Sls. Mgr.:* Bill Mason ..... **A•1065**

Local Sales Offices & Reps

NY Metropolitan, J.L. Sls. Assoc. 516-737-2801
TX Lewisville, Elctrn. Prod. Reps. 214-436-4772

CONDOR D.C. POWER SUPPLIES, INC., 2311 Statham Pkwy., Oxnard, CA 93033, Tel: 805-486-4565, TWX: 910-333-0681, FAX: 805-487-8911; Empl.: 250; *Sls. Mgr.:* Dan Horan, VP Mktg.; *Dist. Mgr.:* Deborah Perez ..... **D•1702-1710**

Local Sales Offices & Reps

AL Huntsville, The John Todd Co. 205-828-0808
AZ Phoenix, CPS Assocs. Inc. 602-246-1097
CA Brea, Masco Elctrns. 714-529-0866
CA Fremont, Telesis Sls. Grp. 415-657-8645
CO Denver, AKI Entprs. 303-388-4488
FL Orlando, Component Des. Mktg. 407-352-5480
IL Schaumberg, Engrg. Prods. 312-882-7640
IN Greenfield, Engrg. Prods. 317-894-7156
IA Cedar Rapids, C-Tron, Inc. 319-373-2029
KS Olathe, C-Tron, Inc. 913-829-0073
MA Taunton, Focus Elctrns. Sls., Inc. 617-824-3840
MN Edina, Engrg. Prods. 612-835-9022
MO St. Charles, C-Tron, Inc. 314-928-8078
NJ Medford, Comp. Consits. 609-654-5300
NY Pittsford, C. W. Beach 716-586-3200
NY Yonkers, Sonkin Assocs. 914-968-8282
OH Cleveland, Versatron 216-581-0090
SC Greenville, RF Sls. 803-234-6931
TX Dallas, M Rep 214-349-5523
Can Toronto, Ont., Duncan Instrs. 416-742-4448

Local Distributors

AL Huntsville, Allied Elctrns. 205-721-3500
AZ Phoenix, Aerospace S.W. 602-582-2779
CA Anaheim, Pacesetter Elctrns. 714-779-5855
CA Costa Mesa, FLW 714-751-7512
CA Hayward, FLW 415-786-9070
CA Orange, Milgray 203-795-0711
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CA Sunnyvale, Pacesetter Elctrns. 408-734-5470
CA Sunnyvale, Sierra West 408-747-1188
CO Westminster, Future Elctrns. 303-650-0123
CT Orange, Milgray 203-795-0711
FL Ft. Lauderdale, Allied 305-486-0500
FL Orlando, Hammomd Elctrns. 305-841-1010
FL Winter Pk., Milgray 305-647-5747
GA Atlanta, Milgray 404-446-9777
IL Chicago, Dalec Distrs. 312-283-0300
IL Schaumberg, Engrg. Prods. 312-882-7640
KS Overland Pk., Milgray 913-236-8800
MD Columbia, Milgray 301-621-8169
MD Columbia, Vantage 301-621-8555
MD Marlow Hgts., Allied 301-423-0161
MD Wheaton, Brimberg Sls. 301-946-2760
MA Westborough, Future Elctrns. 617-366-2400
MA Wilmington, Allied 617-942-0150
MI Ann Arbor, McNaughton-McKay 313-995-9515
MI Madison Heights, McNaughton-McKay 313-399-7500
MN Eden Prairie, Allied Elctrns. 612-829-7554
MN Edina, Engrg. Prods. 612-835-9022
MN Minneapolis, Aerospace Comp. Prod. 612-884-4725
NJ Marlton, Milgray 609-983-5010
NJ Mt. Laurel, Future Elctrns. 609-778-7600
NY Commack, Vantage 516-543-2000
NY Mineola, Allied 516-248-2360
NY Rochester, Future Elctrns. 716-272-7180
NY Yonkers, Kintronics 914-968-7736
NC Raleigh, Allied 919-876-5845
NC Raleigh, Allied Elctrns. 919-876-5845
OH Cleveland, Milgray 216-447-1520
OR Portland, Eoff 503-222-9411
TX Dallas, Cypress Elctrns. 214-869-1435
TX Fort Worth, Allied Elctrns. 817-336-5401
TX Richardson, Future Elctrns. 214-436-2437
UT Salt Lake City, Future Elctrns. 801-972-8489
WA Seattle, Allied 206-547-2827
WA Vancouver, Eoff 206-694-7504
Can Toronto, Ont., Duncan Inst. Ltd. 416-742-4448

CONDOR PACIFIC INDS., INC., 8053 Deering Ave., Canoga Park, CA 91304, Tel: 818-347-8331, TELEX: 65-1442, FAX: 818-713-0162; FSC No.: 24321; Empl.: 70

CONDOR SYSTEMS, INC., 2133 Branham Lane, San Jose, CA 95124, Tel: 408-371-9580, TELEX: 184819 Systems SANTA, FAX: 408-371-9589; FSC No.: 62065; Empl.: 150; *Sls. Mgr.:* Don Strandberg; *Dist. Mgr.:* Ed Brown

CONDUCTIVE RUBBER TECHNOLOGY, 201 N. Salsipuedes St., Ste. 100, Santa Barbara, CA 93103, Tel: 805-965-6511, TELEX: 658-305, FAX: 805-963-2652

CONDUCTIVE SYSTEM, INC., R.D. No. 1, Box 1040, Rte. 5 South, Amsterdam, NY 12010, Tel: 518-843-5740, FAX: 518-843-5829; *Sls. Mgr.:* John Severinsen

Local Sales Offices & Reps

AZ Scottsdale, American Mktg. Inc. 602-948-2778
CA Boulder, Comp. Prods. 303-530-2800
CA Canoga Park, C & W Comp. Sls. 818-700-2684
CA Los Altos, Frauman Assocs. 415-941-0660
CA San Diego, Vincon Sls. Co. 619-466-9785
CT Danbury, D. Setter 203-792-9446
FL Altamonte Springs, Lawrence Assocs. 407-339-3855

FL Boca Raton, Lawrence Assocs. 407-368-7373
FL Palm Bay, Lawrence Assocs. 407-951-0901
FL Palm Harbor, Lawrence Assocs. 813-787-2773
IL Park Ridge, Elctrn. Instr. 312-298-2290
IN Indianapolis, Elctrn. Instr. 317-257-7231
MD Baltimore, Bernie White & Co. 301-484-5400
MN Minneapolis, Deerland Distrs. 612-331-6433
MO St. Charles, Hayes Elec. 314-922-6607
NJ E. Windsor, Warren Engrg. Co. 609-443-3894
NY Farmington, Canavan Scanlon Assoc. 716-924-7450
NY Syracuse, Canavan-Scanlon 716-424-1830
OR Beaverton, Quest Mktg. Inc. 503-641-7377
TX Dallas, Scanlon, Hughes & Assocs. ... 214-739-2888
WA Bellevue, Quest Mktg. Inc. 206-747-9424
Can Lachine, ElectroDesign Ltd. 514-636-4838
Can Nepean, ElectroDesign Ltd. 613-727-5220
Can Toronto, ElectroDesign Ltd. 416-362-3859

CONEXCO INTERNATIONAL, 175-20 Hillside Avenue, Jamaica, NY 11432, Tel: 718-523-4100, FAX: 718-291-1803; *Sls. Mgr.:* Mike Costello; *Dist. Mgr.:* Lyda Magliaro

CONFORMING MATRIX, Box 5126, Pt. Pl. Sta., Toledo, OH 43611, Tel: 419-729-3777; Empl: 35

CONKLIN INSTRUMENT CORP., West Rd., P.O. Box 650, Pleasant Valley, NY 12569, Tel: 914-635-2136, FAX: 914-635-2510; Empl.: 110; *Sls. Mgr.:* Steven Muise, VP Mktg.; *Dist. Mgr.:* Steven Muise, VP Mktg.

CONNECT-AIR INTERNATIONAL, INC., 50 37th St. N.E., Auburn, WA 98002, Tel: 206-939-4880, FAX: 206-939-4882; Empl.: 50; *Sls. Mgr.:* Ron Jones

CONNECTICUT HARD RUBBER CO., See CHR Inds.

CONNECTICUT MICROWAVE CORP., 106 Powder Mill Rd, Box 389, Canton, CT 06019, Tel: 203-693-4247; FSC No.: 50974; Empl.: 10; *Sls. Mgr.:* Michael DePalo

CONNECTOR ACCESSORIES, INC., See Mueller Elec. Co.

FAX: 312-539-3825

CONNECTOR CORP., 6025 N. Keystone Ave., Chicago, IL 60646, Tel: 312-539-3108, TWX: 910-221-6059; *Sls. Mgr.:* Diane Racana ..... **C•1314-1315**

CONNECTOR INDUSTRIES OF AMERICA DIV., Microdot Mfg., 639 N. Wayne, Cincinnati, OH 45215, Tel: 513-733-3680; FSC No.: 32076; Empl.: 55; *Sls. Mgr.:* Bob Cain

FAX: 312-851-5040

CONNOR-WINFIELD CORP., 1865 Selmarten Rd., Aurora, IL 60505-1335, Tel: 312-851-4722, TELEX: 270244; FSC No.: 5955; Empl.: 35; *Sls. Mgr.:* John Hoag ..... **A•1366-1369**

Local Sales Offices & Reps

AL Huntsville, Dean Assocs. 205-534-2255
CA Agoura Hills, C.D.H. Assocs. 818-707-1970
CA Los Altos, Frauman Assocs. 415-941-0660
CO Englewood, Tera-Link Corp. 303-799-8707
FL Clearwater Beach, Perfott Assocs. 813-443-5414
FL Orlando, Perrott Assocs. 407-298-7748
FL West Palm Beach, Perrott Assocs. 407-790-5722
ID Boise, Q.R. Crown 208-344-9588
MD Cockeysville, Koebert Assocs. 301-560-1926
NC Charlotte, Quantum Mktg. 704-365-4538
NC Raleigh, Quantum Mktg. 919-846-5728
OR Portland, Q.R. Crown 503-620-8320
PA Glenside, Koebert Assocs. 215-887-2310
WA Bellevue, Q.R. Crown 206-643-8100
WV Inwood, Koebert Assocs. 304-229-8401

CONRAC DISPLAY PRODUCTS, INC., A Mark IV Industries Co., 1724 S. Mountain Ave., Duarte, CA 91010, Tel: 818-303-0095, TELEX: 67-0437, TWX: 910-584-5913, FAX: 818-303-5484; Empl.: 250; *Sls. Mgr.:* G.L. Ives, Dir. Mktg. & Sls.

Consolidated electronic wire & cable

FAX: 312-455-8837

CONSOLIDATED ELECTRONIC WIRE & CABLE, 11044 King St., Franklin Park, IL 60131-1412, Tel: 312-455-8830, TWX: 910-227-1705; FSC No.: 73612; Empl.: 85; *Sls. Mgr.:* Karl Rankin; *Dist. Mgr.:* Steve Boynton ..... **C•1840-1847**

Local Sales Offices & Reps

AL Huntsville, JWL Assocs.,Inc. 205-883-1712
AZ Phoenix, Howe & Howe Sls. 602-264-7971
CA Los Gatos, Featherstone Sls. Co. 408-356-3243,
CA Pacifica, Featherstone Sls. Co. 415-355-3172,
CO Boulder, The Stratford Grp. 303-530-3194
CT Wethersfield, Compak 203-563-4784
FL Melbourne, Phoenix Comps. 305-723-4414,
GA Atlanta, JWL Assocs., Inc. 404-320-7643
IL Franklin Pk., Con. Elec. Wire & Cable 312-455-8830,
IL Highland Pk., Bransky Sls. 312-433-2375
IN Carmel, Frank E. Kahsan, Sls. Inc. 317-844-9353
IA Cedar Rapids, R. W. Kunz & Assocs. .. 319-396-5386
KS Prairie Village, R. W. Kunz & Assocs. .. 913-648-3535
LA Slidell, Tagco Sls. Co. 504-643-4751
MD Walkersville, Jadelectronic Assocs. ... 301-845-6063
MA Hudson, Compak 508-658-0331
MI Warren, Burcaw Co. 313-573-4605
MO St. Louis, R. W. Kunz & Assocs. 314-966-4977
NM Albuquerque, Syntech 505-266-7951
NY Buffalo, NRM Mktg. Group 716-634-4300
NY Skaneateles, NRM Mktg. Group 315-685-8991
NY Whitestone, Jack Brown Elctrns. 718-767-1917,
NC Charlotte, JWL Assocs., Inc. 704-541-5750
OH Cincinnati, Frank E. Kansar Sls., Inc. .. 513-922-3133
OK Tulsa, SW Mktg.Inc. 918-583-3892
OR Milwaukie, Comtec Intl. 503-654-6626
PA Birchrunville, Jadelectronic Assocs. 215-296-3800,
PA Sewickley, Frank E. Kansar Sls.,Inc. ... 412-741-4155
TX Austin, SW Mktg.Inc. 512-255-8010
TX Dallas, SW Mktg. Inc. 214-341-8631,
TX Houston, SW Mktg. Inc. 713-537-8166,
UT Salt Lake City, Advanced Control Equip. 801-972-9377,
WA Bellevue, Comtec Intl. 206-453-1188,

CONSOLINK CORP., 1840 Industrial Ctr., Longmont, CO 80501, Tel: 303-651-2014, TWX: 910-320-0786; Empl.: 25; *Sls. Mgr.:* Dan Zec; *Dist. Mgr.:* Judith Hester

CONTACT, INC., 5 Elm Ave., Hudson, NH 03051, Tel: 603-883-7708; FSC No.: M07015; Empl.: 11; *Sls. Mgr.:* R. Reid; *Dist. Mgr.:* R. Reid

CONTACT EAST, 335 Willow St. S., P.O. Box 786, N. Andover, MA 01845, Tel: 508-682-2000, TELEX: 383088, FAX: 508-688-7829; *Sls. Mgr.:* Richard Sullivan

CONTAQ TECHNOLOGIES CORP., 15 Main St., Bristol, VT 05443, Tel: 802-453-3332, FAX: 802-453-4250; FSC No.: 6680

CONTINENTAL RESOURCES, Computer & Peripherals Div., 175 Middlesex Tpke., Bedford, MA 01730, Tel: 617-275-0850, 800-937-4688, FAX: 617-275-6563; Empl.: 250; *Sls. Mgr.:* Mark Berling ..... **D•1085, 1237**

Local Sales Offices & Reps

CA Los Angeles, Continental Resources .. 213-638-0454
CA San Francisco, Continental Resources 408-263-1775
DC Washington, Continental Resources .. 202-948-4310
FL Orlando, Continental Resources 407-855-9544
IL Chicago, Continental Resources 312-860-5991
MA Boston, Continental Resources 617-275-0850
NJ Somerset, Continental Resources 201-563-0900
NY New York City, Continental Resources 212-695-3208
PA Philadelphia, Continental Resources .. 215-234-5100
TX Dallas, Continental Resources 214-458-7616

CONTINENTAL RESOURCES, INC, Test Instruments Div., 175 Middlesex Tpke., Bedford, MA 01730, Tel: 617-275-0850, 800-937-4688, FAX: 617-275-2046; Empl.: 250 ..... **D•1237**

Local Sales Offices & Reps

CA Los Angeles, Continental Resources .. 213-638-0454
CA San Francisco, Continental Resources 408-263-1775
NJ Somerset, Continental Resources 201-563-0900
FL Orlando, Continental Resources 407-855-9544
IL Bensenville, Continental Resources ... 312-860-5991
MD Gaithersburg, Continental Resources 301-948-4310
MA Bedford, Continental Resources 617-275-0850

Local Distributors

CA Los Angeles, Continental Resources .. 213-638-0454
CA San Francisco, Continental Resources 408-263-1775
DC Washington, Continental Resources .. 301-948-4310
FL Orlando, Continental Resources 407-855-9544
IL Chicago, Continental Resources 312-860-5991
MA Boston, Continental Resources 617-275-0850
NJ Somerset, Continental Resources 201-563-0900
NY New York City, Continental Resources 212-695-3208
PA Philadelphia, Continental Resources .. 609-234-5100
TX Dallas, Continental Resources 214-458-7616

CONTINENTAL SPECIALTIES CORP., See Global Specialties Corp.

CONTINENTAL WIRE & CABLE, Gulton Rd., P. O. Box 1863, York, PA 17405, Tel: 717-792-2644, TELEX: 84-0437; Empl.: 250; *Sls. Mgr.:* Edward W. Holland III; *Dist. Mgr.:* Shirley A. Eisenhart

CONTOURS INC., 290 Pratt St., Meriden, CT 06450, Tel: 203-237-8331, FAX: 203-237-6353; FSC No.: 033501; *Sls. Mgr.:* Eugene D. Rodman

CONTROL CABLE, INC., 7261 Ambassador Rd., Baltimore, MD 21207, Tel: 301-298-4411, FAX: 301-265-1646; FSC No.: 510124759; Empl.: 90; *Sls. Mgr.:* Greg Jones; *Dist. Mgr.:* Greg Jones

CONTROL CONCEPTS CORP., P.O. Box 1380, Binghamton, NY 13902-1380, Tel: 607-724-2484, TELEX: 62224380, FAX: 607-722-8713; Empl.: 41; *Sls. Mgr.:* Pat Gillette, VP Sls.; *Dist. Mgr.:* Fred Zack

CONTROL DATA CORP., P.O. Box O, Minneapolis, MN 55440, Tel: 1-800-828-8001 Operator 82, In MN 612-921-4400, FAX: 612-853-6748; Empl.: 6623; *Sls. Mgr.:* J. Repp; *Dist. Mgr.:* R. L. Kamps

CONTROL DISPLAYS, INC., 3075 Advance Lane, P.O. Box 227, Colmar, PA 18915, Tel: 215-822-3383, FAX: 215-997-1232; FSC No.: 27878; Empl.: 75; *Sls. Mgr.:* L. Rodrigue

CONTROL ELECTRONICS, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735, Tel: 516-694-0125, FAX: 516-694-0133; FSC No.: 95924; Empl.: 60; *Sls. Mgr.:* Harold Goldstein; *Dist. Mgr.:* Barbara Kilroy .... **A•1540**

Local Sales Offices & Reps

CA Sherman Oaks, R.T. Assocs. 213-788-7588
FL Melbourne, VPI 305-768-9349
FL Tampa, VPI 813-832-2041
IL Chicago, Electro-Tech Mktg. Assoc. ... 312-676-3151
MD Ellicott City, VPI 301-461-2525
MA West Peabody, JK Assocs. 508-535-8068
PA Montgomeryville, Rufo Sys. Comp. 215-368-8495
TX Dallas, Texas Avionics Co. 214-363-6324
WI Brookfield, Electro-Tech Mktg. Assocs. 414-785-9554
EXP FL, Hallandale, Emec 305-925-6366

CONTROL ENGRG., INC., 190 Doty Circle, West Springfield, MA 01089, Tel: 413-781-1330; Empl.: 7; *Sls. Mgr.:* Mark Kimball

CONTROLEX, INC., Francestown Turnpike, New Boston, NH 03070, Tel: 603-487-5512, TELEX: 174094 FNB PETERBORO on TRT; Empl.: 7; *Dist. Mgr.:* Patricia Butler

CONTROLEX/EANCO, See Fincor

CONTROL LASER CORP., 7503 Chancellor Dr., Orlando, FL 32809, Tel: 407-438-2500, TELEX: 514215; Empl.: 130; *Sls. Mgr.:* David Montes, VP Sls./Mktg.

CONTROLLED ENVIRONMENTAL EQUIPMENT CORP., 3 Delta Drive, Westbrook, ME 04092, Tel: 207-854-9126, TELEX: 62903721, FAX: 207-854-4357; FSC No.: 25254; Empl.: 10; *Sls. Mgr.:* M. F. Peck

CONTROLLED POWER COMPANY

FAX: 313-528-0411

CONTROLLED POWER CO., 1955 Stephenson Hwy., Troy, MI 48083, Tel: 313-528-3700, 1-800-521-4792, TWX: 810-2323401; Empl.: 160; *Sls. Mgr.:* Reggie Peck ..... **D•2183-2187**

Local Sales Offices & Reps

AL Homewood, Control Equip. & Sls. 205-945-8454
AK Anchorage, Alaska Computer Environment 907-243-1429
AZ Phoenix, Gruber Assocs. 602-863-2655
CA Foster City, Computer Support Sys. 415-572-9994
CA La Habra, Gru Assocs. 213-691-2993
CA San Diego, Professional Power Sys. 619-581-1937
CO Denver, Computer Facility Components 303-778-8488
CO Denver, Computer Facility Comps. 303-778-9131
CT Woodbridge, Controlled Support Sys. 203-397-1721
FL Orlando, Data Rep 407-648-8460
GA Cummings, LASCOM, Inc. 404-493-0788
IL Crystal Lake, Carzoli Engrg. Sls. 815-459-4397
IN Indianapolis, Computer Enviro-Sys. 317-253-0749
MD Towson, H. L. Frey Corp. 301-821-0058
MA Abington, Bates & Assocs. 617-871-2626
MN Minneapolis, H.M. Cragg Company 612-721-7444
MO St.Louis, Rail Way Industry 314-966-3300
NE Omaha, Electric Specialties Co. 402-391-6000
NJ Englewood Cliffs, Power Conversion & Control 201-569-0015
NM Albuquerque, Sun Data Systems 505-272-1022
NY Buffalo, Bromor Company 716-874-4595
NY Valhalla, Controlled Support Sys. 914-949-0300
NC Charlottte, Glen & Larson of Carolina 704-365-5917
OH Cincinnati, Goldschmidt Elec. Sls. 513-641-1708
OH Westerville, Power Con Systems 614-890-1124
OK Oklahoma City, Computer Power Inc. 405-848-2522
PA
PA Glenshaw, H.C. Johnson Agencies Inc. 412-487-1246
PA Jamison, CRT Inc. 215-343-4068
PA West Chester, T.P.S. 215-431-3670
TN Memphis, ADEPT 901-743-5120
TN Nashville, Jenkins & Associates 615-256-7606
TX Medina, Clean Energy Concepts Inc. 512-589-2280
TX Richardson, Tubbesing Sales Corp. 214-234-3855
TX Stafford, Constant Power Systems 713-240-0404
UT Bountiful, Computer Power Technlgy. 801-295-4772
UT Bountiful, Computer Power Technology 801-295-4772
VA Alexandria, ADAPT 703-684-6393
VA Virginia Beach, Precision Environments 804-473-8767
WA Seattle, Campbell Co. 206-622-3403
WA Seattle, Campbell Company 206-622-3403
WI Germantown, Rekco Inc. 414-784-3430
Can Againcourt, Ontario, Aircom Sales Inc. 416-293-3339
Can Burnaby, BC, Datasphere Sales Ltd. 604-420-6040
Can Calgary, AB, Datasphere Sales Ltd. 403-244-3666
Can Dorval,PQ, Datasphere Sales Ltd. 514-631-7209
Can Edmonton, AB, Datasphere Sales Ltd. 403-483-7979
Can Halifax, NX, Datasphere Sales Ltd. 902-423-2246
Can Mississauga, ON, Datasphere Sales Ltd. 416-278-5501
Can N. Vancouver, B.C., Jerome & Francis Co. Ltd. 604-986-1286
Can Nepan, On, Datasphere Sales Ltd. 613-723-2582
Can Regina, SK, Datasphere Sales Ltd. 306-565-0421
Can St. Leonard, Quebec, B. Beaudoin & Associates 514-328-2266
Can Winnipeg, MB, Datasphere Sales Ltd. 204-943-7102

CONTROL LOGIC, See Hancock Electronics Corp.

CONTROL MODULE, 380 Enfield St., Enfield, CT 06082, Tel: 203-745-2433, TELEX: 643167; Empl.: 160; *Sls. Mgr.:* D. Penn

CONTROL PRODUCTS, INC., 280 Ridgedale Ave., E. Hanover, NJ 07936, Tel: 201-887-9400, FAX: 201-887-5083; FSC No.: 81901; Empl.: 62; *Sls. Mgr.:* H.M. Stuhler; *Dist. Mgr.:* H.M. Stuhler

CSI

FAX: 818-709-8546

CONTROL SCIENCES, INC., 9509 Vassar Ave., Chatsworth, CA 91311, Tel: 818-709-5510, TELEX: 4970496(CSI); FSC No.: 53317; Empl.: 20; *Sls. Mgr.:* Rhod Zimmerman ..... **D•1161-1165**

Local Sales Offices & Reps

AZ Tempe, Hannah-Hill 602-431-1771
CA Luguna Niguel, Aktron Sls. 714-496-5057
CO Broomfield, Hannah-Hill 303-424-0108
CT Asonia, Pace Assocs. 203-732-8756
CT S. Glastonbury, Pace Assocs. 203-659-2266
IN Ft. Wayne, J & B Engrg. 219-483-2813
MI Rochester, Kinetic Technlgs. 313-656-0090
MN St. Paul, Northstar Motion & Control 612-770-5311
NY Victor, A & D Dvcs. 716-385-2778
NC Jamestown, Homersmith, Inc. 919-883-3999
PA Media, Homer Smith Sls. 215-543-2434
NY Albertson, DOL Engrg. 516-747-3944
TX Dallas, McDonald Assocs. 214-239-3293
UT Salt Lake City, Hannah-Hill 801-364-0606
VA Alexandria, Homersmith Inc. 703-922-6986

CONTROLS DIVISION, Ametek, Inc., 820 Pennsylvania Blvd., Feasterville, PA 19047, Tel: 215-355-6900, TELEX: 29-1769, FAX: 215-355-2937; Empl.: 100; *Sls. Mgr.:* R. Thomas Guinn

CONTROLS UNLIMITED, INC., 4823 North Ridge Rd., Perry, OH 44081, Tel: 216-259-2500, FAX: 216-259-5015; Empl.: 35

CONTROL TECHNOLOGY CO., INC., 41-16 29th St., Long Island City, NY 11101, Tel: 718-361-2133, FAX: 718-361-6386; FSC No.: 14545; Empl.: 35; *Sls. Mgr.:* H. Cooper ..... **D•2246-2247**

Local Sales Offices & Reps

Can Montreal, Que., Control Tech. Elctrns. CTC Canada, Ltd. 514-733-3279

CONTROL TECHNOLOGY, INC., 8200 N. Classen Blvd., Ste. 101, Oklahoma City, OK 73114, Tel: 405-840-3163, FAX: 405-848-0489; *Sls. Mgr.:* Charles Weddington; *Dist. Mgr.:* Charles Weddington

CONVER CORP., 916 W. Maude Ave., Sunnyvale, CA 94086, Tel: 408-739-9111, TWX: 910-338-2036, ESYLNK: 62024309, FAX: 408-739-9116; Empl.: 40; *Sls. Mgr.:* Robert Lloyd; *Dist. Mgr.:* Sherri Kirkpatrick

CONVERTER CONCEPTS INC

FAX: 608-429-9241

CONVERTER CONCEPTS, INC., Industrial Pkwy., Pardeeville, WI 53954, Tel: 608-429-2144, TWX: 910-280-2630; Empl.: 125; *Sls. Mgr.:* William A. Pearson ..... **D•1711-1713**

Local Sales Offices & Reps

AZ Tempe, Cantec Sls. 602-345-1276
CA Hayward, Pacific Mktg. 415-887-1620
CA Irvine, Groh Assocs. 714-837-9871
CA San Diego, Groh Assocs. 619-453-7572
FL Boca Raton, Perrott Assocs. 305-792-2211
FL Clearwater, Perrott Assocs. 813-443-5214
FL Orlando, Perrott Assoc. 305-298-7748
MA Chelmsford, Interstate Sls. Assocs. 617-256-2287
MI Grand Rapids, JFCO 616-949-1020
MI Lake Orion, JFCO 313-693-2053
MN Minneapolis, Microelectronic Sls. 612-829-0948
MO Kansas City, Abrams & Assocs. 816-561-9234
MO St. Louis, Abrams & Assocs. 314-569-0447
NY Syracuse, Pi-Tronics 315-455-7346
OH Cleveland, JFCO 216-238-5905
OH Vandalia, JFCO 513-890-8322
PA Glenside, Koebert Assoc. 215-887-2310
PA Pittsburgh, JFCO 412-823-5400
TX Austin, Tesco 512-834-8374
TX Dallas, Tesco 214-553-1200
WA Kirkland, Northwest Comp. Sls. 206-828-4838
WV Inwood, Koebert Assocs. 304-229-8401
Can Nepean, Ont., Electro-Source, Inc. 613-726-1452
Can Rexdale, Ont., Electro-Source, Inc. 416-675-4490
Can Vancouver, BC, Davetek Mktg. 604-430-3680

COOKE VACUUM PRODS., INC., 13 Merritt St., Norwalk, CT 06854, Tel: 203-853-9500, FAX: 203-838-9553; Empl.: 45; *Sls. Mgr.:* Louis W. Genuario

THE COOL-AMP CONDUCTO-LUBE CO., 8603 S.W. 17th Avenue, Portland, OR 97219, Tel: 503-244-2230, FAX: 503-244-2230; FSC No.: 31628; Empl.: 7; *Sls. Mgr.:* Marian Bomber

COONER WIRE CO., 9186 Independence Ave., Chatsworth, CA 91311, Tel: 818-882-8311, TELEX: 353734 Cooner Wire UD, FAX: 818-709-8281; *Sls. Mgr.:* Steven W. Smith

COOPER TOOLS, PO Box 30100, Raleigh, NC 27622, Tel: 919-781-7200, TELEX: 579497

CO-ORD SWITCH DIV., See LVC Inds., Inc.

COORS CERAMICS CO., 600 Ninth St., Golden, CO 80401, Tel: 303-278-4000, TELEX: 4322017; Empl.: 1700

CORBY INDUSTRIES, INC., 1501 E. Pennsylvania St., Allentown, PA 18103, Tel: 215-433-1412, TELEX: 847318 CORBYUHL, FAX: 215-435-1693; Empl.: 27

CORCOM, INC., 1600 Winchester Rd., Libertyville, IL 60048, Tel: 312-680-7400, TWX: 910-687-1058; FSC No.: 05245; Empl.: 1000; *Sls. Mgr.:* Dale Van Scoyk, Dir. OEM Sls. ..... **A•1644-1645; C•1317**

Local Sales Offices & Reps

AL Huntsville, R. O. Whitesell Assocs. 205-883-5110
AZ Phoenix, LS.D.S. 602-971-6250
CA Anaheim, Westrep 714-527-2822
CA Mountain View, Straube Assocs. 415-969-6060
CA San Diego, Westrep 619-566-6580
CA Sunnyvale, Capsco Sls., Inc. 408-734-3020
CO Westminster, Straube Assocs. 303-426-0890
CT Madison, Conti-Younger Assocs. 203-245-1136
CT Norwalk, Wincor Sls. 203-866-8390
FL Maitland, E.I.R. Inc. 407-660-9600
FL Oldsmar, E.I.R. Inc. 813-786-2156
FL Plantation, E.I.R. Inc. 305-581-6905
FL Plantation, E.I.R. Inc. 305-791-8243
GA Norcross, Robert O. Whitesell Assocs. 404-449-9190
ID Boise, Cascade Comps. 208-343-9886
IL Glendale Hgts., Beta Technlg. Sls. Inc. 312-790-9886
IN Ft. Wayne, Robert O. Whitesell 219-432-5591
IN Indianapolis, Robert O. Whitesell 317-359-9283
IN Kokomo, Robert O. Whitesell 317-457-9127
KS Overland Pk., Spectrum Sls. 913-648-6811
KY Peewee Valley, Robert O. Whitesell 502-241-1441
MD Ellicott City, Marketing Technlg. 301-465-5944
MA Burlington, Conti-Younger Assocs. 617-273-1582
MI Grand Rapids, Robert O. Whitesell 616-942-5420
MI Southfield, Robert O. Whitesell 313-559-5454
MI St. Joseph, Robert O. Whitesell 616-983-7337
MN Edina, Mel Foster Co. 612-941-9790
MO Hazelwood, Spectrum Sls. 314-731-5151
NJ Paramus, Win-Cor Sls. 201-967-0242
NM Albuquerque, Rontek, Inc. 505-299-4124
NY Manhasset, Win-Cor Elctrn. Sls. 516-627-9474
NY Pittsford, Noeth-Honsinger Assocs. 716-586-9002
NC Raleigh, Zucker Assoc. 919-782-8433
OH Cincinnati, Robert O. Whitesell 513-521-2290
OH Cleveland, Robert O. Whitesell 216-447-9020
OH Columbus, Robert O. Whitesell 614-888-9396
OH Dayton, Robert O. Whitesell 513-298-9546
OR Beaverton, Jas. J. Backer Co. 503-627-0775
PA Pittsburgh, Robert O. Whitesell 412-963-6161
PA Trevose, Professional Svc. Assoc. 215-245-0513
TN Knoxville, Robert O. Whitesell 615-694-9476
TN Nashville, R. O. Whitesell Assocs. 615-352-4760
TX Austin, K & H Sls. 512-339-7950
TX Plano, K & H Sls. 214-423-6520
UT Salt Lake City, Straube Assocs. 801-263-2640
WA Seattle, Jas. J. Backer Co. 206-285-1300
WI Milwaukee, Beta Technlg. Sls. Inc. 414-543-6609

Local Distributors

AL Huntsville, Pioneer 205-837-9300
AZ Phoenix, Cetec/Future Elec. 602-968-7140
AZ Phoenix, Marshall Inds. 602-496-0290
CA Chatsworth, Cetec/Future Elec. 818-700-0914
CA Garden Grove, Richey Impact 714-895-0060
CA Irvine, Cetec/Future Elec. 714-250-4141
CA Irvine, Marshall Ind. 714-458-5395
CA Irvine, Schweber 714-863-0200
CA Milpitas, Marshall Ind. 408-942-4600
CA San Diego, Cetec/Future Elec. 619-278-5020
CA San Diego, Marshall Ind. 619-578-9600
CA San Diego, Schweber 619-450-0454
CA San Jose, Schweber 408-432-7171
CO Thornton, Marshall Ind. 303-451-8444
CT E. Haven, J.V. Elctrns. 203-469-2321
CT Wallingford, Greene Shaw 203-265-3333
FL Altamonte Springs, Pioneer 407-834-9090
FL Deerfield Beach, Pioneer 305-771-7520
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Orlando, Hammond Elctrns. 407-849-6060
GA Atlanta, Marshall Ind. 404-923-5750
IL Addison, Pioneer/Chicago 312-495-9831
IL Chicago, Newark Elctrns. 312-784-5100
IL Palatine, OHM Elctrns. 312-359-5500
IN Indianapolis, Marshall 317-297-0483
IN Indianapolis, Pioneer 317-849-7300
KS Lenexa, Marshall 913-492-3121
MD Baltimore, Resco/Baltimore 301-529-0500
MD Beltsville, Resco/Washington 301-937-9100

MD	Gaithersburg, Pioneer	301-921-0660
MA	Newton, Greene Shaw	617-969-8900
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Wilmington, Marshall Inds.	313-525-5820
MI	Grand Rapids, Pioneer	616-698-1800
MI	Livonia, Marshall Inds.	313-525-5820
MI	Livonia, Pioneer	313-525-1800
MN	Eden Prairie, Pioneer/Twin Cities	612-944-3355
MN	St. Paul, Gopher Elctrns.	612-483-3322
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NJ	Bellmawr, Mid Atlantic Elctrns. Corp.	609-931-5303
NJ	Fairfield, Marshall Inds.	201-882-0320
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Fairport, Pioneer	716-381-7070
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Mt. Vernon, QAR Indl. Elctrn. Sls.	914-699-2224
NY	Rochester, Simcona	716-328-3230
NY	Rochester, Summit Distrs.	716-334-8110
NY	Ronkonkoma, Arrow Elec.	516-391-1696
NY	Woodbury, Pioneer	516-921-8700
NC	Charlotte, Pioneer	704-527-8188
NC	Raleigh, Marshall Inds.	919-878-9882
NC	Raleigh, Resco	919-781-5700
OH	Cleveland, Pioneer	216-587-3600
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
OH	Dayton, Pioneer	513-236-9900
OR	Beaverton, Almac Elctrns.	503-629-8090
OR	Beaverton, Marshall Inds.	503-644-5050
PA	Horsham, Pioneer	215-674-4000
PA	Philadelphia, Almo Elctrns. Corp.	215-698-4000
PA	Pittsburgh, Pioneer	412-782-2300
TX	Austin, Marshall Inds.	512-837-1991
TX	Austin, Pioneer	512-835-4000
TX	Carrollton, Marshall Inds.	214-233-5200
TX	Dallas, Pioneer	214-386-7300
TX	Houston, Marshall Inds.	713-895-9200
TX	Houston, Pioneer	713-988-5555
UT	Salt Lake City, Marshall Inds.	801-485-1551
VA	Reston, MTI/Tytronics	703-620-4600
WA	Bellevue, Almac Elctrns.	206-643-9992
WA	Bellevue, Marshall Inds.	206-486-5747
WA	Spokane, Almac Elctrns.	509-924-9500
WI	Milwaukee, Marsh Elctrns.	414-475-6000

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CORES UNLIMITED, INC., 8311 Westminster Ave., Ste. 230, Westminster, CA 92683, Tel: 714-894-3062, 800-422-CORE, FAX: 714-895-4502; Empl.: 8

Local Sales Offices & Reps

AZ	Scottsdale, EDP & Assocs.	602-991-6119
CA	Glendora, Holms & Ladky	818-914-2434
CA	San Jose, Comtech Mktg.	408-294-5445
FL	Miami, BG Professional Sls.	305-932-2782
WA	Seattle, Allied Prods.	206-892-8870

CORLUND ELECTRONICS CORP., 2330 Teller Rd., Newbury Park, CA 91320, Tel: 805-499-6877, FAX: 805-499-4072; Empl.: 55; *Sls. Mgr.:* Gary Mesnick

CORMAN TECHNOLOGIES INC., 75 Bathurst Dr., Waterloo, Ontario, Canada N2V 1N2, Tel: 519-884-4430, FAX: 519-884-0204; *Sls. Mgr.:* Bill Lochead; *Dist. Mgr.:* Bill Lochead

CORNELL-DUBILIER ELCTRNS./SANGAMO COMPS., 1605 E. Rodney French Blvd., New Bedford, MA. 02744, MA 02741, Tel: 508-996-8561, TELEX: 929 419, FAX: 508-996-3830; Empl.: 5000; *Sls. Mgr.:* Anthony M. Cavuto, VP Sls.

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CORTEC, INC., 15811 Chemical La., Huntington Bch., CA 92649, Tel: 714-897-2529, FAX: 714-897-2170; Empl.: 35

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COSAR CORPORATION, 10375 Brockwood Rd., Dallas, TX 75238, Tel: 214-340-4584, 800-527-1207, TELEX: 506973; FSC No.: 20891; Empl.: 50; *Sls. Mgr.:* Jerry Jarka

COSMO CORPORATION, 3239 W. 14th St., Cleveland, OH 44109, Tel: 216-861-5594; Empl.: 500; *Sls. Mgr.:* B. Gordon

COTO CORPORATION

FAX: 401-942-0920

COTO CORPORATION, 55 DuPont Drive, Providence, RI 02907, Tel: 401-943-2686; Empl.: 250; *Sls. Mgr.:* John E. Beigel, Dir. Mktg. & Sls.; *Dist. Mgr.:* Aaron Smith ..... **B•1451-1455**

Local Sales Offices & Reps

AL	Owens Cross Rds., cmrCross Assocs.	205-883-5991
AZ	Phoenix, Spectrum Mktg. Assocs., Inc.	602-890-9000
CA	Newport Bch., Forbes Pacific Inc.	714-722-6174
CA	Saratoga, Testco Inc.	408-253-1900
CO	Denver, Spectrum Sls.	303-480-9991
CT	Warren, RI, Wm. Poisson & Assocs.	401-245-0260
DE	Hunt Valley, Eagle Sls. Corp.	301-666-3930
DC	Hunt Valley, Eagle Sls. Corp.	301-666-3930
FL	Tampa, Standard Mktg.	813-933-5833
IL	Downers Grove, Richmar Elctrns.	312-968-0118
IN	Indianapolis, Richmar Elctrns.	317-577-9950
NY	Great Neck, MOS Mktg. Assocs.	516-487-3966
NY	N. Syracuse, Advanced Comps. Corp.	315-699-2671
OR	Tigard, LD Elctrns.	503-684-8221
PA	Huntingdon Valley, Omega Elctrn. Sls.	215-947-4135
RI	Warren, Wm. Poisson & Assocs.	401-245-0260
TX	Plano, Richmar Elctrns.	214-424-8388
TX	Round Rock, Richmar Elctrns.	512-255-2551
UT	Ogden, Spectrum Mktg. Assocs. Inc.	801-972-8552
WA	Snohomish, LD Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883
WI	Butler, Richmar Elctrns.	414-781-1730
Can	Pointe Claire, Que., A. R. Gray Assocs.	514-694-6378

Local Distributors

AL	Huntsville, Allied Elctrns.	800-433-5700, 205-721-3500
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Saratoga, Testco Inc.	408-253-1900
CO	Denver, Spectrum Distrbn.	303-480-9991
FL	Pompano, Allied Elctrns.	304-486-0500, 1-800-336-5401
GA	Norcross, Allied Elctrns.	404-446-8595
IL	Elgin, Allied Elctrns.	312-697-0126
MA	Wilmington, Allied Elctrns.	508-942-0150
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-876-5845
OK	Tulsa, Altair Co.	918-252-5781
CA	Saratoga, Testco, Inc.	408-253-1900
SC	Raleigh, Allied Elctrns.	919-876-5845
TX	Austin, Altair Co.	512-837-4970
TX	Dallas, Allied Elctrns.	214-553-4370
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
UT	Ogden, Spectrum Mktg. Assocs., Inc.	801-972-8552

EXP TX/Ft. Worth, Allied Elec./Exp. Svcs. 817-336-5401

COTRONICS, 3379 Shore Pkwy., Brooklyn, NY 11235, Tel: 718-646-7996, FAX: 718-646-3028; Empl.: 15; *Sls. Mgr.:* Alan Marks

COUTANT ELECTRONICS LIMITED, Kingsley Ave., Ilfracombe, Devon, England EX34 8ES, Tel: (0271)63781, TELEX: 46310, FAX: (0271)64894; Empl.: 330; *Sls. Mgr.:* Andrew Tweedie; *Dist. Mgr.:* Andrew Tweedie

COVER CRAFT CORP., See Amherst International Corp., Cover Craft Div.

COVOX, INC., 675 D Conger St., Eugene, OR 97402, Tel: 503-342-1271, FAX: 503-342-1283; Empl.: 25; *Sls. Mgr.:* M. R. Stewart

CPS, INC., 1362 Borregas Ave., Sunnyvale, CA 94089, Tel: 408-734-8980, TELEX: 35-7450, FAX: 408-734-8993; FSC No.: 31640; Empl.: 30; *Sls. Mgr.:* Clifford Gaw

CP TECHNOLOGY, INC., 21143 Christensen Drive, Cupertino, CA 95014, Tel: 408-996-8069; Empl.: 6

CRAFT DATA, INC., 27022 Cordero Lane, Mission Viejo, CA 92691, Tel: 714-582-8284, TELEX: 751875 Craft Data, FAX: 714-556-8325; Empl.: 4

CRAIG SYSTEMS CORP., Hanson Industries, 10 Industrial Way, Amesbury, MA 01913-4848, Tel: 508-388-5662, TWX: 710-347-0590, FAX: 508-388-0845; FSC No.: 81902; Empl.: 230; *Sls. Mgr.:* Roger Chouinard

CRAMER COIL & TRANSFORMER CO., INC., 401 Progress Dr., Saukville, WI 53080, Tel: 414-284-9425, FAX: 414-377-4028; Empl.: 70; *Sls. Mgr.:* Patti Lincoln

Local Sales Offices & Reps

CA	Santa Clara, Fischer Assocs.	408-733-7350
CO	Monument, Sunbird Inds.	303-481-2900
CT	Bethany, The Reps. Corp.	203-393-0024
IL	Palatine, Somers-Stanton	312-994-1108
IN	Frankfort, C-S Elctrn. Sls.	317-659-1874
KS	Overland Park, Q D C Inds.	913-341-2214
MD	Ellicott City, American Technlg. Assoc.	301-461-5599
MA	Wellesley, The Reps. Corp.	617-237-6476
MI	Jackson, Norwood-Scroggs	517-750-1170
MN	Eden Prairie, Hanna Lind	612-942-8554
NY	Fulton, Carl Truax, Inc.	315-592-7184
NC	Kernersville, Wallace Elctrns. Sls.	919-996-2742
TX	Richardson, Barry Sls., Inc.	214-234-0255

CRAMER CO., Mill Rock Rd., Old Saybrook, CT 06475, Tel: 800-247-6784, FAX: 203-388-9831; Empl.: 210; *Sls. Mgr.:* Joe Lenzo; *Dist. Mgr.:* E. Latourette

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CREATIVE MICRO SYSTEMS, 3822 Cerritos Ave., Los Alamitos, CA 90720, Tel: 213-493-2484, FAX: 213-493-3553; Empl.: 24; *Sls. Mgr.:* Margaret E. Prossen

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Local Sales Offices & Reps

IL	Chicago, Western Sls., Inc.	312-699-6126
NC	Selma, Shalltronix Corp.	919-965-6346

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CRL COMPS., INC., A Cambridge Elctrn. Inds. Co., Highway 20 West, Fort Dodge, IA 50501, Tel: 515-573-1300; FSC No.: 71590; Empl.: 500; *Dist. Mgr.:* Jim Wood ..... **A•2104; B•1704-1708**

Local Sales Offices & Reps

AZ	Tucson, Clemick & Assocs.	602-749-4003
CA	Pleasanton, Moulthrop Sls., Inc.	415-463-0450
CA	Valencia, C & N Assocs., Inc.	805-254-5844
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	Ft. Lauderdale, Panamtech	305-587-3769
FL	Oviedo, Panamtech	407-677-4448
IL	Rolling Meadows, Sumer, Inc.	312-991-8500
IN	Indianapolis, Leslie M. Devoe Co.	317-842-3245
IA	Cedar Rapids, Lorenz Sls., Inc.	319-377-4666
KS	Merriam, Lorenz Sls., Inc.	913-384-6556
MA	Needham Hgts., Coakley, Boyd, & Abbett, Inc.	617-444-5470
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	Minneapolis, Electric Comp. Sls., Inc.	612-933-2594
MO	University City, Lorenz Sls., Inc.	314-997-4558
NE	Lincoln, Lorenz Sls., Inc.	402-475-4660
NJ	Englewood Cliffs, Ed Glass Assocs.	201-592-0200
NY	Skaneateles, Empire Tech. Assoc.	315-685-5703
OH	Cleveland, Arthur H. Baier Co.	216-461-6161
OK	Tulsa, DJ Sls. & Assocs.	918-663-8155
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Narberth, Bresson Assocs.	215-664-6460
TX	Dallas, DJ Sls. & Assocs.	214-783-8876
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WA	Spokane, Eclipse Mktg. Grp.	509-922-3972
WI	Brookfield, Sumer, Inc.	414-784-6641
Can	Pickering, Ont., McHugh Elctrns.	416-831-4773
Can	Vancouver, B.C., Arwin Tech. Sls.	604-980-4557

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CROMPTON INSTRS., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007, Tel: 312-593-1107, TELEX: 210295, FAX: 312-439-5747; Empl.: 38; *Sls. Mgr.:* Wayne Bordelon

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Local Sales Offices & Reps

CA	Granada Hills, Crown Elctrns.	818-368-7475
CA	Redwood City, Caltronic Assocs.	415-365-2545
CT	Weston, CJA Assoc.	203-226-4317
MI	Plymouth, Leading Edge Sls. Corp.	313-420-3344
NY	Syracuse, Lenard Co.	315-479-9191
OH	Cleveland, A.S.A.	216-232-4946
OH	Dayton, Mohawk Intronics	513-434-8873

CROUZET CONTROLS, INC., 1083 State Pkwy., Schaumburg, IL 60173-5419, Tel: 312-843-2200, TELEX: 210 219, FAX: 312-310-8330; Empl.: 18; *Sls. Mgr.:* Benoit Delcourt ..... **B•1239, 1711**

Local Sales Offices & Reps

CA	Corona Del Mar, Motion Control of So. CA	714-675-0211
CA	San Ramon, C. F. M. Sls.	415-866-1705
CO	Denver, Ralph R. Pence & Assocs.	303-936-3464
FL	Clearwater, Gen. Controls, Inc.	813-791-1903
IN	Indianapolis, Emsco Sls. & Engrg. Co.	317-251-7074
IA	Bettendorf, Custom Controls Ltd.	319-355-4787
MA	Taunton, Electro-Kinetics	617-880-0182
MA	Wellesley, Electro Kinetics	617-235-9415
MA	Wenham, Electro-Kinetics	617-468-4166
MN	Minneapolis, DeBeck-Hays Assoc.	612-835-3610
MO	Webster Grove, Schutz & Assocs. Ind. Sls., Inc.	314-962-2622
NY	Fairport, Tac Sls.	716-425-1070
NY	Plainview, Motion Control Sls.	516-756-5656
OH	Cincinnati, Bob Gilbert & Assocs.	513-574-1932
OH	Cincinnati, Bob Gilbert & Assocs.	513-761-4598
PA	Horsham, Jacobsen & Assocs.	215-674-2937
TX	Dallas, Blackburn & Assoc.	214-750-8484
UT	Salt Lake City, Advanced Control Equip.	801-485-0305
WA	Bellevue, Sea Inc.	206-883-4999
WA	Vancouver, Sea Inc.	206-573-5161
Can	Downsview, Ont., Tienkay Inc.	416-736-1221
Can	Longueuil, Que., Decofer	514-651-0285

Local Distributors

CA	Los Angeles, Master Distr.	213-452-1229
CA	San Carlos, Wertern Comp. Sls. N.	415-594-1222
CO	Colorado Springs, Summit Fasteners & Elec. Hdwe.	303-593-7700
FL	Hollywood, M.P. Assocs.	305-962-5751
FL	Lakeland, A. A. Elec.	813-665-6941
GA	Smyrna, Waffles Elec.	404-433-8377
IL	Chicago, Excel Elec.	312-421-7220
IL	Chicago, Hawk Elctrns.	312-459-4030
IL	Chicago, MC Master-Carr	312-834-9600
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-634-8202
IN	Indianapolis, Control Des. Supp.	317-788-4559
IN	Indianapolis, Vonnegut Indl. Prods.	317-899-8800/8877
IA	Bettendorf, Custom Controls Ltd.	319-335-4787
MA	Wellesley, Electro-Mechanical Distr.	617-235-1565
MI	Comstock Park, Mor Elec.	616-784-1121
MI	Grand Rapids, S-F Electronics	616-459-0216
MI	Royal Oak, George Instr. Co.	313-280-1111
MI	Saginaw, Fischer-Flack	517-752-4181
MN	St. Paul, Powermation	612-645-0781
NE	Omaha, Lakeland Engrg.	402-734-2600
NJ	Edison, Howman Applied Control Prods.	201-797-3313
NJ	Fair Lawn, Relay Specialties	201-797-3313
NC	Asheville, Electric Supply Co.	704-255-8899
NC	Gastonia, J.M.T. Elctrn. Supp.	704-867-4401
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cincinatti, Hughes-Peters.	513-351-2000
OH	Cleveland, Reserve Motion Control Sys.	216-826-0290
OH	Columbus, Hughes-Peters.	614-294-5351
OH	Dayton, Duellman Elctrns.	513-461-5010
OK	Tulsa, Radio Inc.	918-587-9123
PA	Allentown, P. A. Peters.	215-434-5237
PA	Philadelphia, Herbach & Rademan	215-426-1700
SC	Greenville, Holder Elec. Supp.	803-271-7111
TX	Ft. Worth, Swieco.	817-335-6521
WA	Kent, Motors & Controls Corp.	206-872-8010
WA	Seattle, Eicher-Richards Co.	206-523-7888
WI	Waukesha, Powermation	414-542-2868
Can	St. Hubert, Que., Decofer	514-678-2252
Can	Willowdale, Ont., PS Comps.	416-498-0214

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Local Sales Offices & Reps

AZ	Mesa, Sedco Sls.	602-461-9069
CA	San Mateo, Melvin Sls.	415-349-7444
CA	Trabuco Canyon, Martronix	714-858-0632
FL	Longwood, D-Assocs.	407-830-8976
MA	Milton, Naton Assoc.	617-698-0670
MO	St. Charles, Hayes Elec. Sls.	314-946-6677
NY	Melville, Carnes Assocs.	516-694-1600
OH	Englewood, Clayton-Ellier Co.	513-836-3556
PA	Glenside, Koebert Assocs. Inc.	215-887-2310
TX	Euless, Fralia Co. & Assocs.	817-267-3577
PA	Glensida, Koebert Assoc.	215-887-2310
WA	Bellevue, Eltech, Inc.	206-643-4330
WI	Oconomowoc, Artmor Ltd.	414-367-8789

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Local Sales Offices & Reps

AL	Huntsville, EMA, Inc.	205-830-4030
AR	Ft. Smith, Electra Reps, Inc.	501-452-7822
CA	Cerritos, Crydom Co.	213-865-3536
CA	Pleasanton, Sierra Sls. Engrg.	415-463-2250
CA	Stockton, Sierra Sls. Engrg.	209-465-3968
FL	Deerfield Bch., EMA Inc.	305-421-6830
FL	Longwood, EMA, Inc.	305-682-1202
GA	Roswell, EMA, Inc.	404-992-7240
IL	Elk Grove Village, Control Sls.	312-595-2110
IN	Carmel, Technology Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Technology Mktg. Corp.	219-432-5553
KY	Louisville, Technology Mktg. Corp.	502-893-1377
PA	Chestnut Hill, Deltratronics, Inc.	215-248-0294
MA	North Reading, Alpha Omega Sls.	508-664-1118
MI	Farmington Hills, Luebbe Sls.	313-489-8828
MN	Eden Prairie, Electronic Innovators, Inc.	612-941-0830
MO	St. Louis, Midtec Assocs.	314-275-8666
NY	Binghamton, GEN-TECH Elctrns.	607-648-8833
NY	Liverpool, Gen-Tech Elctrns.	315-451-3480
NY	Penfield, Gen-Tech Elctrns.	716-381-5159
NC	Charlotte, EMA, Inc.	704-365-0547
NC	Raleigh, EMA, Inc.	919-846-6888
OH	Cincinnati, Luebbe Sls. Co.	513-530-0600
OH	Cleveland, Cleveland Luebbe Sls.	216-333-0425
OH	Columbus, Luebbe Sls. Co.	614-431-0474
OH	Dayton, Luebbe Sls. Co.	513-294-0426
OR	Hillsboro, Turn-a-Round Sls.	503-640-4641
PA	Chestnut Hill, Deltatronics Inc.	215-248-0294
PA	Pittsburgh, Luebbe Sls. Co.	412-364-0490
TX	Austin, Electra Reps.	512-339-1163
TX	Dallas, Electra Reps.	214-248-3852
UT	Salt Lake City, Control Agy.	801-972-8787
VA	Richmond, McCourt Co., Inc.	804-741-3253
WI	Brookfield, Control Sls.	414-797-9500

CSB/USA, 1204 W. 7th St., Ft. Worth, TX 76102, Tel: 800-3CSB/USA, 817-332-1309, FAX: 817-332-6036; *Sls. Mgr.:* Gregg Hubbard ..... **D•1478**

Local Sales Offices & Reps

AL	Huntsville, Rep, Inc.	205-881-9270
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Los Altos, Frauman Assocs.	415-941-0660
GA	Atlanta, Rep, Inc.	404-938-4358
IL	MortonGrove, Power Pak, Inc.	312-966-6000
IL	Palatine, Technlg. Sls., Inc.	312-991-6600
IN	Granger, Wolff Sls., Inc.	219-272-4388
MA	Seekonk, Rudolph Mktg. Assocs.	617-399-6270
MI	Grand Rapids, Stiles & Assocs.	616-531-7759
NY	Franklin Sq., Cooper-Simon & Co., Inc.	516-489-0404
NC	Charlotte, Rep, Inc.	704-563-5554
OH	Lima, T.C. Co.	419-226-6952
TN	Knoxville, Rep, Inc.	615-475-9012
WI	Milwaukee, Technlg. Sls., Inc.	414-964-5015

Local Distributors

CA	San Diego, Tauber Elctrns.	619-274-7242
GA	Smyrna, ERC Parts, Inc.	404-352-1626

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CSI Capacitors

CSI CAPACITORS, CSI Technologies, 810 Rancheros Dr., San Marcos, CA 92069, Tel: 619-747-4000, TELEX: 697832; FSC No.: 10026; Empl.: 50; *Sls. Mgr.:* J. D. Kowalsky ..... **A•1067**

Local Sales Offices & Reps

AZ	Paradise Valley, Astrocom Mktg.	602-991-6646
CA	San Jose, Comtech Mktg.	408-365-7474
FL	Orlando, SAM Rep., Inc.	407-869-9565
IL	Chicago, Esco Assocs.	312-298-5310
KY	Louisville, K. W. Elctrn. Sls.	614-888-0483
MD	Middletown, ST/Woolard	301-371-4500
MA	Canton, New England Elctrn. Sls.	617-828-4835
NM	Albuquerque, Cleveland Entprs.	505-265-7893
NY	Cazenovia, S. T. Woolard	315-655-8145
OH	Dayton, K. W. Elctrn. Sls.	513-890-2150
OR	Tigard, Components West	503-684-1671
PA	Allison Pk., KW Elctrn. Sls.	412-487-4300
SC	Pickens, S.T. Woolard	803-878-3830
VA	Lynchburg, ST/Woolard	804-528-5421
WA	Redmond, Components West	206-885-5880
Can	Richmond, BC, Macom Agencies	604-271-2661

CSTS, 4015 E. Leaverton Ct., Anaheim, CA 92807, Tel: 714-632-1300, FAX: 714-632-1937; Empl.: 14

C-TEK INC., 4 Railroad Ave., Wakefield, MA 01880, Tel: 617-246-1720, FAX: 617-246-2905; Empl.: 15; *Sls. Mgr.:* John Vanaman; *Dist. Mgr.:* John Vanaman ..... **D•1142-1143**

Local Sales Offices & Reps

IL	Westchester, Cadre Technical Reps, Inc.	312-449-3900
CT	Seymour, R.H. Sturdy Co., Inc.	203-888-1480
IL	Hillside, Cadre Tech. Reps.	312-449-3900
MA	Wellesley Hills, R. H. Sturdy Co.	617-235-2330
MA	Wellesley Hills, R.H. Sturdy Co., Inc.	617-235-2330
MN	Minneapolis, Northstar Motion & Control	612-571-9600
MN	St. Paul, Northstar Motion & Control	612-770-5311
NY	Buffalo, Good Comps. Corp.	716-634-4400
Can	Nepean, Ont., Tech- Trad	613-727-1272
NC	Charlotte, Jake Rudisill Assocs.	704-377-6901
VA	Richmond, Jake Rudisill Assocs.	804-320-0201

Local Distributors

NC	Charlotte, Motionex	704-377-6901

CTI ELECTRONICS, 200 Benton Street, Stratford, CT 06497, Tel: 203-386-9779, TWX: 710-465-6349, FAX: 203-378-4986; Empl.: 19 ..... **D•1087**

Local Sales Offices & Reps

AL	Huntsville, Rakes Engrg. & Mktg. Corp.	205-533-3763
CA	Los Angeles, Leo Miller Co.	213-832-5858
CA	San Jose, Motion Sys., Inc.	408-246-0641
CT	Bridgeport, CTI Elctrns.	203-366-9444
FL	New Port Richey, Spinney Assocs.	813-848-8578
GA	Atlanta, Rakes Engrg. & Mktg. Corp.	404-447-6937
MO	Blue Springs, A-Tronics Sls. & Engrg. Co.	816-224-2131
NH	Manchester, Northeast Comps.	603-627-7242
NY	New Hartford, PDQ Assocs.	315-793-3666
OH	Columbus, McFadden Sls.	614-761-3177
PA	Glenside, Wyncote Instrmn. Co.	215-572-6500
TX	Dallas, Hamilton Elctrns.	214-987-3326
VA	Reston, Delmarva Technlgs.	703-620-3555
WI	Appleton, Vine Tech. Sls.	414-731-9873
WI	Genoa City, Vine Tech. Sls.	414-279-3871

CTS CORPORATION, 905 West Blvd. North, Elkhart, IN 46514, Tel: 219-293-7511, TWX: 810-294-2167; Empl.: 6,500; *Dist. Mgr.:* George Greener

Local Distributors

AL	Huntsville, Arrow Elctrns., Inc.	205-837-6955
AL	Huntsville, Bell Inds.	205-837-1074
AL	Huntsville, Hall-Mark Elctrns. Corp.	205-837-8700
AL	Huntsville, Marshall Inds.	205-881-9235
AZ	Phoenix, Marshall Inds.	602-496-0290
AZ	Tempe, Arrow Elctrns., Inc.	602-968-4800
AZ	Tempe, Bell Inds.	602-966-7800
CA	Canoga Pk., Hall-Mark Elctrns. Corp.	818-716-3300
CA	Chatsworth, Arrow Elctrns., Inc.	818-701-7500
CA	Chatsworth, Marshall Inds.	818-407-0101
CA	Citrus Hgts., Hall-Mark Elctrns. Corp.	916-722-8600
CA	El Monte, Marshall Inds. (Corp.)	818-459-5500
CA	Garden Grove, Bell Inds.	714-895-7801
CA	Gardena, Bell Inds.	213-515-1800
CA	Gardena, California Switch & Signal	213-538-9830
CA	Irvine, Marshall Inds.	714-859-5050
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Milpitas, Marshall Inds.	408-942-4600
CA	Rancho Cordova, Marshall Inds.	916-635-9700
CA	Rohnert Pk., First Source Elctrns. Corp.	707-586-0800
CA	Roseville, Bell Inds.	916-969-3100
CA	San Carlos, Logan Elctrns.	415-594-0700
CA	San Diego, Arrow Elctrns., Inc.	619-565-4800
CA	San Diego, Bell Inds.	619-268-1277
CA	San Diego, Hall-Mark Elctrns. Corp.	619-268-1201
CA	San Diego, Marshall Inds.	619-578-9600
CA	San Jose, Hall-Mark Elctrns. Corp.	408-432-0900
CA	San Jose, Rose Elctrns.	408-263-9700
CA	Sunnyvale, Arrow Elctrns., Inc.	408-745-6600
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Thousand Oaks, Bell Inds.	805-499-6821
CA	Torrance, Hall-Mark Elctrns. Corp.	213-217-8400
CA	Tustin, Arrow Elctrns., Inc.	714-838-5422
CA	Tustin, Hall-Mark Elctrns. Corp.	714-669-4100
CO	Aurora, Arrow Elctrns., Inc.	303-696-1111
CO	Denver, Integrated Elctrns. Co., Inc.	303-292-6121
CO	Englewood, Indl. Elctrns.	303-694-9444
CO	Englewood, Indl. Elctrns., Inc.	303-694-9444
CO	Thorton, Marshall Inds.	303-451-8444
CT	Wallingford, Arrow Elctrns., Inc.	203-265-7741
CT	Wallingford, Marshall Inds.	203-265-3822
CT	Wallingford, Midan Elctrns., Inc.	203-265-2077
CT	Wallingford, The Greene-Shaw Co., Inc.	203-265-3333
FL	Clearwater, Hall-Mark Elctrns. Corp.	813-530-4543
FL	Deerfield Bch., Arrow Elctrns., Inc.	305-429-8200
FL	Deerfield Bch., Bell Inds.	305-421-1997
FL	Ft. Lauderdale, Marshall Inds.	305-977-4880
FL	Largo, Bell Inds.	813-541-4434
FL	Orlando, Hall-Mark Elctrns. Corp.	305-855-4020
FL	Orlando, Marshall Inds.	305-841-1878
FL	Palm Bay, Arrow Elctrns., Inc.	305-841-2424
FL	Pompano Bch., Hall-Mark Elctrns. Corp.	305-971-9280
GA	Norcross, Arrow Elctrns., Inc.	404-449-8252
GA	Norcross, Bell Inds.	404-662-0923
GA	Norcross, Hall-Mark Elctrns. Corp.	404-447-8000
GA	Norcross, Marshall Inds.	404-923-5750
IL	Elk Grove Vl, Bell Inds.	312-640-1910
IL	Schaumburg, Arrow Elctrns., Inc.	312-397-3440
IL	Shaumburg, Marshall Inds.	312-490-0155
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IL	Wooddale, Hall-Mark Elctrns. Corp.	312-860-3800
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Arrow Elctrns., Inc.	317-243-9353
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Bell Inds. (JIT Only)	317-299-5487
IN	Indianapolis, Marshall Inds.	317-297-0483
IA	Cedar Rapids, Arrow Elctrns.	319-395-7230
IA	Cedar Rapids, Bell Inds.	319-395-0730
KS	Lenexa, Arrow Elctrns., Inc.	913-541-9542
KS	Lenexa, Hall-Mark Elctrns. Corp.	913-888-4747
KS	Lenexa, Marshall Inds.	913-492-3121
MD	Columbia, Arrow Elctrns., Inc.	301-995-0003
MD	Columbia, Hall-Mark Elctrns. Corp.	301-988-9800
MD	Gaithersburg, Marshall Inds.	301-840-9450
MA	Newton, The Greene-Shaw Co., Inc.	617-969-8900
MA	Wilmington, Marshall Inds.	617-658-0810
MA	Woburn, Arrow Elctrns., Inc.	617-933-8130
MI	Ann Arbor, Arrow Elctrns., Inc.	313-522-1040
MI	Ann Arobor, Bell Inds.	313-971-9093
MI	Grand Rapids, Arrow Elctrns. Inc.	616-243-0912
MI	Livonia, Marshall Inds.	313-525-5850
MN	Eden Prairie, Hall-Mark Elctrns. Corp.	612-941-2600
MN	Edina, Arrow Elctrns., Inc.	612-830-1800
MN	Minneapolis, Indl. Comps., Inc.	612-831-2666
MN	Plymouth, Marshall Inds.	612-559-2211
MO	Earth City, Hall-Mark Elctrns. Corp.	314-291-5350
MO	St. Louis, Arrow Elctrns., Inc.	314-567-6888
NE	Lincoln, Scott Elctrn. Supp. Corp.	402-466-8221
NH	Manchester, Arrow Elctrns., Inc.	603-668-6968
NJ	Clifton, Vantage Comps., Inc.	201-667-1840
NJ	Fairfield, Marshall Inds.	201-882-0320
NJ	Marlton, Arrow Elctrns., Inc.	609-596-8000
NJ	Mt. Laurel, Hall-Mark Elctrns. Corp.	609-235-1900
NJ	Mt. Laurel, Marshall Inds.	609-234-9100
NJ	Parsippany, Arrow Elctrns., Inc.	201-538-0900
NM	Albuquerque, Arrow Elctrns., Inc.	505-243-4566
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Buffalo, Summit Dists.	716-887-2800
NY	Commack, Vantage Comps.	516-543-2000
NY	Hauppauge, Arrow Elctrns., Inc.	516-231-1000
NY	Hauppauge, Marshall Inds.	516-273-2424
NY	Jamaica, Archer Indl. Dists., Inc.	718-291-3232

NY Johnson City, Marshall Inds. 607-798-1611
NY Melville, Arrow Elctrns., Inc. (Corp.) 516-694-6800
NY Melville, Semispecialists of America, Inc. (SAI) 516-293-2710
NY Mt. Vernon, QAR Indl. Elctrns. Sls., Inc. 914-699-2224
NY Rochester, Arrow Elctrns., Inc. 716-427-0300, 1-800-462-6422
NY Rochester, Marshall Inds. 716-235-7620
NY Rome, Rome Elctrns., Inc. 315-337-5400
NC Clifton, Vantage Comps., Inc. (Corp.) .. 201-667-1840
NC Raleigh, Arrow Elctrns., Inc. 919-876-3132
NC Raleigh, Hall-Mark Elctrns. Corp. 919-872-0712
NC Raleigh, Marshall Inds. 919-878-9882
NC Raleigh, RESCO/Raleigh 919-781-5700
NC Winston Salem, Arrow Elctrns., Inc. 919-725-8711
OH Centerville, Arrow Elctrns., Inc. 513-435-5563
OH Dayton, Bell Inds. 513-435-8660
OH Dayton, Marshall Inds. 513-236-8088
OH Solon, Arrow Elctrns., Inc. 216-248-3990
OH Solon, Hall-Mark Elctrns. Corp. 216-349-4632
OH Solon, Marshall Inds. 216-248-1788
OH Worthington, Hall-Mark Elctrns. Corp. 614-888-3313
OK Broken Arrow, Hall-Mark Elctrns. Corp. 1-800-327-9989
OK Tulsa, Arrow Elctrns., Inc. 918-665-7700
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TX Carrollton, Marshall Inds. 214-233-5200
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TX Dallas, Hall-Mark Elctrns. Corp. (Corp.) 214-343-5000
TX Dallas, Southwest Elctrns., Inc. 214-234-3050
TX Houston, Arrow Elctrns. 713-530-4700
TX Houston, Hall-Mark Elctrns. Corp. 713-781-6100
TX Houston, Marshall Inds. 713-895-9200
TX Stafford, S.W. Elctrns., Inc. 713-491-4900
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UT Salt Lake City, Marshall Inds. 801-485-1551
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WA Bellevue, Bell Inds. 206-747-1515
WA Bellevue, Marshall Inds. 206-641-6800
WI Brookfield, Arrow Elctrns., Inc. 414-792-0150
WI Brookfield, Marshall Inds. 414-797-8400
WI New Berlin, Hall-Mark Elctrns. Corp. .. 414-797-7844
WI Waukesha, Bell Inds. 414-547-8879
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Can Montreal, Que., Arrow Elctrns. Canada Ltd. 514-735-5511
Can Quebec City, Que., Arrow Elctrns. Canada Ltd. 418-687-4231

CTS CORPORATION, Connector Division, 9210 Science Center Dr., New Hope, MN 55428, Tel: 612-533-3533, TWX: 910-576-2717; FSC No.: 16512; Empl.: 300; *Sls. Mgr.:* Steve Otto

'Refer to CTS Corp., Elkhart, IN, for sales offices & representatives & for distributor listings.'

CTS CORP., ELECTROMECHANICAL DIV., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, Tel: 219-295-3575, FAX: 219-295-2099; *Sls. Mgr.:* R. G. Sumrak

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CTS CORPORATION
FREQUENCY CONTROLS DIVISION

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CTS CORP., FREQUENCY CONTROL DIV., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548, Tel: 815-786-8411, TWX: 910-642-0860; Empl.: 450; *Sls. Mgr.:* Terry Luxmore, Act. Sls. Mgr. ..... **A•1372-1393**

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CTS CORPORATION, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906, Tel: 317-463-2565, TWX: 810-342-1882; Empl.: 505; *Sls. Mgr.:* Dick Kramer

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CTS CORP., RESISTOR NETWORK DIV., (Formerly CTS Corp., Berne Div.), 406 Parr Rd., Berne, IN 46711, Tel: 219-589-3111, TWX: 810-323-1580; Empl.: 1100; *Sls. Mgr.:* D. L. Akers; *Dist. Mgr.:* Cliff Stults ..... **A•1922-1923**

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CTS CORPORATION, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446, Tel: 805-238-0350, TELEX: 62537040, FAX: 805-238-9663; *Sls. Mgr.:* Jack Bell; *Dist. Mgr.:* Bob Tarkenton ..... **B•1712-1716**

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CTS CORPORATION, Systems Division, 6900 Shady Oak Rd., Eden Prairie, MN 55344, Tel: 612-941-9100, TWX: 910-576-2913; FSC No.: 21542; Empl.: 1400; *Sls. Mgr.:* S. Beyl

'Refer to CTS Corp., Elkhart, IN, for sales offices & representatives & for distributor listings.'

CTS CORPORATION, Tool, Die & Machine Division, 3000 Engle Rd., Fort Wayne, IN 46809, Tel: 219-747-0531

Refer to CTS Corp., Elkhart, IN, for sales offices and representatives and for distributor listings.

CTS OF CANADA, LTD., 80 Thomas St., Streetsville, Ontario, Can. L5M 1Y9, Tel: 416-826-1141

Refer to CTS Corp., Elkhart, IN, for sales offices and representatives and for distributor listings.

CTSI INTERNATIONAL INC., 75 Mall Drive, Commack, NY 11725-5703, Tel: 516-864-5260, FAX: 516-864-5878; Empl.: 50; *Sls. Mgr.:* Paul Onish

CUBIT, Div. of Proteus Industries. Inc., 340 Pioneer Way, Mountain View, CA 94041, Tel: 415-962-8237, FAX: 415-965-9355; Empl.: 27; *Sls. Mgr.:* Jon Heiner

CUESTA SYSTEMS CORPORATION, 3440 Roberto Ct., San Luis Obispo, CA 93401, Tel: 805-541-4160, 800-332-3440, TELEX: 4949381 CUESTA; *Sls. Mgr.:* Gary Brehmer

CUNO, INC., Process Filtration Products, 400 Research Pkwy., Meriden, CT 06450, Tel: 203-237-5541, TELEX: 221083; Empl.: 700

CUPLEX, INC., 1500 E. Hwy. 66, Garland, TX 75040, Tel: 214-276-0333, FAX: 214-276-3401; Empl.: 389; *Sls. Mgr.:* Grady C. Young

CURRENT RING CO. INC., 252 Sunset Drive, P. O. 1525, Ballwin, MO 63011, Tel: 800-325-8653, FAX: 314-423-5637; *Sls. Mgr.:* Peter Racen; *Dist. Mgr.:* Peter Racen

CURRENT TECHNOLOGY, INC., 1400 S. Sherman, 6202, Richardson, TX 75081, Tel: 214-238-5300, FAX: 214-238-0911; *Sls. Mgr.:* Barry Epstein; *Dist. Mgr.:* Peter Diamond

CURTIS ELECTRO DEVICES, INC., Box 4090, Mountain View, CA 94040, Tel: 415-964-3846, FAX: 415-964-3574; Empl.: 10; *Sls. Mgr.:* P. Curtis

CURTIS INDUSTRIES, INC.

FAX: 414-535-1150

CURTIS INDUSTRIES, 7400 W. Douglas Ave., P.O. Box 18699, Milwaukee, WI 53218-0699, Tel: 414-535-1500, TWX: 910-262-3035; FSC No.: 73631; Empl.: 160; *Sls. Mgr.:* W.M. Tennie; *Dist. Mgr.:* Al Hungsberg ..... **A•1646-1647; C•1318-1319**

Local Sales Offices & Reps
AL Huntsville, Advanced Comps. Mktg. 205-881-5493
CA Garden Grove, Elsco Elctrns., Inc. 714-891-4621

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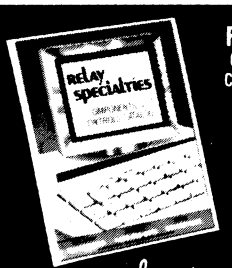

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IN Indianapolis, Bell Ind., Graham Div. 317-875-8200
IN Indianapolis, Pioneer Std. 317-849-7300
IA Cedar Rapids, Dee Elctrns. 319-365-7551
IA Cedar Rapids, Hamilton/Avnet 319-362-4757
KS Lenexa, Hamilton/Avnet 913-888-8900
KY Lexington, Hamilton/Avnet 606-259-1475
MD Baltimore, RESCO 301-529-0500
MD Beltsville, RESCO 301-937-9100
MD Columbia, Hamilton/Avnet 301-995-3526
MD Columbia, T. T. I, Inc. 301-995-1331
MD Gaithersburg, Pioneer Technlgs. 301-921-0660
MA Billerica, A. W. Mayer Co. 617-229-2255
MA Lexington, Pioneer Std. 617-861-9200
MA Peabody, Hamilton/Avnet 617-596-7668
MA Wilmington, T.T.I. Inc. 508-658-4700
MA Woburn, Sterling Elctrns. 617-938-6200
MI Grand Rapids, Hamilton/Avnet 616-243-8805
MI Grand Rapids, Pioneer Std. 616-698-1800
MI Grand Rapids, S-F Elctrn. Supp. 616-459-0216
MI Livonia, Hamilton/Avnet 313-522-4700
MI Livonia, Pioneer Std. 313-525-1800
MI Livonia, R-S Elctrns. 313-525-1155
MI Livonia, Reptron Elctrns. 313-525-2700
MI Novi, Hamilton/Avnet 313-347-4270
MI Oak Pk., Newark Elctrns. 313-967-0600
MN Eden Prairie, Pioneer-Std. 612-935-5444
MN Eden Prairie, T. T. I, Inc. 612-944-5080
MN Minneapolis, Newark Elctrns. 612-331-6350
MN Minneapolis, Stark Elctrns. 612-332-1325
MN Minnetonka, Hamilton/Avnet 612-932-0670
MN St. Paul, Shelley-Ragon, Inc. 612-642-2828
MO Earth City, Hamilton/Avnet 314-344-1254
MO Independence, Shelley-Ragon, Inc. 816-254-3410
NH Manchester, Hamilton/Avnet 603-624-9400
NJ Cherry Hill, Hamilton/Avnet 609-424-0117
NJ Cranford, G.S.I. Elec. 201-272-6400
NJ Fairfield, Hamilton/Avnet 201-575-3490
NJ Kenilworth, Federated Purchaser 201-272-0505
NJ Mount Laurel, T.T.I, Inc. 609-234-6400
NJ Pine Brook, Pioneer Std. 201-575-3510
NM Albuquerque, Hamilton/Avnet 505-765-1500
NY Binghamton, Pioneer Std. 607-722-9300
NY Bohemia, March Elctrns. 516-563-6000
NY Buffalo, Summit Distr. 716-887-2800
NY Endwell, A.S.I. Elctrns. 607-754-3823
NY Fairport, Pioneer Std. 716-381-7070
NY Farmingdale, Command Elctrns. 516-293-1212
NY Hauppauge, Fairmont 516-231-3313
NY Hauppauge, Hamilton/Avnet 516-231-9800
NY Medford, Shelley-Ragon, Inc. 516-447-2000
NY Rochester, Hamilton/Avnet 716-272-2704
NY Rome, Rome Elctrns. 315-337-5400
NY Ronkonkoma, T.T.I, Inc. 516-737-2000
NY Syracuse, Hamilton/Avnet 315-437-2641
NY Valley Stream, L&S Elctrns. 516-561-2474
NY Woodbury, Pioneer Std. 516-921-8700
NC Charlotte, Pioneer Technlgs. 704-527-8188
NC Raleigh, Hamilton/Avnet 919-878-0819
NC Raleigh, RESCO 919-781-5700
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cleveland, Hamilton/Avnet 216-831-3500
OH Cleveland, Pioneer Standard 216-587-3600
OH Columbus, T.T.I. Inc. 614-848-5770
OH Dayton, Bell Inds. 513-435-8660
OH Dayton, Bell Inds., Military Div. 513-434-8231
OH Dayton, Hamilton/Avnet 513-439-6730
OH Dayton, Hamilton/Avnet 513-439-6700
OH Dayton, Pioneer Standard 513-236-9900
OH Dayton, Stotts-Friedman Co. 513-298-5555
OH Solon, Hamilton/Avnet 216-349-5100
OH Valley View, Newark Elctrns. 216-447-8860
OH Westerville, Hamilton/Avnet 614-882-7004
OK Tulsa, Hamilton/Avnet 918-252-7297
OK Tulsa, Radio, Inc. 918-587-9123
OR Beaverton, Acacia Div. of Univar 503-646-3377
OR Beaverton, Hamilton/Avnet 503-526-6209
OR Portland, Radar Elec. 503-232-3404
PA Horsham, Pioneer Technlgs. 215-674-4000
PA McKean, Advacom 814-476-7774
PA Philadelphia, Almo Elctrns., Inc. 215-698-4009
PA Pittsburgh, Hamilton/Avnet 412-281-4150
PA Pittsburgh, Pioneer Std. 412-782-2300
PA York, E.C.I., Inc. 717-846-5334
TX Austin, Hamilton/Avnet 512-837-8911
TX Austin, Pioneer Std. 512-835-4000
TX Dallas, Pioneer Std. 214-386-7300
TX Dallas, Shelley-Ragon, Inc. 214-349-2424
TX Dallas, Sterling Elctrns. 214-243-1600
TX Ft. Worth, T.T.I., Inc. 817-831-8300
TX Ft. Worth, T.T.I., Inc. 817-595-3100
TX Garland, Newark Elctrns. 214-494-5911
TX Houston, Lenert Co. 713-225-1465
TX Houston, Newark Elctrns. 713-783-1629
TX Houston, Pioneer Std. 713-988-5555
TX Houston, Sterling Elctrns. 713-627-9800
TX Irving, Hamilton/Avnet 214-550-6155
TX Irving, Hamilton/Avnet 214-550-6111
TX Stafford, Hamilton/Avnet 713-274-9336
UT Salt Lake City, Hamilton/Avnet 801-974-9649
WA Redmond, Hamilton/Avnet 206-881-6697
WA Redmond, Shelley-Ragon Inc. 206-883-2220
WA Redmond, T.T.I. Inc. 206-882-0291
WA Seattle, Radar Elec. 206-282-2511
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI Waukesha, Hamilton/Avnet 414-784-4510

DALE ELECTRONICS, INC., El Paso Div., P.O. Box 26728, El Paso, TX 79926-6728, Tel: 915-592-3253; FSC No.: 91637; Empl.: 272; *Sls. Mgr.:* Douglas Wagenknecht; *Dist. Mgr.:* Jerry Jilek ..... **A•1925-1928, 1940-1942; B•1890-1893**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701-2242, Tel: 402-371-0080; FSC No.: 91637; Empl.: 1200; *Sls. Mgr.:* Jim Filips; *Dist. Mgr.:* Jerry Jilek ..... **A•1929-1936, 1940-1943**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, Techno Division, 7803 Lemona Avenue, Van Nuys, CA 91405-1139, Tel: 818-781-1642; FSC No.: 69274; Empl.: 140; *Sls. Mgr.:* Danny Jagirdar; *Dist. Mgr.:* Jerry Jidek ..... **A•1924, 1940-1942, 2100-2103**

Refer to Dale Electronics, Inc., Columbus, NE for sale offices and distributor information.

DALE ELECTRONICS, INC., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282-1883, Tel: 602-967-7874; FSC No.: 22929; Empl.: 139; *Sls. Mgr.:* Mike Brown; *Dist. Mgr.:* Jerry Jilek ..... **A•1394-1397, 2092-2099**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078-0180, Tel: 605-665-9301; FSC No.: 09969; Empl.: 400; *Sls. Mgr.:* John Elliot; *Dist. Mgr.:* Jerry Jilek ..... **A•1232-1239, 2273-2275; C•1325-1327**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE WESTERN THERMISTOR DIVISION, See Dale Norfolk Division

DAMON

FAX: 617-329-0551

DAMON ELECTRONICS DIV., 80 Wilson Way, Westwood, MA 02090, Tel: 617-329-2460, TWX: 710-348-6722; Empl.: 90; *Sls. Mgr.:* Edward J. Doherty ... **A•1398**

Local Sales Offices & Reps
AZ Phoenix, Sanford Sls. Assocs. 602-957-3570
CA N. Hollywood, Jewett Co. 213-789-8103
CA Palo Alto, Tri-Rep 415-965-1822,
DC Washington, Stemler Assocs. 301-944-8262
FL Melbourne, Repcom 305-254-1877
MD Baltimore, Stemler Assocs. 301-944-8262
MA Waltham, Del Tech Sls. 617-890-1020
NJ Cherry Hill, Stemler Assocs. 609-966-4070
NJ Hackensack, T.M.A. Assoc. 201-342-4008
TX Ft. Worth, El-Tec Sls. 817-268-2896

D & B POWER, INC.

FAX: 516-586-5952

D & B POWER, INC., 204 N. Fehr Way, P.O. Box 40M, Bayshore, NY 11706, Tel: 516-586-5955; FSC No.: 54337; Empl.: 25; *Sls. Mgr.:* Gordon Best; *Dist. Mgr.:* Dan Hall ..... **D•1716-1717**

Local Sales Offices & Reps
CA Pasadena, Electro Mecha. Instrs. 818-795-7193
NY Rochester, Technical Comp. Sls. 716-342-2406

Local Distributors
MA Shannon, Adcour, Inc. 617-784-8123

D & P MFG. INC., 32 Hamilton St., Chalfont, PA 18914, Tel: 215-997-1200, FAX: 215-997-1200; Empl.: 7

DMC DANIELS MANUFACTURING CORPORATION

FAX: 407-855-6884

DANIELS MANUFACTURING CORP., 6103 Anno Ave., Orlando, FL 32809, Tel: 407-855-6161, TELEX: 564321; FSC No.: 11851; Empl.: 180; *Sls. Mgr.:* Dave Kelly; *Dist. Mgr.:* Ralph R. Recht ..... **C•1753**

Local Sales Offices & Reps
CA San Diego, Cetinske Sls. Co. 619-487-3335
CA Yorba Linda, DMC Western Regional 714-996-5881
CO Englewood, Columbine Fab. 303-761-2121
CT Orange, DMC N.E. Regional Off. 203-799-2343
TX Bedford, DMC S.W. Regional Off. 817-283-2750
VA Virginia Beach, Summit Inds. & Marine 804-463-8820
WA Redmond, Pan Pacific Electronics 206-881-7252

Local Distributors
CO Englewood, Columbine Fabricators ... 303-761-2121
CT Hamden, Connector Company 203-288-0044
TX Fort Worth, Wadco 817-483-9111
VA Virginia Beach, Summit Inds. & Marine 804-463-8820
WA Redmond, Pan Pacific Electronics 206-881-7252
Can Ontario, Patlon Aircraft 416-624-5572

DAN-L INC., 229 Laurel Rd., E. Northport, NY 11731, Tel: 516-757-8000; FSC No.: 28327; Empl.: 22

DANMAR INDS., 9705 Lurline Ave., Chatsworth, CA 91311, Tel: 818-882-7979/5280, FAX: 818-882-5280; FSC No.: 31690; Empl.: 10; *Sls. Mgr.:* Mukund Patel

DANTEL, 2991 N. Argyle Ave., Fresno, CA 93727, Tel: 209-292-1111, TELEX: 35-5457, FAX: 209-292-9355; FSC No.: 56960; Empl.: 205; *Sls. Mgr.:* Dan Finch

DANTRONICS, INC., 3175 Hafner Ct., St. Paul, MN 55126, Tel: 612-484-2108; Empl.: 22

DASIBI ENVIRONMENTAL SW CORP., Dasibi Environmental Corp., Box 14447, Austin, TX 78761, Tel: 512-835-0330, TWX: 910-350-5536, FAX: 512-832-1775; Empl.: 14; *Sls. Mgr.:* Ronnie Laufman

DASOFT DESIGN SYSTEMS, INC., 1827-B Fifth St., Berkeley, CA 94710, Tel: 415-486-0822, TELEX: 4945245; Empl.: 8

DATA, INC., 7702 Emerald Ave., Box 2071, Ft. Collins, CO 80525, Tel: 303-493-1222; Empl.: 3; *Sls. Mgr.:* Sharon Shilling; *Dist. Mgr.:* Sharon Shilling

D.A.T.A., INC., International Thomson Organization, P.O. Box 26875, San Diego, CA 92126, Tel: 619-578-7600, TWX: 910-322-1340; Empl.: 30; *Sls. Mgr.:* Allen Gressler

DATA CAPTURE TECHNOLOGY, Hathaway Corp., 10837 E. Marshall, Tulsa, OK 74116, Tel: 918-438-5366, TELEX: 796355; FSC No.: 7E812; Empl.: 30; *Sls. Mgr.:* Raymond Johnson

DATA CHECK CORPORATION, 9918 Via Pasar, San Diego, CA 92126, Tel: 619-578-0101, FAX: 619-578-9215; FSC No.: 55792; Empl.: 45; *Sls. Mgr.:* Bill Acosta

DATACHRON INC., 1150 E. Stanford Court, Anaheim, CA 92805, Tel: 714-385-1705, FAX: 714-978-2514; FSC No.: 56259; Empl.: 19; *Sls. Mgr.:* Clyde Davis

Local Sales Offices & Reps

CA Palo Alto, Egbert Engrg. 415-326-1387
FL Titusville, Data-Time, Inc. 407-267-5600
NM Albuquerque, Rustco 505-292-2741

DATA CIRCUITS, COMPUTER LOGICS LTD., 6380 Viscount Rd., Mississauga, Ont., Canada L4V 1H3, Tel: 416-672-3833, TELEX: 416-672-3869; Empl.: 80; *Sls. Mgr.:* Rick Way; *Dist. Mgr.:* Rick Way

DATACOM, INC., Box 278, Ft. Walton Beach, FL 32549, Tel: 904-244-6121, TWX: 510-730-7693, FAX: 904-244-6344; Empl.: 50

DATACON, INC., 60 Blanchard Rd., Burlington, MA 01803, Tel: 617-273-5800, FAX: 617-273-4809; Empl.: 350; *Dist. Mgr.:* Tom Malek ..... **C•1725; D•1119**

Local Sales Offices & Reps

AL Huntsville, Macro Mktg. 205-883-9630
CA El Toro, Par Mktg. 714-768-6021
CA San Jose, Arnold Tech. Sls. 408-954-0400
CO Littleton, Con-Tek Mktg. 303-973-8490
FL Altamonte Springs, Semtronics 305-831-8233
FL Clearwater, Semtronics 813-461-4675
FL Ft. Lauderdale, Semtronics 305-731-2484
GA Norcross, Macro Mktg. 404-662-5580
IL Downers Grove, Richmar Elctrns. 312-968-0118
IN Indianapolis, Richmar Elctrns. 317-577-9950
MD Severna Park, New Era Sls. 301-544-4100
MA Needham Heights, Todino Engrg. Sls., Inc. 617-444-7925
MI Livonia, Amtech Reps., Inc. 313-474-8300
MN Minneapolis, Loren Green 612-571-6666
NJ Englewood, Gray Assocs. 201-894-0894
NY Brooklyn, Schwartz, HY 718-266-1526
NY Syracuse, I.A. Hotze Assocs. 315-455-8807
OH Chargin Falls, John J. Bair & Assocs. 216-247-8244
PA Newton Square, Hagy Assocs. 215-459-0504
PA Southeastern, Quality Comps. Co. 215-687-3553
TX Plano, Richmar Elctrns. 214-424-8388
TX Round Rock, Richmar Elctrns. 512-255-2551
WI Butler, Richmar Elctrns. 414-781-1730

data delay devices, inc.

FAX: 201-773-9672

DATA DELAY DEVICES, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, Tel: 201-773-2299 ..... **A•1541-1555**

Local Sales Offices & Reps

AL Huntsville, Mountain Electro Prods. ... 205-533-0084
AZ Phoenix, Tech Sls., Inc. 602-246-1614
AR R-Squared 713-820-3210
CA El Toro, Martronix 714-858-0632
CA Mountain View, Weseloh/Swanson & Assocs. 415-961-0565
CT Dynamic Sls., Inc. 617-272-5676
DE Jack McCoy Assocs. 215-363-0350
FL Casselberry, Southern Elctrns. Mktg. .. 407-332-4718
GA Stone Mountain, Mountain Electro Prods., Inc. 404-448-5594
IN J. M. Finnegan & Co. 216-238-5905
KY J. M. Finnegan & Co. 216-238-5905
LA R-Squared 713-820-3210
ME Dynamic Sls., Inc. 617-272-5676
MA Burlington, Dynamic Sls., Inc. 617-272-5676
MI Grand Rapids, Jim Finnegan & Co. ... 616-245-4621
MS Mountain Electro Prods. 404-448-5594
NH Dynamic Sls., Inc. 617-272-5676
NJ Medford, Jack McCoy Assocs. 609-953-0770
NY Pittsford, James E. Zimmmerman Sls. 716-381-3186
NC Durham, Mountain Electro Prods. 919-383-9839
OH Vandalia, Jim Finnegan & Co. 513-890-8322
OK R-Squared 713-820-3210
PA Downingtown, Jack McCoy, Inc. 215-363-0350
PA Pittsburgh, Jim Finnegan & Co. 412-823-5400
RI Dynamic Sls., Inc. 617-272-5676
SC Mountain Electro Prods. 404-448-5594
TN Mountain Electro Prods. 404-448-5594
TX Houston, R-Squared 713-820-3210
VT Dynamic Sls., Inc. 617-272-5676
VA Jim Finnegan & Co. 216-238-5905
Can Ont., Source Elctrns. 416-676-0830

Local Distributors

CA Sunnyvale, Target Elctrns. 408-734-5611

DATA-DESIGN LABS., P.O. Box 711, 7925 Center Ave., Cucamonga, CA 91730, Tel: 714-987-2511; Empl.: 1400; *Sls. Mgr.:* M. L. Sneller

DATA DEVICE CORP., See ILC Data Device Corp.

DATA DISPLAY PRODUCTS, Box 91072, Los Angeles, CA 90009, Tel: 213-640-0442, FAX: 213-640-7639; FSC No.: 15513; Empl.: 35; *Sls. Mgr.:* Peggy Stevens

DATA ENGINEERING, INC., 2515 N. State Rd. 7 Ste. 207, Margate, FL 33063, Tel: 305-971-0400

DATA INSTRUMENTS, INC., 100 Discovery Way, Acton, MA 01720, Tel: 508-264-9550, TELEX: 200081; Empl.: 285; *Sls. Mgr.:* Ernest C. Lutfy ..... **B•1943**

Local Sales Offices & Reps

AL Huntsville, FLW Southeast, Inc. 205-536-6207
AZ Scottsdale, Williams Assocs. 602-947-4297
CA Laguna Hills, Elotek Sys., Inc. 714-830-4856
CA San Carlos, Elctrn. Engrg. Assocs. 415-593-2189
CO Englewood, Dynatech, Inc. 303-773-2830
FL Orlando, FLW Southeast, Inc. 305-894-1100
GA Marietta, FLW Southeast, Inc. 404-424-1731
IL Addison, Robert Kanter 312-620-8701
MA Acton, Data Instrs., Inc. 617-264-9550
MA Acton, Dave Hannon 617-264-9550
MO Florissant, Delltron Co. 314-839-0033
MO Kansas City, Delltron Co. 816-436-6445
NM Albuquerque, Williams Assocs. 505-255-1638
NY Albany, Robert F. Lamb Co., Inc. 518-869-3355
NY Buffalo, The Robert F. Lamb Co. 716-827-1111
NY Rochester, Robert F. Lamb Co., Inc. ... 716-323-1250
NY Syracuse, Robert F. Lamb Co., Inc. 315-455-2469
NC Charlotte, Emco, Inc. 704-372-8281
OH Sharonville, Production Resources, Inc. 513-777-0400
OH Worthington, Bob Young 614-431-0412
OK Tulsa, Bauman Instr. Corp. 918-492-8086
PA Radnor, Pressure Prods. Inc. 215-688-7795
TN Memphis, FLW Southeast, Inc. 901-345-3563
TX Arlington, Collinsystems, Inc. 817-261-2703
TX Houston, Collinsystem Inc. 713-464-9428
WA Redmond, S.E.A. Sls. 206-883-4999
WA Vancouver, S.E.A. Sls. 206-573-5161
Can Woodbridge, Ont., Technel Engrg. Inc. 416-851-4244

Local Distributors

CO Lafayette, Big Horn Instrmn. 303-665-4054
CT Meriden, Meriden Cooper 203-237-8448
GA Columbus, Wetherbee Elec. Supp. Inc. 404-568-0157
IL Rockford, Power/mation 815-397-0510
IN Indianapolis, J. N. Fauver Co., Inc. 317-872-3060
MA Billerica, Tanyx Meas. Inc. 617-671-0183
MI Kalamazoo, North Cen. Engrg., Inc. ... 616-349-3010
MI Midland, North Cen. Engrg., Inc. 517-631-3274
MI Taylor, North Cen. Engrg., Inc. 313-942-942-0900
MN St. Paul, Power/mation 612-645-0781
MO Kansas City, ISL Corp. 816-587-5400
MO St. Louis, ISL Corp. 314-535-5760
NY Albany, KOM Lamb Inc. 518-382-1044
NY Buffalo, KOM Lamb Inc. 716-874-3530
NY Rochester, KOM Lamb Inc. 716-266-1868
NY Syracuse, KOM Lamb Inc. 315-455-7436
NC Charlotte, EMCO 704-372-8281
OH Sharonville, Production Resources, Inc. 513-777-0400
OH Twinsburg, The Stanley M. Proctor Co. 216-425-7814
OR Portland, Brancom Instr. 503-283-2555
UT Salt Lake City, Rust Automation Equip. 801-486-9865
WA Colbert, Branom Instr. 509-466-9365
WA Seattle, Branom Instr. 206-762-6050
WI Green Bay, Power/mation 414-496-0944
WI Waukesha, Power/mation 414-542-2868

DATA I/O CORP., 10525 Willows Rd. N.E., Redmond, WA 98073-9746, Tel: 206-881-6444, TELEX: 15-2167; Empl.: 550

DATAK CORP., 3117 Paterson Plank Rd., N. Bergen, NJ 07047, Tel: 201-863-7667, FAX: 201-863-4199; *Sls. Mgr.:* Theresa Pflueger ..... **C•1584, 1726**

Local Sales Offices & Reps

AL Birmingham, Henry W. Phillips Co., Inc. 205-979-3572
CA City of Industry, Don Forth Assocs. ... 818-333-8009
CA Foster City, Polach & Bensinger 415-578-8200
CO Denver, MKP Mktg., Inc. 303-759-5661
FL Lauderdale Lakes, Seacom Sls. Co., Inc. 305-486-0260
GA Roswell, Henry W. Phillips Co. 404-992-3070
IL Des Plaines, Manx Co. 312-299-6269
IN Indianapolis, Elmarcon, Inc. 317-846-0221
MD Silver Spring, Mid-Atlantic Sls. 301-593-7749
MI Grand Blanc, Inter-Comm, Inc. 313-695-0665
MO Raytown, Marty Taraski Sls. 816-358-1442
NC Statesville, Henry W. Phillips Co., Inc. 704-876-0730
OH Chagrin Falls, L.W. Bennett & Assoc. .. 216-247-2174
OR Portland, Jos. V. Belusko 503-222-4279
PA Philadelphia, Instrmn. Specialties 215-742-0898
RI Coventry, Adams McGregor 401-726-1300
TX Dallas, J & J Sls. Co. 214-328-9739

Local Distributors

AL Birmingham, ACK Radio Supp. Co. 205-322-0588
AZ Phoenix, Tri-Tek, Inc. 602-371-0860
AZ Tempe, Circuit Specialists 602-966-0764
AZ Tucson, Inland Elctrns. 602-889-5301
CA Milpitas, Zack Elctrns. 408-942-5432
CA Pasadena, Dow Radio 818-793-1196
CA San Jose, Quement Elctrns. 408-998-5900
CA Sunnyvale, Fry's Elctrns. 408-733-1770
CA Thousand Oaks, Pace Elctrns. 805-497-7515
CA Van Nuys, All Elctrns. 818-333-8009
CO Denver, Gateway Elctrns. 303-458-5444
CT Greenwich, Wise Comps. 203-531-4880
CT Hartford, Hatry Elec. 203-527-1881
CT Wallingford, Tron Town U.S.A. 203-237-5598
DE Wilmington, Wholesale Elctrns. 302-656-9988
FL Miami, Elctrn. Equip. 305-871-3500
FL Orlando, Orlando Frame & Art 305-898-6271
GA Atlanta, Ack Elctrn. Supp. 404-351-6340
GA Atlanta, Specialty Distrb. Co. 404-873-2521
IL Berwyn, B-B & W, Inc. 312-749-1710
IL Mt. Prospect, Tri-State Elec. 312-255-0600
IL Niles, Joseph Elec. 312-297-4200
IL Peoria, Klaus Radio, Inc. 309-691-4840

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KY	Louisville, Peerless Elec.	502-637-7674
LA	Lafayette, Ralph's	318-233-0105
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MI	Livonia, Norwest Elctrns.	313-261-4551
MN	Minneapolis, Acme Elctrns.	612-338-4754
MO	Kansas City, Elctrn. Supp.	816-931-0250
MO	St. Louis, Gateway Elec.	314-427-6116
MO	St. Louis, Van Sickle	314-621-5000
NE	Lincoln, Scott Elec. Supp.	402-466-8221
NV	Las Vegas, Hurley Elec.	702-384-5666
NV	Reno, Elect. Distr. Co.	702-323-2766
NH	Pelham, Radiokit	603-635-2235
NJ	Greenbrook, Greenbrook Elctrns.	201-968-3500
NJ	Rahway, RSR Elctrns.	201-381-8777
NY	Buffalo, Summit Distr.	716-887-2800
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Plainview, Kelvin Elctrns.	516-349-7620
NY	Rochester, Summit Elec.	716-334-8110
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Cincinnati, URI Elec.	513-761-4030
OH	Columbus, Hughes Peters	513-351-2000
OK	Oklahoma City, Radio Supp.	405-232-6127
OR	Beaverton, Norvac Elec.	503-644-1025
OR	Portland, Portland Radio Supp.	503-228-8647
PA	Braddock, Leff Elctrns.	412-351-5000
PA	Drexel Hill, Kass Elctrns.	215-449-2300
PA	Philadelphia, A.C. Radio	215-462-9379
PA	Reading, Barbey Elctrns.	215-376-6116
RI	Providence, W. Dandreta & Co.	401-861-2800
SC	Charleston, Wholesale Inds. Elctrns.	803-722-2634
TN	Memphis, Bluff City Distr.	901-345-9500
TX	Dallas, Electrotex Elect. Corp. of TX	214-234-0433
TX	El Paso, Ideal Indl. Elec. Supp.	915-779-6647
TX	Houston, Elctrn. Parts Outlet	713-784-0140
TX	San Antonio, Altex Elctrns.	512-828-0503
UT	Salt Lake City, Kimball Elec.	801-328-2075
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
VA	Arlington, Arlington Elec. Whlse.	703-524-2412
VA	Norfolk, Priest Elctrns.	804-855-0105
WA	Seattle, Seattle Art	206-625-0711
WI	Milwaukee, Indl. Elctrns.	414-276-1212

DATAPOWER INC., Power Systems Div., 3545 Cadillac Ave., Costa Mesa, CA 92626, Tel: 714-754-4400, TWX: 910-595-1560, FAX: 714-754-5407; Empl.: 120; *Sls. Mgr.:* Bob Gomez; *Dist. Mgr.:* Edward Blackman

DATA POWER, See Beaver Labs

DATA PRECISION CORP., Analogic Corp., Electronics Ave., Danvers, MA 01923, Tel: 617-246-1600, TELEX: 6817144; Empl.: 140; *Sls. Mgr.:* Jay Long

DATAPROBE, 170 Coolidge Ave., Englewood, NJ 07631, Tel: 201-569-6464, TELEX: 200679-PROB-UR, FAX: 201-894-0939; Empl.: 20; *Sls. Mgr.:* D. Weiss; *Dist. Mgr.:* S. Weiss

DATAPRODUCTS CORPORATION, 6200 Canoga Ave., Woodland Hills, CA 91365, Tel: 818-888-4014, TELEX: 67-4734, FAX: 818-887-4789; Empl.: 4200; *Sls. Mgr.:* Keith Bauserman; *Dist. Mgr.:* Keith Bauserman

DATAPRODUCTS NEW ENGLAND, INC., 50 Barnes Park North, Wallingford, CT 06492, Tel: 203-265-7151, FAX: 203-265-9101; Empl.: 400; *Sls. Mgr.:* Robert Griffith

DATAQ INSTRUMENTS, INC., 825 Sweitzer Ave., Akron, OH 44311, Tel: 216-434-4284, TELEX: 6502817028

DATA RACE, INC., 12758 Cimarron Path, San Antonio, TX 78249, Tel: 512-692-3909, TELEX: 517659 RTS TX, FAX: 512-692-7632; Empl.: 28; *Sls. Mgr.:* Garrick C. Colwell

DATARAM CORP., P. O. Box 7528, Princeton, NJ 08543-7528, Tel: 609-799-0071, 800-822-0071, TWX: 510-685-2542, FAX: 609-799-6734; Empl.: 100; *Sls. Mgr.:* Carl Anderson

DATA RAY CORPORATION

FAX: 303-466-9524

DATA RAY CORP., 452 Burbank Street, Broomfield, CO 80020, Tel: 303-469-5173; Empl.: 75; *Sls. Mgr.:* E. Yanagida ..... **B•1058-1060**

Local Sales Offices & Reps

CA	Mtn. View, Straube Assocs.	415-969-6060
CA	Seal Bch., Texel	213-596-9411
OR	Beaverton, Olson Tech. Sls.	503-643-9488
WA	Bellevue, Olson Tech. Sls.	206-883-7792

DATA RENTALS/SLS., INC, 4209 Van Owen Place, Burbank, CA 91505, Tel: 818-843-1221; Empl.: 140; *Sls. Mgr.:* Steven Beaver, VP Mktg.

DATA SET CABLE CO., INC., 748 Danbury Rd., Ridgefield, CT 06877, Tel: 203-438-9684, TWX: 710-467-0668, FAX: 203-431-4657; Empl.: 70; *Sls. Mgr.:* T. Busch

DATASOUTH COMPUTER CORP., 4216 Stuart Andrew, P.O. Box 240947, Charlotte, NC 28224, Tel: 704-523-8500, TELEX: 6843018, FAX: 704-523-9298; Empl.: 160; *Dist. Mgr.:* Ann Vetas, National Accounts Mgr.

DATA SPECIALTIES, INC., See Zebra Technologies Corp.

DATA TECH, DIV. OF PENRIL CORP., See Moisture Register Products Div., Aqua Measure Instrument Co.

DATA TECHNOLOGY, INC., 4 Gill St., Woburn, MA 01811, Tel: 617-935-8820, FAX: 617-935-9656; Empl.: 45; *Sls. Mgr.:* L. Rizzo ..... **B•1945-1947**

Local Sales Offices & Reps

AZ	Paradise Valley, Tech Rep Comps.	602-443-8288
CA	Danville, Tech Rep Comps.	415-866-1705
CA	Lomita, Tech Rep Assocs.	213-539-9070
CA	Tarzana, Tech Rep Comps.	818-708-9161
CO	Englewood, Thorson Rocky Mtn., Inc.	303-799-3435,
FL	Melbourne, R-Rep Co.	305-725-6993
IL	Elk Grove VL, Carlson Elctrn. Sls.	312-956-8240
MD	Columbia, Tyler Griffin Co.	301-596-1808
NY	E. Rochester, A & D Dvcs.	716-385-2778
NY	Hawthorne, Swedelco, Inc.	914-747-0101
NY	Sidney, Southern Tier Equip.	607-563-8978
OH	Cincinnatti, Drivex Corp.	513-474-5100
OH	Cleveland, Servo Mark, Inc.	216-871-2353
TX	Dallas, Blackburn Assocs.	214-750-8484,
UT	Salt Lake City, Thorson Rocky Mt.	801-973-7969
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790

Local Distributors

NY	Sidney, Southern Tier Equip. & Cont.	607-563-8978

DATATRAN CORP., 355 Yuma St., Denver, CO 80223, Tel: 303-778-0870, FAX: 303-778-0877; Empl.: 17; *Sls. Mgr.:* Cindi L. Kemper; *Dist. Mgr.:* Cindi L. Kemper

DATA TRANSLATION, INC., 100 Locke Dr., Marlboro, MA 01752, Tel: 508-481-3700, TELEX: 951646, FAX: 617-481-8620; FSC No.: 61867; Empl.: 270; *Sls. Mgr.:* John Molinari; *Dist. Mgr.:* Michael Travis

DATATROL, Division of Data Card Corporation, Brent Dr., Hudson, MA 01749, Tel: 617-568-1411; Empl.: 125; *Sls. Mgr.:* Howard Cantor

Distributor

DATATRONICS, LTD., P. O. Box 2839, Blue Jay, CA 92317, Tel: 714-336-3561, TWX: 910-595-1578 DATAN US LKARW 663, 684, 719, 722, 767, 783, 805, 820

DATATRONIC SYSTEMS CORP., Computer Sciences Div., Bx 44128 EEM/NMR, Panorama City, CA 91412-0128, Tel: 818-988-5290; Empl.: 150

DATA WORLD PRODUCTS, Second N.H. Tpke., Francestown, NH 03043, Tel: 603-588-3746; *Sls. Mgr.:* Stephen Berry

DATAWRAP, INC., 37 Water St., Wakefield, MA 01880, Tel: 617-246-5757, FAX: 617-246-5758; Empl.: 16; *Sls. Mgr.:* Tony Lockwood

DA-TECH CORP., 141 Railroad Drive, Ivyland, PA 18974, Tel: 215-322-9410; Empl.: 110; *Sls. Mgr.:* Bradford W. Bentz

DATEL

FAX: 508-339-6356

DATEL, INC., 11 Cabot Blvd., Mansfield, MA 02048-1194, Tel: 508-339-3000, TELEX: 174388; Empl.: 550; *Sls. Mgr.:* N. Renaud ..... **D•1167-1175**

Local Sales Offices & Reps

AL	Huntsville, Advanced Comps. Mkt.	205-881-5493
AZ	Phoenix, Tech. Sls.	602-246-1614
CA	Santa Ana, Datel	714-835-2751
CO	Denver, Elcom, Inc.	303-337-2300
CT	Southbury, Dynamic Technlgs.	203-262-6220
FL	Coral Springs, H. A., Inc.	305-752-7520
GA	Norcross, Advanced Comps. Mktg.	404-448-7025
IL	Hoffman Estates, Carvel Engrg. & Sls.	312-885-8800
IA	Cedar Rapids, Ensco-Rep, Inc.	319-396-1109
KS	Wichita, Ensco-Rep Inc.	316-683-1070
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Mansfield, Datel	508-339-3000
MI	Auburn Hgts., Infinity, Inc.	313-853-9880
MN	Edina, Carvel Engrg. & Sls.	612-835-7929
MO	Maryland Heights, Ensco-Rep, Inc.	314-423-3935
NJ	Fairfield, ASTROREP, Inc.	201-808-0025
NM	Albuquerque, S & S Technlgs. Inc	505-255-5599
NY	Babylon, Astrorep	516-422-2500
NY	Clark Mills, KLM-Garner	315-853-6126
OH	Cleveland, Arthur Baier Co.	216-461-6161
PA	Feasterville, Knowles Assocs.	215-322-7100
PA	Pittsburgh, Arthur Baier Co.	412-367-7799
TX	Carrollton, Tech. Mktg., Inc.	214-387-3601
UT	Salt Lake City, Elcom, Inc.	801-486-4233
WA	Bellevue, Advanced Power Comps.	206-527-7945
WA	Seattle, Advanced Power Comps.	206-747-9127
WI	Sheboygan, Carvel Engrg. & Sls.	414-457-8800
Can	Burnaby, B.C., Vitel Elctrns.	604-682-3139
Can	Kanata, Ontario, Vitel Elctrns.	613-592-0090
Can	Lachine, Quebec, Vitel Elctrns.	514-636-5951
Can	Mississauga, Ontario, Vitel Elctrns.	416-676-9720

Local Distributors

AL	Huntsville, Magaro & Assocs.	205-882-0827
FL	Orlando, Magaro & Assocs.	407-859-6546
GA	Atlanta, Magaro & Assocs.	404-451-8862/8876
NC	Greensboro, Magaro & Assocs.	919-294-4783

DATRON INSTRUMENTS, A Wavetek Company, Hurricane Way, Norwich, England, United Kingdom NR6 6JB, Tel: 603-404824, TELEX: 851975173, FAX: 603-483670

DATRON INSTRS., INC., 3401 SW 42nd Ave., Stuart, FL 33497, Tel: 305-283-0935, TELEX: 525724; FSC No.: 66-15b,66-23F,66 Part II SECT H, J; Empl.: 120; *Sls. Mgr.:* Irene Bugno

DATRON SYSTEMS, INC., 200 West Los Angeles Ave., Simi Valley, CA 93065-1650, Tel: 805-584-1717, TWX: 910-494-2787, FAX: 805-526-0885; FSC No.: 32255; Empl.. 160; *Sls. Mgr.:* Bruce Strean, VP Mktg.

DATUM INC., Timing/Aacom Divisions, 1363 S. State College Blvd., Anaheim, CA 92806-5790, Tel: 714-533-6333, TELEX: 4722045 (intl.), TWX: 910-592-1289; FSC No.: 31160; Empl.: 280; *Sls. Mgr.:* Charles Neumann ..... **D•1066, 1176**

Local Sales Offices & Reps

AL	Huntsville, Southern Mktg. Assocs. Ltd.	205-534-6020
CA	Anaheim, Datum	714-533-6333
CA	San Diego, M. Ficken	619-292-9392
CA	Santa Clara, Ward/Davis Assocs.	408-245-3700
CO	Aurora, Vic Meyers Assocs. Inc.	303-629-9676
CT	Mt. Carmel, Scientific Dvcs.- Connecticut	203-248-9361
FL	Longwood, Southern Mktg. Assocs. Ltd.	407-682-7317
FL	Satellite, Southern Mktg. Assocs. Ltd.	407-777-3587
GA	Marietta, Southern Mktg. Assocs. Ltd.	404-565-0603
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs.	317-293-5437
MA	Waltham, Scientific Devices-New England	617-890-2252
MA	Wayland, Daner-Hayes	508-655-0888
WI	New Berlin, Marsland	414-786-6611
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-991-1399
NJ	Haddonfield, G. L. Williams Assocs.	609-428-6060

NM Albuquerque, Vic Meyers Assocs. Inc. 505-884-6878
NC Greensboro, Southern Mktg. Assocs. Ltd. 919-854-5588
OH Dublin, Micro Sls. Corp. 614-792-9117
OH No. Olmsted, Micro Sls. Corp. 216-734-3080
OK Tulsa, Data Mktg. Assocs. 918-494-2711
TX Austin, Data Mktg. Assocs. 512-338-4701
TX Dallas, Data Mktg. Assocs. 214-661-0300
TX Houston, Data Mktg. Assocs. 713-954-5020
TX San Antonio, Data Mktg. Assocs. 512-342-3031
UT Salt Lake City, Vic Meyers Assocs. Inc. 801-581-1760
MD Rockville, Creative Mktg. Assocs. 301-251-4100
WA Seattle, Comptronics 206-284-4842

DAVIDGE CORPORATION, 94 Commerce Dr., Buellton, CA 93427, Tel: 805-688-9598, FAX: 805-688-3306; *Sls. Mgr.:* Dean Davidge

DAVIES, HARRY, MOLDING CO., 4920 Bloomingdale Ave., Chicago, IL 60639, Tel: 312-622-8966; FSC No.: 72512; Empl.: 113; *Sls. Mgr.:* Leo A. Sera; *Dist. Mgr.:* Leo A. Sera

DAYCO PRODUCTS, INC., P.O. Box 1004, Dayton, OH 45401-1004, Tel: 513-226-5923, TELEX: 288219, TWX: 810-459-1822; Empl.: 4500

DAYTRONIC CORP., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342, Tel: 513-866-3300, TWX: 810-473-2978, FAX: 513-866-3327; Empl.: 180; *Sls. Mgr.:* John A. Perkins

DBA SYSTEMS, INC., P.O. Drawer 550, Melbourne, FL 32902-0550, Tel: 305-727-0660, TELEX: 56-4383; Empl.: 740

D-B-DEVELOPMENTS, 201 Mill St., Rome, NY 13440 Tel: 315-338-2184; Empl.: 3

DCI INC., 14812 W. 117th Street, P.O. Box 215, Olathe, KS 66061, Tel: 913-782-5672, FAX: 913-782-5766; FSC No.: 58677; Empl.: 25; *Sls. Mgr.:* Larry Shelton ..... **B•1061; D•1380**

Local Sales Offices & Reps

AL Huntsville, Saber Assocs. 800-327-0853
AZ Phoenix, J. Smith & Assoc. 602-267-0981
CA Los Angeles, Power Partners 213-215-0800
CA Mtn. View, XEL 415-969-1222
CO Colorado Springs, J. Smith & Assoc. 303-597-5343
CT Tolland, R. G. Assoc. 203-875-4201
FL Melbourne, Saber Assocs. 407-724-0920
GA Lawrenceville, Saber Assocs. 800-327-0853
IL Chicago, Commodore I 312-394-5441
MO Raytown, Vertec 816-737-0377
MA Marchfield, R. G. Assocs. 617-837-3290
MN Minneapolis, Trask Engrg. 612-537-2434
MO Manchester, Vertec 314-394-6242
NJ Marlton, Analectro, Inc. 609-983-1088
NJ Scotch Plains, Analectro 201-396-8310
NM Albuquerque, J. Smith & Assoc. 505-265-3406
NY Pittsford, L-Tron 716-383-0050
NC Clayton, Saber Assocs. 800-327-0853
OH Cleveland, Bradcor 216-671-1200
OH Dayton, Bradcor 513-294-5477
TX Dallas, Meas. Sys. & Sls. 214-934-0247
VA Alexandria, Analectro 703-922-4317
Can Montreal, Que., Morrison & Force Dvcs. 514-737-0072

DEAK TECHNOLOGY, INC., See Elpaz Instruments, Inc.

DE ANZA MFG. & SVCS. INC., 310 E. Caribbean Dr., Sunnyvale, CA 94089, Tel: 408-734-2020, FAX: 408-734-2580; FSC No.: 5935 & 5965; Empl.: 100; *Sls. Mgr.:* Michael A. Takahara

DEARBORN WIRE & CABLE, INC., 250 W. Carpenter, Wheeling, IL 60090, Tel: 312-459-1000, 800-323-0198, TWX: 910-253-0343, FAX: 312-459-0170; FSC No.: 28105; Empl.: 135; *Sls. Mgr.:* Ray Grabowski; *Dist. Mgr.:* Donna Kudlicki

DE COURSEY ENGINEERING LABORATORY, 11828 W. Jefferson, Culver City, CA 90230, Tel: 213-EX7-9668; Empl.: 7

DEGUSSA CORP., Temperature Sensing Products, 104 New Era Drive, So. Plainfield, NJ 07080, Tel: 201-757-6500, TELEX: 4754247, FAX: 201-757-8561; FSC No.: 630673043; *Sls. Mgr.:* David W. Molnar

Local Sales Offices & Reps

CA Mtn. View, Gado Instr. Sls. 415-961-2222
CA San Dimas, RDX Corp. 714-599-0985
CO Littleton, Bennett Co. 303-933-1690
IL Woodstock, TMI Inc. 815-385-2212
KS Louisburg, Advanced Indl. Syss. Co. .. 913-837-4328
MN Maple Grove, Pyramid Controls 612-420-7579
NJ Hohokus, Par Assocs. 201-444-6200
NY Fairport, Protech Controls Corp. ..... 716-377-4310 -
PA Bethel Park, Advance Instrs. Sls. 412-835-6200
PA Doylestown, Scott Instrs. Inc. 215-348-8989
TN Knoxville, Hile Controls of TN 615-584-0208
VA Chester, Hile Controls of VA 804-796-3001
WA Medical Lake, Calvert Controls Inc. ... 509-244-3601

DEI, 230 N. Market Pl., Escondido, CA 92025, Tel: 619-743-8344, FAX: 619-743-5297; Empl.: 30; *Sls. Mgr.:* Matt Pedote

DEK INC., 3480 Swenson Ave., St. Charles, IL 60174, Tel: 312-377-2575, FAX: 312-377-0372; Empl.: 115; *Sls. Mgr.:* L. R. Pappone

DELBERT BLINN CO., Box 2007, Pomona, CA 91769, Tel: 714-629-3900, FAX: 714-622-6218; Empl.: 6

DEL

FAX: 914-699-4005

DEL ELCTRNS. CORP., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, Tel: 914-699-2000, TWX: 710-562-0130; FSC No.: 01378; Empl.: 115 ..... **A•1068-1069, 2277; D•1719-1723**

Local Sales Offices & Reps

AZ Tempe, Trembly Assocs. 602-967-2058
CA Los Alamitos, Power Specialist, Inc. ... 213-594-9418
CA Mountain View, Leddy Assocs., Inc. ... 415-969-6313
CA Santa Clara, Sourcetronics, Inc. 408-988-8801
CO Wheatridge, Trembly Assocs. 303-421-8900
IL Elmhurst, Scott Assoc. 312-279-5681
IL Elmhurst, Scott Assocs. 312-279-5681
MA Burlington, Ta Tek 617-272-4550
MI Dearborn, Pitcher-Poulin 313-582-5450
MN Burnsville, Allied Comps. Reps., Inc. ... 612-435-7876
NV Las Vegas, Trembly Assocs. 702-739-9770
NM Albuquerque, Trembly Assocs. 505-266-8616
NY E. Syracuse, Nycom Inc. 315-437-8343
PA Ardmore, Martin Assocs. 215-649-6332
TX Richardson, Barry Sls. 214-234-0255
UT Salt Lake City, Trembly Assocs. 801-486-5292
Can Toronto, Ont., Norgay Entprs. Ltd. 416-234-8966

DELEVAN / SMD Divisions
AMERICAN PRECISION INDUSTRIES
Electronic Components Group

FAX: 716-652-4814

DELEVAN DIV., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, Tel: 716-652-3600, TELEX: 91-293; FSC No.: 99800; Empl.: 300; *Sls. Mgr.:* Denis Kohlhagen ..... **A•1240-1245**

Local Sales Offices & Reps

AL Decatur, El Tech 205-353-7899
AZ Phoenix, Toward Engrg. 602-955-3193
CA Chatsworth, First Rep. of S. CA 818-718-6155
CA Del Mar, Galaxie Sls. Int'l. 619-480-5540
CA El Toro, Delevan 714-768-5522
CA Freemont, Advanced Technlg. Sls. 415-651-6402
CO Englewood, Romulus 303-770-4888
FL Hollywood, Askland Elctrn. Comps. ... 305-987-1074
IL Downers Grove, Momak Sls. 312-963-6400
IN Fort Wayne, Liberty Sls. 317-888-8396
IN New Albany, Liberty Sls. 317-888-8396
IA Cedar Rapids, C. Horn & Asst. 319-393-8703
KS Parker, S. W. Wollard 913-898-6552
MD Lutherville, D. A. Dougherty Sls. Co. ... 301-321-7890
MA Sterling, Compatible Comps. 617-422-6762
MN Mendota Hgts., G-II Sls. 612-454-3086
NJ Bellmawr, TAI 609-933-2600
NY Johnson City, Tech-Mark 607-729-6340
NY Manhassett, Ballou, Inc. 516-627-1151
NY Mendon, Tech-Mark 716-624-3840
NY Utica, Tech-Mark 315-733-0575
NC Raleigh, Godwin 919-878-8000
OH Troy, M & T Sls. 513-339-5882
TX Irving, Kite Elctrn. Sls. Co. 214-986-0321
WA Bellevue, N. R. Schultz 206-454-0300
Can Mississauga, J. G. Weiss Co. Ltd. 416-673-0011
Can Nepean, J. G. Weiss Co. Ltd. 613-825-0545
Can St. Laurent, J. G. Weiss Co. Ltd. 514-337-5022
Can Vancouver, J. G. Weiss Co. Ltd. 604-873-1112
Can Winnipeg, J. G. Weiss Co. Ltd. 204-949-1877

Local Distributors

CA Irvine, ITT Multicomponents 714-727-4001
CA Santa Clara, WDG/Santa Clara 408-727-2500
CA Stanton, Inductive Comps. 716-828-3420
FL Ft. Lauderdale, Bros. Elec. of FL 800-331-8080
IA Cedar Rapids, Dee Elctrns. 319-365-7551
MA Burlington, Compatible Comps. 617-270-9246
MA Sterling, Compatible Comps. 617-422-6762
MN Fridley, Voyager Elctrns. Corp. 612-571-7766
NJ E. Brunswick, Brothers Elctrns. 201-238-2200
NJ W. Berlin, GCI 609-768-6767
NY Bohemia, Car-Lac 516-567-4200
NY Buffalo, Summit Distrs. 716-884-3450
NY Farmingdale, Milgray/New York 516-420-9800
NY Plainview, ACI Elctrns. 516-293-6630
PA Norristown, Century Elctrn. Comp. 215-631-5400
TX Fort Worth, Patco Supply 817-429-8596
Can Burnaby B.C., R-A-E Indl. Elctrns. Ltd. 604-291-8866
Can Don Mills, Ontario, Saynor Varah Elctrns. 416-445-0723
Can Montreal, Quebec, Prelco Elctrns. Ltd. 514-389-8051
Can Pointe-Claire Quebec, Future Elctrn. .. 514-694-7710

DELTA DESIGN, 5775 Kearny Villa Rd., San Diego, CA 92123-1111, Tel: 619-292-5000, TWX: 910-335-1215, FAX: 619-277-7884; Empl.: 110; *Sls. Mgr.:* Bob Williams

DELTA ELECTRONICS MFG. CORP., 416 Cabot St., Beverly, MA 01915, Tel: 617-927-1060, TELEX: 710-347-0631; FSC No.: 00795; Empl.: 210; *Sls. Mgr.:* S. J. Somerset; *Dist. Mgr.:* R. J. Cullinan

DELTA M CORPORATION, 525 Warehouse Rd., Oak Ridge, TN 37830, Tel: 615-483-1569

DELTA

FAX: 415-770-0122

DELTA PRODUCTS CORPORATION, 3823 Spinnaker Ct., Fremont, CA 94538, Tel: 415-770-0660; Empl.: 15 Local/2000 Overseas; *Sls. Mgr.:* Joe Desmond; *Dist. Mgr.:* Joe Desmond ..... **A•1648-1650; C•1328-1329, 1642-1643**

Local Sales Offices & Reps

AL Huntsville, Technlg. Mktg. Assocs. Inc. 205-883-7893
CA Newport Bch., Venture Tech. Sls. 714-646-6475
CA Santa Clara, Gagner-Toomey Assocs. 408-244-2200
CT North Haven, Kitchen & Kutchen 203-239-0212
GA Atlanta, Technlg. Mktg. Assocs., Inc. ... 404-446-3565
IL Wheeling, United Prods. Co. 312-459-1222
MA Burlington, Kitchen & Kutchen 617-229-2660
MN Edina, Hanna Lind Ltd. 612-925-5700
NJ Berkley Hgts., Cambridge & Allen Assocs. 201-464-0203
OH Shaker Hgts., Omega Sls., Inc. 513-434-5507
OH University Hgts., Omega Sls.-Cleveland 216-751-9600
OK Tulsa, Advance Tech. Sls. 918-664-0482
TX Houston, Texoma Tech. Sls. 713-462-1432
PR San Juan, Elctrn. Tech. Sls. 809-720-1300

Local Distributors

AL Huntsville, Hammond Elctrns. 205-830-4764
CA Buena Park, Cypress Elctrns. 714-521-5230
CA Fullerton, Pyramid Elctrns. 714-773-0781
CA San Diego, Cypress Elctrns. 619-535-0011
CA San Diego, Pyramid Elctrns. 619-271-5404
CA San Diego, Sigma Elctrns. 619-565-2000
CA San Jose, Compass Comp. 408-432-7575
CA San Jose, Sierra West 408-435-7477
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CO Wheatridge, Added Value Elctrns. 303-422-1701
CO Wheatridge, Cypress Elctrns. 303-431-2622
CT Wallingford, Cronin Elctrn. 203-265-3134
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
GA Norcross, Hammond Elctrns. 404-449-1996
MD Beltsville, Pertricko Sls. 301-937-4960
MA 617-657-6523
MA Needham, Cronin 617-449-5000
MA Wilmington, JV Elctrns. 617-273-4300
MN Minneapolis, Berquist Co. 612-835-2322

NH Hudson, TNT Elctrns. 603-880-8300
NJ Camden, General Radio 609-964-8560
NY Mt. Vernon, Q.A.R. Indl. 914-699-2224
NC Greensboro, Hammond Elctrns. 919-275-6391
OH Cincinnati, Schuster 216-425-8134
OR Beaverton, Cypress Elctrns. 503-641-2233
PA Harrisburg, Pyttronics 215-643-2850
TX Allen, Prime Distrbg. Co. 800-526-7478
TX Dallas, Cypress 214-869-1435
WA Bothell, Cypress Elctrns. 206-483-1144
WA Kent, Pyramid Elctrns. 206-872-5800
Can Mississauga, Ont., Prelco Elctrns. 416-678-0401
Can Montreal, Prelco Elctrns. 514-389-8051
Can Nepean, Ont., Prelco Elctrns. 613-726-1800

DELTA WIRE & CABLE CO., 1260 Neil Ln., North Chicago, IL 60064, Tel: 312-473-4990, FAX: 312-473-2425; Empl.: 12; *Sls. Mgr.:* Perry Stein

DELTEC CO., 13065 H Tom White Way, Norwalk, CA 90650, Tel: 213-926-2304, FAX: 213-926-8536; Empl.: 7; *Sls. Mgr.:* Dennis Orman

DELTEC CORPORATION, A Fiskars Co., 2727 Kurtz St., San Diego, CA 92110, Tel: 619-291-4211, 800-854-2658, TELEX: 910-335-1241, FAX: 619-299-6124; FSC No.: 52297; Empl.: 200; *Sls. Mgr.:* Jeff Frank

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FAX: 414-671-6809

DELTROL CONTROLS, 2745 S. 19th St., Milwaukee, WI 53215, Tel: 414-671-6800, TELEX: 26871; Empl.: 250; *Sls. Mgr.:* D. Uhen; *Dist. Mgr.:* D. Uhen ..... **B•1462-1463, 1658-1661**

Local Sales Offices & Reps

AL Huntsville, JWL Assocs. 205-883-1712
AZ Tucson, Earl Clemick & Assocs. 602-749-4003
CA Canago Park, C & W Comp. Sls. 818-700-2684
CA Santa Clara, Gagner-Toomey Assocs. 408-244-2200
CO Boulder, Front Range Mktg. 303-443-4780
CT Bloomfield, Wood Sls. Corp. 203-243-0457
FL Deerfield Bch., Jack Krutek & Assocs. 305-427-4202
GA Atlanta, JWL Assocs. 404-320-7643
IL Elk Grove Village, Tristar Group 312-593-0200
IN Wannamaker, Nationwide Comps. 317-872-7207
MA Wakefield, Wood Sls. Corp. 617-245-8300
MN St. Paul, Kencotronics, Inc. 612-645-7717
MO Chesterfield, Weisler & Assocs. 314-537-0010
NY Pt. Washington, Ashtec Inc. 516-767-0336
NY Rochester, Omni Sls. 716-342-5270
NC Pineville, JWL Assocs. 704-541-5750
OH Willoughby, Nationwide Comps. 216-946-3226
PA Valley Forge, Providence Mktg. 215-935-3300
TX Houston, Weisler & Assocs. 713-467-1862
UT Midvale, Front Range Mktg. 801-566-2500
WA Vancouver, Halbar Assocs. 206-696-0170
WI Milwaukee, Werking Ind. Sls. 414-964-2225
Can Laval Que., Elcom GBM, Inc. 514-668-3361

Local Distributors

AL Birmingham, American Elctrn. Supp. 205-942-4656
AL Montgomery, Southern Controls 205-277-5030

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CA San Jose, Consolidated Parts 408-435-1200
CA Tustin, Western Switches 714-259-8144
CA Van Nuys, Wes-Garde Comps. 213-873-4802
CO Denver, Integrated Elctrns. 303-292-6121
CT Hartford, Hatry Elctrns. 203-527-1881
CT Waterbury, Century Elec. 203-755-0405
FL Altamonte Springs, Control Des. 407-788-3220
FL Ft. Lauderdale, SE Elctrns. 305-563-4131
FL Lakeland, Wes-Garde Comps. 813-644-7564
FL Orlando, EMSCO 407-849-6362
GA Stone Mountain, Control Des. 404-979-3500
IL Bensenville, Gould Elctrns. 312-860-7171
IL Villa Park, Melvin Elctrns. 312-279-5015
IN Indianapolis, Control Design 317-788-4559
IA Davenport, Warren Radio 319-322-5301
IA Dubuque, Miller Elec. Supp. 319-588-1469
IA Marion, Control Des. 319-373-2923
IA West Des Moines, Ramco Co. 515-225-6933
KS Kansas City, Kornfield Thorp Elec. 913-321-7070
KS Wichita, Kriz-Davis Co. 316-267-4354
KY Louisville, Peerless Elctrn. Equip. 502-637-7674
MD Aberdeen, Harco Elctrns. 301-838-7990
MA Brighton, Interstate Elctrns. Equip. 617-782-9000
MA Westborough, In Stock Prods. 508-870-5750
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MI Madison Hgts., Galco Indl. Elctrns. 313-542-9090
MN Minneapolis, Control Design 612-721-6555
MO St. Louis, Wes-Garde Comps. 314-567-7776
NH Keene, Tradesmen Elctrl. Supp. 603-352-1205
NJ Oakland, Relay Specialties 201-337-1000
NJ Raritan, Masters Elctrn. 201-725-3533
NY Hauppauge, Broadline Elctrns. 516-231-4100
NY Hempstead, Davis Elctrns. 516-483-9200
NY Rochester, Masline Elctrns. 716-546-5373
NY Vestal, Wholesale Elec. Supp. 607-729-1526
ND Fargo, WESCO 701-232-4446
ND Minot, John Iverson Co. 801-852-4466
OH Akron, AESCO Elctrns. 216-762-8818
OH Wickliffe, Gateway Megatech 216-953-0333
OK Ardmore, Ardmore Elec. Supp. 405-223-3571
OK Tulsa, Radio, Inc. 918-587-9123
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PA Erie, Rem Elctrns. 814-453-5626
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SD Aberdeen, Plainsco 605-225-7100
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UT Salt Lake City, Kimball Elctrns. 801-328-2075
VA Glen Allen, Hermitage Distrs. 804-798-3830
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WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Control Design 414-784-1015

DELTRON, INC., P.O. Box 1369, Wissahickon Ave., N. Wales, PA 19454-9990, Tel: 215-699-9261, FAX: 1 215 699 2310; Empl.: 175-180; *Sls. Mgr.:* Jack Phillips; *Dist. Mgr.:* Linda Schepise, Prod. Mgr.

DENNIS CHEMICAL, 2700 Papin St., St. Louis, MO 63103, Tel: 314-771-1800, FAX: 314-771-8399; Empl.: 70; *Sls. Mgr.:* Charles F. Seger III; *Dist. Mgr.:* Charles F. Seger III

DENNISON MFG. CO., 300 Howard St., Framingham, MA 01701, Tel: 617-879-0511, TELEX: 948-478; FSC No.: 5975;2310; Empl.: 8000; *Sls. Mgr.:* George Curtis; *Dist. Mgr.:* Don Malloy

DENSEPAC MICROSYSTEMS, INC., 7321 Lincoln Way, Garden Grove, CA 92641-1428, Tel: 714-898-0007, 800-64-CHIPS, TWX: 510-601-1045; Empl.: 50; *Sls. Mgr.:* Stephen J. Whyte

DC DENSITRON CORPORATION

FAX: 213-534-8419

DENSITRON CORPORATION, Densitron International, 2540 W. 237th St., Torrance, CA 90505, Tel: 213-530-3530, TWX: 910-349-6200; FSC No.: 62483; Empl.: 42; *Sls. Mgr.:* Kevin Finn; *Dist. Mgr.:* Kevin Finn ..... **B•1062-1063**

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AL Huntsville, E.M.A. 205-536-3044
AL Huntsville, Elctrn. Mktg., Inc. 205-837-7363
AZ Phoenix, Chaparral Elctrn., Inc. 602-252-0897
CA Irvine, Comp. Mktg. Assocs. 714-951-5950
CA San Mateo, Comp. Mktg. Assocs. 415-345-7373
CO Arvada, Delconec 303-422-7023
CT W. Hartford, Nova Assocs. (M-R Tech. Sls.) 203-521-2101
FL Margate, E.P.M. Corp. 305-977-0331
GA Decatur, E.A.B., Inc. 404-981-1600
IL Northbrook, H. Benjamin & Assoc. 312-272-2900
IA Marion, Ensco-Rep, Inc. 319-377-8551
KS Wichita, Ensco-Rep, Inc. 316-683-1071
MA Braintree, Nova Assocs. 617-848-9330
MI Southfield, R. C. Nordstrom & Co. 313-559-7373
MN Minneapolis, Electro-Serv 612-338-3475
MO Maryland Heights, Ensco-Rep, Inc. 314-423-3935
NJ Cherry Hill, Metz-Benham Assocs., Inc. 609-424-0404
NY Marcellus, J. G. Welch Assocs. 315-685-6280
NY Patchogue, Optimum Sls. 516-758-0644
NY Rochester, J. G. Welch Assocs. 716-244-1100
NY Rochester, Mullahy-Welch Sls. 716-266-2798
NC Raleigh, C-Tech Sls. 919-847-0202
OH Worthington, Dynel Corp. 614-436-9452
PA Wynnewood, Metz-Benham Assocs., Inc. 215-896-7300
SC Greenville, Elctrn. Mktg. Assoc., Inc. 803-233-4637
TX Seagoville, Delta Comp., Inc. 214-287-6333
WA Seattle, J. J. Assocs., Inc. 206-246-6619

DERINGER MFG. CO., 1250 Townline Road, Mundelein, IL 60060, Tel: 312-566-4100, TWX: 910-685-4321, FAX: 312-566-5370; *Sls. Mgr.:* W. Johnston

DESIGNATRONICS, INC., See Automatic Coil Corp., Sub. Designatronics, Inc.

DESIGN AUTOMATION, INC., 809 Massachusetts Ave., Lexington, MA 02173-3992, Tel: 617-862-8998, TELEX: 247346 SBSB UR, FAX: 617-862-3769; FSC No.: 4D417; Empl.: 9

DESIGN COMPONENTS, INC., 1 Kenwood Circle, Franklin, MA 02038, Tel: 508-528-7300, 800-341-4811, FAX: 508-520-1424; Empl.: 60

DESIGN TECHNOLOGY, 1050-R Pioneer Way, El Cajon, CA 92020, Tel: 619-440-7666, TELEX: 503476; FSC No.: 619-440-8048; Empl.: 50; *Sls. Mgr.:* Michael Golden; *Dist. Mgr.:* Sherry Golden

DESPATCH INDUSTRIES, 619 S.E. 8th St., P.O. Box 1320, Minneapolis, MN 55440-1320, Tel: 612-331-1873, TELEX: 29-0704, TWX: 6288-5512; Empl.: 525; *Sls. Mgr.:* P. Olson

DETORONICS CORPORATION, 10660 E. Rush St., S. El Monte, CA 91733, Tel: 818-579-7130, TWX: 910-587-3436, FAX: 818-579-1936; FSC No.: 29867; Empl.: 45

DETROIT TESTING LABORATORY, INC., 8720 Northend Avenue, Oak Park, MI 48237, Tel: 313-398-2100, TWX: 510-601-5345, FAX: 313-589-0665; FSC No.: 0739; Empl.: 100

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DEVAR, INC., P.O. Box 589, Bridgeport, CT 06601, Tel: 203-368-6751, TELEX: 96-4234, FAX: 203-368-3747; Empl.: 80; *Sls. Mgr.:* T. W. Tomasko

DEVCO ENGINEERING, 36 Pier Lane West, Fairfield, NJ 07006, Tel: 201-CA8-0321, TELEX: 139-340; Empl.: 36

DEVELCO, INC., 175 Nortech Pkwy., San Jose, CA 95134-2306, Tel: 408-945-6500, TWX: 910-339-9295; Empl.: 50; *Sls. Mgr.:* W. J. Baker

DEXTER RESEARCH CTR., INC., 7300 Huron River Dr., Dexter, MI 48130, Tel: 313-426-3921, TELEX: 757075 DEXTER RES UD; Empl.: 22; *Sls. Mgr.:* Robert Toth Jr.

DEYOUNG MANUFACTURING, INC., 12920 N.E. 125th Way, Kirkland, WA 98034, Tel: 206-823-4798, FAX: 206-821-8633; FSC No.: 54937; Empl.: 70; *Sls. Mgr.:* Ted Johnson

DGH CORPORATION, P. O. Box 5638, Manchester, NH 03108, Tel: 603-622-0452, TWX: 510 601 6112, FAX: 603-622-0487; Empl.: 10

DH PRINT, Technical Research Park, Riverton, WY 82501; Tel: 307-856-4821, TWX: 910-949-4864, FAX: 307-856-0412; Empl.: 185; *Sls. Mgr.:* Rich Phillips; *Dist. Mgr.:* Rich Phillips

DIAGOSTIC INSTRUMENT CORP., 4 Copeland Dr., Box J, Ayer, MA 01432, Tel: 508-772-4572, FAX: 508-772-5210; Empl.: 125; *Sls. Mgr.:* Brad Barone

DIALIGHT CORP., A Cambridge Elctrns. Inds. Co., 1913 Atlantic Ave., Manasquan, NJ 08736, Tel: 201-223-9400, TELEX: 244536, FAX: 201-223-8788; Empl.: 400; *Sls. Mgr.:* W. Moore ..... **B•1065, 1133-1141**

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CA	Los Angeles, Landa & Assocs.	213-879-0770
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CA	Santa Ana, Landa & Assocs.	714-543-7805
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Ft. Lauderdale, Panamtech, Inc.	305-587-3769
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Rolling Meadows, Sumer, Inc.	312-991-8500
IN	Indianapolis, Elctrn. Reps.	317-894-1414
KS	Shawnee Mission, Lowell Kangas & Assocs.	913-631-3515
LA	Covington, Cartwright & Bean	504-892-1780
MA	Hingham, Northeast Reps., Inc.	617-749-8700
MI	Royal Oak, Hilltronics	313-435-0920
MN	Minneapolis, Professional Sales For Ind.	612-944-8545
MS	Jackson, Cartwright & Bean	601-981-1170
MO	St. Louis, Lowell Kangas & Assocs.	314-821-4050
NY	Liverpool, Gen-Tech	315-451-3480
NY	Melville, Parallax	516-351-1000
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
OH	Worthington, Baehr, Greenleaf & Assocs.	614-847-0220
OR	Beaverton, Earl & Brown Assocs.	503-643-5500
PA	Broomall, L.D. Lowery	215-356-5300
PA	Evans City, Baehr, Greenleaf & Assocs.	412-776-2151
TN	Knoxville, Cartwright & Bean	615-693-7450
TN	Memphis, Cartwright & Bean	901-362-8345
TX	Austin, Tesco	512-834-8374
TX	Dallas, Tesco	214-553-1200
UT	Woodscross, Comp. Prods. Sls.	801-292-8882
WA	Redmond, Earl & Brown Assocs.	206-885-5064

Local Distributors

AZ	Tempe, Bell Inds.	602-966-7800
AR	Little Rock, Carleton-Bates Co.	501-562-9100
CA	Alhambra, Harper S.I.D.	213-289-0255
CA	Buena Pk., Cypress Elect.	213-744-0355
CA	Compton, Harper;S.I.D.	213-979-5090
CA	Garden Grove, Bell Inds.	714-895-7801
CA	Garden Grove, Richey Western Elec.	714-895-0060
CA	Gardena, Bell Indus.	213-515-1800
CA	Gardena, Cal Switch & Signal	213-770-2330
CA	Inglewood, Newark Elctrns.	213-671-7378
CA	Roseville, Bell Inds.	916-969-3100
CA	Sacramento, Sacramento Elctrns.	916-441-4821
CA	San Diego, Harper S.I.D.	714-560-8545
CA	San Diego, Richey Western Elctrns.	619-271-4511
CA	San Jose, Richey Western	408-432-7100
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Santa Clara, Harper S.I.D.	408-988-6041
CA	Santa Clara, Richey Western Elctrns.	408-727-7411
CA	Sun Valley, Richey Western Elec. Inc.	213-768-3800
CA	Sunnyvale, Arrow Elec.	408-745-6600
CA	Sunnyvale, Bell Indus.	408-734-8570
CA	Sunnyvale, Harper;S.I.D.	408-747-0333
CA	Sunnyvale, Time Elect.	408-734-9888
CA	Thousand Oaks, Bell Inds.	818-340-1940
CO	Denver, CSID Inc.	303-292-9594
CO	Denver, Newark Denver Elctrns.	303-757-3351
CT	Wallingford, Sager Elctrl. Supply	203-265-4600
FL	Ft. Lauderdale, Peerless Radio	305-973-4141
FL	Orlando, Hammond Elctrns.	305-849-6060
FL	Pompano Bch., Peerless Radio	305-973-4141
GA	Atlanta, Dow Elec.	404-873-2521
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Northbrook, Classic Comps. Supp.	312-272-9650
IL	Palatine, OHM Elctrns.	312-359-5500
IL	Peoria, Klaus Radio & Elect.	309-691-4840
IN	Ft. Wayne, Bell Inds./Graham Elctrn. Div.	219-423-3422
IN	Indianapolis, Bell Inds./Graham Elctrn. Div.	317-634-8202
IN	Indianapolis, PEI-Genesis	317-637-5571
IN	South Bend, PEI-Genesis	219-287-2911
KY	Louisville, P.I. Burks	502-589-3960
LA	Lafayette, Ralph's of Lafayette	318-234-0105
LA	New Orleans, Southern Radio Supp.	504-524-2343
MD	Gaithersburg, Pioneer Washington Elec.	301-948-0710
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MD	White Marsh, Resco/Baltimore	301-529-0500
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	W. Springfield, T.F. Cushing	413-788-7341
MA	Wilbraham, Ind'l. Comps.	413-596-3854
MI	Ann Arbor, Wedemeyer Elctrn. Supp.	313-665-8611
MI	Livonia, RS Elctrns.	313-525-1155
MI	Oak Park, Newark Elctrn.	313-967-0600
MN	St. Paul, Gopher Elctrns.	612-483-3322
MO	Kansas City, LCOMP	816-221-2400
MO	Kansas City, Walters Radio Supp.	816-531-7015
MO	Maryland Hgts., LCOMP	314-291-6200
NE	Lincoln, Scott Elctrn. Supp.	402-466-8221
NJ	Hanover, State Elctrns.	201-887-2550
NJ	Kenilworth, Federated Purchaser	201-272-0505
NJ	Pennsauken, Resco Elctrns.	609-662-4000
NY	Buffalo, Summit Dists.	716-887-2800
NY	Elmsford, Ancar Elctrns. Supp.	914-592-7100
NY	Endwell, ASI Elect.	607-754-3823
NY	Hauppauge, Broadline Elec. Dists.	516-231-4123
NY	Long Island City, Dalis Indl. Elect.	718-361-1100
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Melville, Arrow Elctrns.	516-694-6800
NY	Rochester, Summit Elctrns.	716-334-8110
NY	Rome, Rome Elctrns.	315-337-5400
NY	Woodbury, Pioneer Standard	516-921-8700
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Akron, Sun Radio	216-434-2171
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cincinnati, URI Elctrns.	513-761-4030
OH	Cleveland, Pioneer-Cleveland	216-587-3600
OH	Columbus, Hughes-Peters	614-294-5351
OH	Dayton, Pioneer/Dayton	513-236-9900
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Solon, REPCO Elctrn.	216-248-8900
OH	Warren, REM Elctrns.	216-373-1300
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Beaverton, Almac Elctrns.	503-629-8090
OR	Lake Oswego, Bell Inds.	503-635-6500
PA	McKean, Advacom	814-476-7774
PA	Montgomeryville, Pyttronic Indus.	215-643-2850
PA	Philadelphia, Almo Elctrns.	215-698-4000
PA	Philadelphia, PEI-Genesis Elctrn.	215-673-0400
PA	Pittsburgh, Cam RPC Elect.	412-782-3770
PA	Reading, Barbey Elctrns.	215-376-7451
RI	Providence, Wm. Dandreta	401-861-2800
SC	Greenville, Emsco	803-233-4121
TN	Kingsport, Radio Elec. Supp.	615-247-8111
TN	Nashville, Carlton-Bates Co.	615-244-3562
TN	Nashville, Electra Dist.	615-256-0800
TX	Austin, Harrison Equip.	512-458-3555
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Garland, Newark Elctrns.	214-487-8144
TX	Houston, Newark Elctrns.	713-782-4800
TX	Stafford, Harrison Equip.	713-879-2600
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Norfolk, Priest Elctrns.	804-855-0105
WA	Bellevue, Almac Elctrns.	206-643-9992
WA	Bellevue, Bell Inds.	206-747-1515
WI	Milwaukee, Elctrn. Expeditors	414-228-8100
WI	Milwaukee, Indl. Elect.	414-276-1212
WI	Milwaukee, Marsh Elctrns.	414-475-6000

DIAL PRODUCTS CO., 19-21 Cottage St., Bayonne, NJ 07002, Tel: 201-HE7-0720; Empl.: 100; *Sls. Mgr.:* Beverly Malen

DIANACHART INC., 129 Hibernia Ave., Rockaway, NJ 07866, Tel: 201-625-2299, FAX: 201-625-2449; Empl.: 10; *Sls. Mgr.:* S. Byrom

DI/AN CONTROLS, INC., 944 Dorchester Ave., Boston, MA 02125, Tel: 617-288-7700; FSC No.: 06900; Empl.: 60; *Sls. Mgr.:* Robert D. Kodis

DIA-NETICS, INC., 18823 Napa St., Northridge, CA 91324, Tel: 818-886-2616; Empl.: 48

DIEGO POWER, 9250 Brown Deer Rd., San Diego, CA 92121, Tel: 619-587-1925, TELEX: 211063 ELSD UR, FAX: 619-458-0267; Empl.: 250; *Sls. Mgr.:* Martin Sanders; *Dist. Mgr.:* Martin Sanders

DIELECTRIC COMMUNICATIONS, General Signal, Tower Hill Rd., Raymond, ME 04071, Tel: 207-655-4555, 800-341-9678, TELEX: 710-229-6890, FAX: 207-655-4669; FSC No.: 08441; Empl.: 270; *Sls. Mgr.:* Rolf Olsen

DIELECTRIC LABS., Rte. 20 E., Cazenovia, NY 13035, Tel: 315-655-8710, TELEX: 882-691 Dielectric Labs., FAX: 315-655-8179; FSC No.: 55153; Empl.: 100; *Sls. Mgr.:* Gunter Vorlop

DIETZ DESIGN, INC., 100 Electronics Pkwy., Belton, MO 64012, Tel: 816-331-4911, FAX: 816-331-4914; FSC No.: 93652; Empl.: 75; *Sls. Mgr.:* Chas. A. McMurray

DIGI-DATA CORP., 8580 Dorsey Run Rd., Jessup, MD 20794, Tel: 301-498-0200, TELEX: 87-580, FAX: 301-498-0771; Empl.: 40; *Sls. Mgr.:* Allen Grams

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DSP TECHNOLOGY, 48500 Kato Rd., Fremont, CA 94538, Tel: 415-657-7555, TELEX: 263608, FAX: 415-657-7576; Empl.: 60; *Sls. Mgr.:* Robert LeBrun

DUBBELDEE HARRIS DIAMOND CORP.:D. DRUKKER & ZN. N.V., 100 Stierli Ct., Mt. Arlington, NJ 07856, Tel: 201-770-1420, TELEX: RCA 236064, FAX: 201-770-1549; *Sls. Mgr.:* Keith Harris

DUKANE CORP., Communications Sys. Div., 2900 Dukane Dr., St. Charles, IL 60174-9984, Tel: 312-584-2300, TELEX: 720426, FAX: 312-584-2370; Empl.: 650; *Sls. Mgr.:* Warren Anderson; *Dist. Mgr.:* Warren Anderson

DUMONT/E & R ELECTRONICS, INC., 40 Fairfield Pl., W. Caldwell, NJ 07006, Tel: 201-575-8666, TELEX: 219236 DOLI-UR; FSC No.: 30669; Empl.: 30; *Sls. Mgr.:* Edward Petrasek

DUNCAN ELECTRONICS, INC., 2865 Fairview Rd., Costa Mesa, CA 92626, Tel: 714-545-8261, TWX: 910-595-1128, FAX: 714-557-6240; FSC No.: 5905;Multiple; Empl.: 110; *Sls. Mgr.:* J. Colligan; *Dist. Mgr.:* S. Anderson ..... **A•2106-2107**

Local Sales Offices & Reps

AL Huntsville, L. & D., Inc. 205-837-1469
AZ Tempe, Southwest E/M Engrg. 602-941-2828
AR El Dorado, Kemp Engrg. Co., Inc. 501-862-5869
CA Costa Mesa, Comar Co. 714-250-0140
CA Santa Clara, Caltron Comps. 408-980-0181
CO Denver, Elcom 303-337-2300
CT Cheshire, The MacInnis Co. 203-272-3797
FL Deerfield Bch., ElectroComp Assocs. 305-429-0802
FL Palm Harbor, ElectroComp Assocs. 813-787-6669
GA Atlanta, L. & D., Inc. 404-395-7079
IL Arlington Hgts., KMA Sales Co. 312-398-5300
IN Indianapolis, Mktg. Engrs., Inc. 317-872-5665
KS Shawnee Mission, Florence & Meyer 913-722-5210
LA Lafayette, Kemp Engrg. Co. 318-269-9452
MA Norwood, The MacInnis Co. 617-762-8090
MI Farmington Hills, Elcon Michigan Sls. 313-855-3240
MN New Brighton, J. J. Exon Co. 612-636-5533
NY Clinton, Advanced Comps. 315-853-6438
NY Copiague, Sencor 516-789-8557
NY Endicott, Advanced Comps. 607-785-3191
NY N. Syracuse, Advanced Comps. 315-699-2671
NY Scottsville, Advanced Comps. 716-889-1429
NC Greensboro, L. & D., Inc. 919-292-3201
NC Raleigh, L. & D., Inc. 919-876-5301
OH Dayton, Dolfuss-Root & Co. 513-433-6776

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OK Tulsa, Kemp Engrg. Co. 918-663-4501
WA Vancouver, Elctrn. Mktg. Grp. 503-684-5935
PA Birchrunville, Jadelectronic Assocs., Inc. 215-296-3800
PA Bridgeville, Dolfuss-Root & Co. 412-221-4420
PA Philadelphia, Jadelectronic Assocs., Inc. 215-455-0664
TX Addison, Kemp Engrg. Co. 214-931-7100
TX Austin, Kemp Engrg. Co., Inc. 512-263-3322
TX Houston, Kemp Engrg. Co. 713-466-1465
UT Salt Lake City, Elcom 801-486-4233
VA Richmond, L & D, Inc. 804-257-7717
WA Liberty Lake, Elctrn. Mktg. Grp. 509-922-2718
WA Redmond, Elctrn. Mktg. Grp. 206-882-0962
WI Milwaukee, KMA Sales Co. 414-259-1771

DUPLICON, INC., 516 E. Second St, S. Boston, MA 02127, Tel: 617-269-5484; FSC No.: 0ASD8; Empl.: 6; *Sls. Mgr.:* William A. Currier

DUPONT DE NEMOURS, E. I., & CO., 1007 Market St., Wilmington, DE 19898, Tel: 302-773-3218; Empl.: 130,000

DUPONT

FAX: 302-992-4442

DUPONT ELECTRONICS, Barley Mill Plaza, P.O. Box 80013, Wilmington, DE 19880-0013, Tel: 800-237-4357; *Sls. Mgr.:* E. N. Tolson; *Dist. Mgr.:* J. M. Kendrick ..... **C•1331-1342**

Local Sales Offices & Reps
CA Santa Clara 408-562-9300,800-237-4357
MA Burlington 617-273-6000,800-237-4357
NC Resch. Triangle Pk. 919-248-5000,800-237-4357

DUPREE, INC., 14395 Romona Ave., Chino, CA 91710, Tel: 714-597-4889, TWX: 510-100-0281; Empl.: 65; *Sls. Mgr.:* S. Broussard; *Dist. Mgr.:* S. Broussard

DURACELL®

FAX: 203-791-3273

DURACELL INC.:OEM SLS. & MKTG., Berkshire Industrial Park, Bethel, CT 06801, Tel: 203-791-3274, TELEX: 6972165; Empl.: 4000; *Sls. Mgr.:* R. D'Alessandro ..... **D•1479-1482**

Local Sales Offices & Reps
CA Irvine, Duracell Inc. 714-476-1811
CT Southbury, Duracell 203-264-3935
IL Oak Brook, Duracell Inc. 312-954-2714

Local Distributors
CA Mtn. View, Energy Sls. Inc. 415-969-0800
CA San Diego, Tauber Elctrns. Inc. 619-274-7242
GA Norcross, Applied Power Inc. 404-263-0421
IL Downers Grove, TDI 312-971-3460
MA Sharon, Adcour 617-784-8123
MI Brighton, Applied Power Inc. 313-227-3604
MN St. Paul, dc Battery Prods. 612-646-7478
MO Maryland Hgts., LComp 314-291-6200
NJ Clifton, Engrd. Assemblies Corp. 1-800-BATTERY
NY Commack, Bren-Tronices Inc. 516-499-5155
NC Winston-Salem, Progressive Technlgs., Inc. 919-761-1375
TX Houston, K-Tec Inc. 713-780-7770
WA Redmond, Energy Sls. Inc. 206-883-2343

DURAKOOL INC
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FAX: 219-264-4681

DURAKOOL, INC., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514, Tel: 219-264-1116, TELEX: 25-8482; Empl.: 230; *Sls. Mgr.:* Stan Kalin ..... **B•1724-1725**

Local Sales Offices & Reps
AZ Mesa, H-D Assocs., Inc. 602-437-0064
CA Burlingame, Campbell & George 415-697-2965
CA Canoga Parkk, C & W Comp. Sls. 818-700-2684
CA Sunnyvale, Pass Assocs. 408-735-9040
CO Englewood, Harthun Assocs. 303-792-5050
FL Clearwater, J. J. Galleher Co. 813-461-7706
GA Smyrna, Tech Controls, Inc. 404-333-9883
IN Mishawaka, Power Comps. of Midwest 219-256-6630
IA Davenport, Volco Co. 319-326-5233
KS Overland Park, R. Greene Co. 913-492-6886
LA Baton Rouge, L. Elliott Co. 504-272-2877
MA Hingham, Hingham Bay Corp. 617-740-1900
MI Novi, Advanced Controls & Technlg. .. 313-349-0260
MN Minneapolis, Volco Co. 612-933-6631
MS Corinth, World Dists. 205-533-9108
MO St. Louis, R. Greene Co. 314-994-0222
NE Omaha, Volco Co. 402-346-2203
NY Buffalo, Niagara Elec. Sls. Co. 716-825-3100
NY Wantagh, DONY Tech. Sls. 516-826-5550
NC Pineville, Mel Sls. 704-541-5750
OH Parma, Orr Assocs. 216-885-1324
OK Tulsa, L. Elliott Co. 918-663-4616
OR Portland, Branom Instr. Co. 503-283-2555
PA Narberth, Power Modules Inc. 215-668-0664
TX Addison, L. Elliott Co. 214-239-8533
TX Midland, Lynn Elliott Co. 915-684-8414
TX Missouri City, L. Elliott Co. 713-499-1571
UT Salt Lake City, Western Controls 801-266-1500
WA Bothell, Temco N.W. 206-821-5434

Local Distributors
IN Mishawaka, Power Comps. of Midwest 219-256-6630
PA Narberth, Power Modules 215-839-1331

DUREL CORPORATION, Affiliate of 3M & Rogers Corp., 645 W. 24th St., Tempe, AZ 85282, Tel: 602-731-6200, FAX: 602-731-6210

DURGIN & BROWNE, See Tridyne Process Systems, DBI Inds.

DY-4 SYSTEMS INC., 21 Credit Union Way, Nepean, Ont., Canada K2H 9J4, Tel: 613-596-9911, TELEX: 0534111, FAX: 613-596-0574; Empl.: 280; *Sls. Mgr.:* Mitch Robinson

DYLON GRAPHITE CO., 124 First Avenue, Berea, OH 44017, Tel: 216-234-1600, FAX: 216-234-6392; Empl.: 35; *Sls. Mgr.:* K. A. Partee

DYMEC

FAX: 617-729-1639

DYMEC SILICON TRANSISTOR CORP., 8 Lowell Ave., Winchester, MA 01890, Tel: 617-729-7870, TWX: 710-348-6596; Empl.: 50; *Sls. Mgr.:* J. Dennis Santucci ..... **B•1206-1207; D•1177**

Local Sales Offices & Reps
AZ Phoenix, Southwest Tech. Sls. 602-893-1209
CA San Diego, California Elctrn. Mktg., Inc. 619-265-8331
CA San Ramon, Technical Consultants ... 415-830-0829
CA Santa Ana, California Elctrn. Mktg., Inc. 714-835-2702
GA Duluth, Dixie Tech. Mktg. 404-381-5592
MD Linthicum Heights, KD Assocs. 301-859-5151
MA Winchester, Factory 617-729-7870
MO St. Louis, Ozark Elctrn. Mktg., Inc. 314-423-7200
NM Albuquerque, Reptronix, Ltd. 505-292-1718
NY New Rochelle, Repco Assocs., Inc. 914-235-6405
NY Syracuse, Labtronics, Inc. 315-455-7314
OH Chagrin Falls, Hester Assocs., Inc. 216-338-5102
PA Sellersville, Tech-Com Mktg., Inc. 215-723-0820
TX Dallas, Kay Todd Assocs. 214-458-8837
WA Everett, Cunningham Sls., Inc. 206-348-4800

DYNACAST, Div. Coats & Clark Inc., 1401 Front Street, Yorktown Heights, NY 10598, Tel: 914-245-0060, TELEX: 6716096; Empl.: 150

DYNACIRCUITS INC., 11230 W. Addison, Franklin Park, IL 60131, Tel: 312-451-1700; FSC No.: ;;;312-451-9266; Empl.: 300; *Sls. Mgr.:* Dennis Dworzak(Western U.S.), Carl Morahan(Eastern U.S.)

DYNAGE/CONTROLS, INC., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, Tel: 605-296-3487, TELEX: 753243 (OAKLEAFINC), FAX: 605-296-3231; Empl.: 12; *Sls. Mgr.:* Sidney C. Oakleaf

DYNAGE/POWER & MAGNETICS, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, Tel: 605-296-3462/3487, TELEX: 753243 (OAKLEAFINC), FAX: 605-296-3231; FSC No.: 9Y852; Empl.: 20; *Sls. Mgr.:* Sidney C. Oakleaf ... **A•2278-2279; D•1724-1726**

DYNALOY, INC., 7 Great Meadow La., Hanover, NJ 07936, Tel: 201-887-9270, TELEX: 642-033, FAX: 201-887-3678; FSC No.: 27908; Empl.: 19; *Sls. Mgr.:* Jay Parton

DYNAMIC AIR ENGRG., INC., 620 E. Dyer Rd., Santa Ana, CA 92705-5697, Tel: 714-540-1000, TWX: 910-595-2588, FAX: 714-545-9145; FSC No.: 4140-6105; *Sls. Mgr.:* Carl A. Grisier

DYNAMICS, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-998-8281, TELEX: 69-6171, FAX: 818-407-1320; Empl.: 100; *Sls. Mgr.:* Tony Mastroianni

DYNAMICS RESEARCH CORP., Encoder Division, 60 Concord St., Wilmington, MA 01887-2193, Tel: 508-658-6100, FAX: 508-658-0522; Empl.: 125; *Sls. Mgr.:* Joe Portada

DYNAPAR, 1675 Delany Rd., Gurnee, IL 60031, Tel: 312-662-2666, TWX: 910-235-1865; Empl.: 150

DYNAPOWER CORPORATION

FAX: 313-553-9096

DYNAPOWER CORPORATION, Box 3180, Farmington Hills, MI 48333, Tel: 313-553-4300, TWX: 810-242-8804; Empl.: 75 ..... **D•1729-1732**

DYNATECH COMPUTER COMPANY, 280 Bernardo Ave., P.O. Box 7400, Mountain View, CA 94039-7400, Tel: 415-964-7400, TWX: 910-379-6988, FAX: 415-969-3350; Empl.: 49; *Sls. Mgr.:* Howard Klemmer; *Dist. Mgr.:* Karen Vorster

DYNATECH COMPUTER POWER, INC., 5800 Butler Ln., Scotts Valley, CA 95066, Tel: 408-438-5760, TELEX: 887-247, FAX: 408-438-5793; FSC No.: 7045

DYNATEM, 19 Thomas St., Irvine, CA 92718, Tel: 714-855-3235, TWX: 910-595-2603, FAX: 714-770-3481; Empl.: 20; *Sls. Mgr.:* Mike Horan; *Dist. Mgr.:* Linda Boate

DYNISCO, 10 Oceana Way, Norwood, MA 02062, Tel: 617-769-6600, TELEX: 174-292; FSC No.: 15687; Empl.: 153; *Sls. Mgr.:* Warden B. Hunt

DYTRONICS CO., See Ryan Intl. Corp.

DZUS FASTENER, 425 Union Blvd., W. Islip, NY 11795, Tel: 516-669-6000, TELEX: 71-4974043, FAX: 516-669-0785; FSC No.: 72794; Empl.: 140; *Sls. Mgr.:* Victor Cappetta

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EAGLE, P.O. Box 911, Fallbrook, CA 92028, Tel: 619-728-6000 ..... **A•1700-1702**

Local Sales Offices & Reps
AZ Mesa, Sedco 602-461-9069
MA BrainTree, Lancer Assocs. 617-849-3083

EAGLE MAGNETIC COMPANY, INC., P.O. Box 24283, Indianapolis, IN 46224, Tel: 317-297-1030, FAX: 317-299-1323; Empl.: 44; *Sls. Mgr.:* Robert Jackson ..... **C•1734**

Local Sales Offices & Reps
FL Jupiter, Cherry Assocs. 305-746-4591
GA Roswell, Electro Comp. Sls. 404-992-2344
MA Concord, Nortech Engr. Sls. 508-369-8605
MN Eden Prairie, Electro Mark, Inc. 612-944-5850
NY Commack, R.C. Engrg. 516-543-3325
PA Glenside, Koebert Assocs. 215-576-1329
TX Irving, Space Elctrns. 214-251-3636

EAGLE PICHER
ELECTRONICS DIVISION

FAX: 417-776-2257

EAGLE-PICHER, Box 47, Joplin, MO 64801, Tel: 417-623-8000, TWX: 910-774-4508; Empl.: 700 ... **D•1486-1488**

EAGLE-PICHER, P.O. Box 130, Bethel Road, Seneca, MO 64865, Tel: 417-776-2256, TWX: 910-774-4533; FSC No.: 3L498; Empl.: 400; *Sls. Mgr.:* H. M. York; *Dist. Mgr.:* H. M. York ..... **D•1483-1485**

Local Sales Offices & Reps

AL Huntsville, L & D Inc. 205-837-1469
AZ Scottsdale, S.W. Sls. 602-391-3180
AR Hot Springs, Automation Supp. Inc. (ASI) 501-767-5444
CA San Jose, O'Donnell Assocs.-North ... 408-263-6500
CA Torrance, O'Donnell Assoc. 213-539-9664
CT Bloomfield, Zaslow Sls. Co. 203-242-7781
FL Longwood, NSL Assocs., Inc. 305-629-5226
GA Atlanta, L & D Inc. 404-395-7079
ID Elk Grove Vl, Parcom, Inc. 312-228-6360
IA Des Moines, SPS Assocs., Ltd. 515-225-0607
KS Olathe, SPS Assocs., Ltd. 913-764-4460
MA Westboro, Zaslow Sls. Co. 617-393-8150
MN Minneapolis, Ohlin Sls. Co. 612-929-6924
MO Earth City, SPS Assocs., Ltd. 314-291-0520
NE Panama, SPS Assocs., Ltd. 402-788-2536
NH Londonderry, Zaslow Sls. Co. 603-432-8907
NM Albuquerque, WJM Sls. 505-268-9499
NY Massapequa Pk., HC Assocs. 516-541-0262
NY Morrisville, Naylor Elec. Co. 315-684-9620
NC Raleigh, L & D Inc. 919-876-5301
OH Dayton, Lyons Corp. 513-278-0714
OR Beaverton, Pacific Mktg. Spec. 503-641-9373
PA Exton, Kiley Elec. Co. 215-363-8550
TX Dallas, Rem Air Comps. 214-234-1069
VA Richmond, L & D Inc. 804-359-0125
WA Redmond, Pacific Mktg. Spec. 206-882-3144

Local Distributors

AZ Tempe, Lynntronics 602-433-0288
AR Hot Springs, Automation Supp. Inc. ... 501-767-5444
CA Anaheim, Carefree Unltd. 714-630-3433
CA Palo Alto, The Power Source, Inc. 415-856-0700
CO Denver, J & B Sls. 303-698-2211
FL Duneoin, Battery Powered Lighting & Sys. 813-734-9498
GA Austell, DC Power Prods. 404-948-2593
GA Smyrna, Mark C. Pope Assocs. 404-435-2471
IL Arlington Hgts., Lodan Elctrns. 312-398-5311
KS Wichita, RSC Elctrns. 316-267-5213
LA Shreveport, Indl. Elctrn. Supp. Inc. 318-222-9459
MD Baltimore, Professional Elctrns. 301-661-2126
MA Sharon, Adcour 617-784-8123
MN Minneapolis, Ohlin Sls. Co. 612-929-6924
NE Lincoln, Spectronics Corp. 402-467-3651
NJ E. Brunswick, Brothers Elctrns. 201-238-2200
NY Amityville, Battery Power of LI. 516-691-1993
NY Brewster, WHI Batteries 914-278-6151
OH Columbus, Promark Elctrns., Inc. 614-876-8885
OK Tulsa, Altair Co. 918-252-5781
OR Tualatin, Moore Elctrns. 503-692-5333
PA Bensalem, Scotts Emergency Lighting 215-639-1777
TX Stafford, Southwest Elctrns. 713-240-4000
Can Mississauga, Ont., Battery Tech. 416-670-7373

EAGLE SIGNAL CONTROLS:A MARK IV INDS. CO., 8004 Cameron Rd., Austin, TX 78753, Tel: 512-837-8300, TELEX: 166975, FAX: 512-837-8486; Empl.: 3000; *Sls. Mgr.:* Donald Morse

EALING ELECTRO-OPTICS, New Englander Industrial Park, Holliston, MA 01746, Tel: 617-429-8370, 1-800-343-4912, TELEX: 240041, FAX: 617-875-5616; *Sls. Mgr.:* James F. Babb

E & L INSTRUMENTS, Interplex Electronics, Inc., 70 Fulton Terrace, New Haven, CT 06512, Tel: 203-624-3103, FAX: 203-468-0060; Empl.: 70; *Sls. Mgr.:* Dan Marley

EAO SWITCH CORP., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, Tel: 203-877-4577, TELEX: 96-4347, FAX: 203-877-3694; FSC No.: 61706; Empl.: 19; *Sls. Mgr.:* George T. Bracci ..... **B•1732**

Local Sales Offices & Reps

AZ Scottsdale, Luscombe Engrg. Co. of AZ 602-949-9333
CA Los Gatos, Luscombe Engrg. Co. of S.F. 408-370-2020
CA Montrose, Luscombe Engrg. Co. of L.A. 818-249-9000
CA San Diego, Luscombe Engrg. Co. of S.D. 619-292-4323
CO Longmont, Luscombe Engrg. Co. of CO 303-772-3342
CT Bethel, Ray Perron & Co. 203-798-0261
CT Farmington, Ray Perron & Co., Inc. 203-673-4825
FL Deerfield Beach, Florida Comp. Sls. ... 305-429-1758
FL Tampa, Florida Comp. sls. 813-960-7044
GA Norcross, Mtn. Electro Mktg. 404-448-5594
IL Arlington Hgts., Brainard-Wilson Mktg., Inc. 312-437-2700
IN Ft. Wayne, M/S Sls. & Assocs. 219-436-3023
IN Greenwood, M/S Sls. & Assocs. 317-881-0110
IA Cedar Rapids, Delltron Co., Inc. 319-393-0075
MD Columbia, Delta III Assocs., Inc. 301-730-4700
MA Needham, Ray Perron & Co., Inc. 800-225-4280, 617-449-6162
MI Plymouth, Jay Mktg. Assocs., Inc. 313-459-1200
MN Golden Valley, Highland Elctrn. Sls. ... 612-546-2123
MO Florissant, Delltron Co., Inc. 314-839-0033
MO Gladstone, Delltron Co., Inc. 816-436-6445
NH Merrimack, Ray Perron & Co., Inc. 603-424-4423
NJ Englewood, Sprung/Nussbaum 201-569-5666
NY Hauppauge, Sager Elec. Supp. Co. 516-348-1300
NY Rochester, Apex Assocs., Inc. 716-272-7040
NC Raleigh, C-Tech Sls., Inc. 919-782-8100
OR Lake Oswego, Luscombe Engrg. Northwest 503-636-6664
PA Horsham, Jacobsen Assocs. 215-674-2937
PA Pittsburgh, R. W. Kneip 412-823-0169
TX Dallas, Glidden Electro Equip. Co 214-341-0610
TX Houston, Glidden Electro Equip. Co. .. 713-681-1415
UT Midvale, Luscombe Engrg. Co. 801-565-9885
WA Bellevue, Luscombe Engrg. N.W. 206-223-1541
WI Mequon, Badgerep 414-241-9200

Local Distributors

AZ Phoenix, Minarik Elec. 602-233-3000
AZ Tempe, Harper SID 602-967-1464
CA Compton, Harper SID 213-979-5090
CA Gardena, California Switch & Sig. 213-770-2330
CA Glendale, Minarik Elec. Co. 818-507-6500
CA Hayward, KEA Elctrns. 415-887-2900
CA S. San Francisco, Bell Elctrl. Supp. 415-589-7055
CA Salinas, Bell Elctrl. Supp. 408-758-6110
CA San Diego, Harper SID 619-578-2500
CA San Diego, Minarik Elec. Co. 619-560-6632
CA San Jose, Harper SID 408-943-9490
CA Santa Clara, Bell Elctrl. Supp. 408-727-2355
CA Santa Clara, Minarik Elec. Co. 408-727-0575
CA Torrance, Kent Elctrns. 213-320-2700
CO Denver, CSID, Inc. 303-292-9594
CO Denver, Minarik Elec. Co. 303-329-3525
CT Wallingford, Midan Elctrns. 203-265-2077
CT Wallingford, Sager Elec. Supp. co. 203-265-4600
FL Lakeland, Wes-Garde/Switch Controls, Inc. 813-644-7564
FL Oviedo, Dixie Sls. 407-365-5211
IL Algonquin, Marshall Wolf Automation 312-658-8130
IL Crystal Lake, Sub-Sem, Inc. 312-782-3954
IL Elk Grove, Martec Assoc. 312-956-8090
IL Rosemont, Advent Elctrns., Inc. 312-297-6200
IL Schaumburg, Minarik Elec. Co. 312-885-9337
IN Indianapolis, Mar Elctrns. 317-633-6699
IN Indianapolis, R.M. Indiana 317-291-7110
IA Cedar Rapids, Advent Elctrns., Inc. 319-363-0221
KS Wichita, Radio, Inc. 316-264-2798
KY Louisville, Peerless Elctrns. 502-637-7674
LA Baton Rouge, Menard Elctrns. 504-355-0323
ME W. Buxton, Nelson & Wright 207-929-8238
MD Gaithersburg, Axis Elctrns. 301-840-9640, 800-492-3190
MD Jessup, Treeko Sls. 301-792-0112
MA Canton, Impact Sls. Co. 617-821-1500
MA Hingham, Sager Elec. Supp. Co. 617-749-6700
MA N. Billerica, Minarik Elec. Co. 508-663-0740
MI Grand Rapids, R. M. Elctrns. Co. 616-531-9300
MI St. Claire Shores, SPEMCO Switches 313-771-2700
MN Minneapolis, Electronic Ctr., Inc. 612-378-2442
MO St. Louis, Beckwith, Inc. 314-343-6463
NH Salem, Sager Elec. Supp. Co. 603-898-1348
NJ Cranford, Garden State Indl. Elctrns., Inc. 201-272-6400
NY Bohemia, Key Comps., Inc. 516-567-7500
NY Buffalo, Summit Distrs., Inc. 716-887-2800
NY New York, Martin-Audio/Video 212-541-5900
NY Rochester, Simcona Elctrns. 716-328-3230
NY Rochester, Summit Elctrns., Inc. 716-334-8110
NY Victor, ADD/Modutex 716-924-4400
NY Woodside, Switches Unlimited 718-478-5000
NC Charlotte, Dixie Elctrns. 704-377-4348
NC Charlotte, Elctrns. Mktg. Corp. 704-394-6195
NC Winston-Salem, Kirkman Elctrns., Inc. 919-722-9131,800-334-8688
OH Columbus, Electronics Mktg. Corp. 614-299-4161
OH Highland Hgts., Electronics Mktg. Corp. 216-442-3441
OK Tulsa, Radio, Inc. 919-587-9123
OR Portland, Minarik Elc. Co. 503-253-3402
PA Harrisburg, Ad-Tech Elctrns. 717-939-8337
PA McKean, Advacom 814-476-7774
PA Norristown, Kimberly-James Co. 215-666-7286
PA Pittsburgh, Grant Indl. Controls, Inc. ... 412-787-9770
PA Wayne, Peak Elctrns. Corp. 215-293-9000
SC Columbia, Dixie Elctrns. 803-779-5332
TX Garland, Indl. Equip. Co. of Dallas 214-271-5494
TX Houston, Minarik Elec. Co. 713-748-0808
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TX Irving, Minarik Elec. Co. 214-929-4111
TX San Antonio, Minarik Elec. Co. 512-822-7097
WA Seattle, Platt Elec. 206-624-4083
WI Milwaukee, Marsh Elctrns. Corp. 414-475-6000

E-A-R DIV., Cabot Corp., 7911 Zionsville Rd., Indianapolis, IN 46268, Tel: 317-872-1111, TWX: 810-341-3412, FAX: 317-872-0617; *Sls. Mgr.:* Lawrence K. Landers

EASCO/K D TOOLS, See Hunter Tools, Easco/K D Tools

EAST CONTROLS, 6851 Church St., Hanover Park, IL 60103, Tel: 312-837-7709; Empl.: 1

EASTERN AIR DEVICES, INC., 1 Progress Dr., Dover, NH 03820, Tel: 603-742-3330, FAX: 603-742-9080; Empl.: 175 ..... **B•1240**

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FL Orlando, Werndli & Assoc. 407-851-1923
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NH Dover, Eastern Air Dvs. 603-742-3330
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NC Charlotte, Jake Rudisill Assocs. 704-377-6901
OH Cincinnati, KCH Co. 513-931-1686
OR Portland, D.A. Sullivan Co. 503-292-2448
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TX Richardson, D.J. Sls. 214-783-8876
WI Racine, KMG Sls., Inc. 414-639-9005

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CT Waterbury, Bearings, Inc. 203-755-3151
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ME Bangor, Bearings, Inc. 207-947-6583
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MA Wakefield, Bearings, Inc. 617-246-3906
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NH Berlin, Bearings, Inc. 603-752-6001
NH Dover, Bearings, Inc. 603-749-2121
NH Manchester, Bearings, Inc. 603-623-8897
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NC Charlotte, Motionex 704-377-6901
PA Pittsburgh, EXONIC Sys. 412-784-8400
RI Warwick, Bearings, Inc. 401-732-2600
VT Rutland, Bearings, Inc. 802-775-3550

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EATON CORP, Durant Products, 901 S. 12th St., Watertown, WI 53094, Tel: 414-261-4070, TWX: 910-260-3713; Empl.: 350; *Sls. Mgr.:* H. L. Sisson; *Dist. Mgr.:* Dennis G. Walz

EATON CORP., Electronic Instrument Div., 5340 Alla Rd., Los Angeles, CA 90066, Tel: 213-822-3061, TWX: 910-343-6969; Empl.: 200; *Sls. Mgr.:* John Martocci

EATON CORPORATION, Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086, Tel: 408-773-3700, TWX: 910-339-9556; FSC No.: 27338; Empl.: 495; *Sls. Mgr.:* John Stahlke

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KS	Kansas City, Eaton Corp./A & CCD	913-384-0080
MD	Baltimore, Eaton Corp./A & CCD	301-296-9640
MA	Boston, Eaton Corp./A & CCD	617-863-5427
MI	Detroit, Eaton Corp./A & CCD	313-354-7513
MN	Minneapolis, Eaton Corp./A & CCD	612-831-8668
NJ	Mt. Laurel, Eaton Corp./A & CCD	609-778-1100
NY	Long Island, Eaton Corp./A & CCD	516-864-6065
OH	Cleveland, Eaton Corp./A & CCD	216-835-4554
OH	Dayton, Eaton Corp./A & CCD	513-294-1877
PA	Pittsburg, Dolfuss-Root & Co.	412-221-4420
TX	Dallas, Eaton Corp./A & CCD	214-386-4121
WA	Seattle, Eaton Corp./A & CCD	206-946-5157
WI	Milwaukee, Eaton Corp./A & CCD	414-449-6709
Can	Scarborough, Ont., Eaton Ltd.	416-291-2563

EBERHARD MFG. CO., DIV., Eastern Co., 21944 Drake Rd., Strongsville, OH 44136, Tel: 216-238-9720, TELEX: 98-5301, FAX: 216-572-2732; FSC No.: 19220; *Sls. Mgr.:* Edward Hongosh

EBM INDUSTRIES, INC., 110 Hyde Road, Farmington, CT 06032, Tel: 203-674-1515, TWX: 710-423-8723, FAX: 203-674-8536; FSC No.: 62292; *Sls. Mgr.:* Robert Sobolewski ..... **C•1644-1649**

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CT	Clinton, Selmark Assocs.	203-573-9088
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FL	Clearwater, Raycom, Inc.	813-572-4282
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FL	Wellborn, Raycom, Inc.	904-963-5023
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MD	Ellicott City, Mktg. Technlg.	301-465-5944
MA	Millis, Selmark Assocs.	508-376-2914
MI	Warren, Burcaw Co.	313-573-4605
MI	Wyoming, Burcaw	800-572-1610
MN	St. Paul, Arkco Sls.	612-777-7454
MO	Florissant, Web Elctrns.	314-921-5720
NH	Hopkinton, Selmark Assocs.	603-746-3299
NJ	Marlton, b.g.r. Assocs.	609-983-1020
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OH	Maple Hgts., Versatron	216-581-0090
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TX	Houston, Bonser-Philhower Sls.	713-782-4144
TX	Richardson, Bonser-Philhower Sls.	214-234-8438
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VA	Fairfax, Mktg. Technlg.	703-323-9640
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WA	Spokane, Temco Northwest	509-534-8635
WI	Milwaukee, Beta Technolg. Sls., Inc.	414-543-6609
PR	Bayamon, Selmark	809-797-9176

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AZ	Tucson, Southwest Sls.	602-628-1613
CA	Anaheim, Deco Elec.	714-630-8252
CA	Costa Mesa, Powell	714-754-1717
CA	Fullerton, Pyramid/Fullerton	714-773-0781
CA	Hollywood, Yale Elctrns.	818-465-3186
CA	Irvine, Integrated Elctrns.	714-837-9960
CA	Sacramento, Integrated Elctrns.	916-424-5297
CA	San Diego, Deco Elctrns.	619-693-1595
CA	San Diego, Pyramid	619-271-5404
CA	San Jose, Integrated	408-435-1000
CA	San Jose, Powell Elec.	408-943-9020
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CA	Sunnyvale, Power Supply Comps.	408-737-1333
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CO	Englewood, Indl. Elctrns.	303-694-9444
CT	Danbury, Pilgrim Elctrns.	203-792-7274
CT	E. Haven, J. V. Elctrns.	203-469-2321
CT	Wallingford, Cronin Elec.	203-265-3134
CT	Yalesville, Glynn Elctrns.	203-265-2498
FL	Ft. Lauderdale, Powell Elec.	305-484-8377
GA	Atlanta, ACK Radio Supp.	404-351-6340
GA	Fayetteville, Frankland	404-461-4026
IL	Hoffman Estates, I.E.C. Intercomp	312-843-2040
IL	Rosemont, Advent Elctrns.	312-297-6200
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
KY	Florence, U.R.I. Elctrns.	606-371-4423
MD	Baltimore, Resco/Baltimore	301-529-0500
MD	Beltsville, Resco/D.C.	301-937-9100
MD	Columbia, Powell	301-621-8080
MA	Canton, Impact Sls. Co.	617-821-1500
MA	Middleboro, Glynn Elctrns.	508-947-4262
MA	Needham, Cronin	617-449-5000
MA	Westborough, Powell	617-366-6100
MA	Wilmington, Heilind Elctrns.	617-657-4870
MA	Woburn, Control Design Supp.	617-932-9404
MI	Battle Creek, Great Lakes Elctrns.	616-963-6282
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	Grand Rapids, S. F. Elctrns.	616-459-0216
MN	Minneapolis, Control Des. Supp.	612-721-1628
MO	Kansas City, L Comp	816-221-2400
MO	Maryland Hgts., L Comp	314-291-6200
NV	Carson City, Integrated Elctrns.	702-883-9399
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NH	Manchester, Glynn Elctrns.	603-622-8131
NH	Nashua, Brevan Elctrns.	603-889-7230
NJ	Englewood, Powell Elec.	201-894-0800
NJ	Rockaway, Tonar	201-586-9000
NJ	W. Berlin, General Comps.	609-768-6767
NM	Albuquerque, Betatron	505-821-1122
NY	Farmingdale, Addem Sls.	516-752-9303
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NY	Lynbrook, Peerless Radio	516-593-2121
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NC	Raleigh, Century	919-782-2116
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WI	New Berlin, Control Design Supp.	414-784-1015

EBY COMPANY, 4300 H Street, Philadelphia, PA 19124, Tel: 215-537-4700, TWX: 710-670-0452, FAX: 215-537-4780; FSC No.: 72825; Empl.: 75; *Sls. Mgr.:* Maurice Sterling

ECG, 14123 21st Ave. N., Plymouth, MN 55441, Tel: 612-554-0720

ECOSOFT, INC., 6413 N. College Ave., Indianapolis, IN 46220, Tel: 317-255-6476, FAX: 317-251-4604; Empl.: 3; *Sls. Mgr.:* Emma Alkire

ECS COMPOSITES, 3560 Rogue River Hwy., Box 188, Grants Pass, OR 97526, Tel: 503-476-8871, TWX: 510-755-0777; FSC No.: 24995; Empl.: 135; *Sls. Mgr.:* John L. Smith ..... **C•1022-1023**

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FL	Orlando, Honeyco, Inc.	305-299-1000
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OR	Grants Pass, ECS Inc.	503-476-8871
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TX	Dallas, Advance Tech. Sls.	214-340-1300
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GA	Norcross, Saber Assoc. Inc.	800-327-0853
IL	Elmhurst, Sector Engrg. Sls.	312-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-842-1120
KS	Overland Pk., Ramsey Assocs.	913-541-1007
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WA Seattle, Datacom Assoc. Inc. 206-285-2525
WI Milwaukee, Sector Eng. Sls. Inc. 414-352-8280

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NC Cary, Montgomery Mktg. 919-467-6319
NC Raleigh, Montgomery Mktg. 919-851-0010
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OH Centerville, Engrg. & Mktg. Assocs. 513-433-2800
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PA Huntingdon Valley, Omega Elctrn. Sls. 215-947-4135
TX Austin, West Assocs. 512-339-6886
TX El Paso, S.W. Sls. 915-594-8259
TX Houston, West Assocs. 713-621-5983
TX Richardson, West Assocs. 214-680-2800
WA Lynnwood, Blair Hirsh Co. 206-774-8151
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Can Napean, Ont, Renmark Elctrns. Ltd. 613-727-0320
Can Piedmont, P.Q., Renmark Elctrns. Ltd. 514-594-8679
Can Richmond Hill, Ont., Renmark Elctrns. Ltd. 416-881-8844

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CA Santa Monica, Master Distrs. 213-452-1229
AL Huntsville, Hall-Mark Elctrns. 205-837-8700
AL Huntsville, Marshall Inds. 205-881-9235
AZ Phoenix, Hall-Mark Elctrns. 602-437-1200
AZ Phoenix, Marshall Inds. 602-496-0290
AZ Tempe, Harper SID 602-967-1464
CA Canoga Park, Hall-Mark Elctrns. 213-217-8400
CA Chatsworth, Hall-Mark Elctrns. 818-773-4500
CA Chatsworth, Marshall Inds. 818-407-4100
CA Compton, Harper SID 213-979-5090
CA El Monte, Marshall Inds. 818-459-5500
CA Irvine, Marshall Inds. 714-458-5301
CA Milpitas, Marshall Inds. 408-942-4600
CA Rancho Cordova, Marshall Inds. 916-635-9700
CA San Diego, Hall-Mark Elctrns. 619-268-1201
CA San Diego, Harper SID 619-578-2500
CA San Diego, Marshall Inds. 619-578-9600
CA San Jose, Hall-Mark Elctrns. 408-432-0900
CA Santa Clara, Master Dists. 408-496-6151
CA Santa Fe Springs, MICRONET Computer Sys. 213-921-0068
CA Sunnyvale, Marshall Inds. 408-942-4600
CA Sunnyvale, Time Electronics 408-734-9888
CA Tustin, Hall-Mark Elctrns. 714-669-4700
CO Englewood, Hall-Mark Elctrns. 303-790-1662
CO Thornton, Marshall Inds. 303-451-8383
CT Wallingford, Hall-Mark Elctrns. 203-269-0100
CT Wallingford, Marshall Inds. 203-265-3822
CT Wallingford, Sager Electrical Supply Co. 203-265-4600
FL Clearwater, Hall-Mark Elctrns. 813-541-7440
FL Orlando, Hall-Mark Elctrns. 305-855-4020
FL Orlando, Marshall Inds. 305-767-0505
FL Pompano Beach, Hall-Mark Elctrns. 305-971-9280
GA Norcross, Hall-Mark Elctrns. 404-447-8000
GA Norcross, Marshall Inds. 404-923-5750
IL Schaumburg, Marshall Inds. 312-490-0155
IL Wood Dale, Hall-Mark Elctrns. 312-860-3800
IN Indianapolis, Hall-Mark Elctrns. 317-872-8875
IN Indianapolis, Mar Elctrns., Inc. 317-633-6699
IN Indianapolis, Marshall Inds. 317-297-0483
KS Lenexa, Hall-Mark Elctrns. 913-888-4747
KS Lenexa, Marshall Inds. 913-492-3121
MD Baltimore, Hall-Mark Elctrns. 301-988-9800
MD Silverspring, Marshall Inds. 301-622-1118
MA Billerica, Hall-Mark Elctrns. 617-667-0902
MA Hingham, Sager Elctrn. Supp. Co. 617-749-6700
MA Wilmington, Marshall Inds. 617-658-0810
MI Livonia, LWC Distrs. 313-464-7700
MN Eden Prairie, Hall-Mark Elctrns. 612-941-2600
MN Plymouth, Marshall Inds. 612-559-2211
MO Earth City, Hall-Mark Elctrn. 314-291-5350
MO Maryland Hgts., Chelsea Inds. 314-997-7709
NJ Fairfield, Hall-Mark Elctrns. 201-530-4543
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Mt. Laurel, Marshall Inds. (Philadelphia Div.) 215-627-1920
NM Albuquerque, International Elctrns. 505-293-3497
NY Buffalo, Summit Distrs. 716-887-2800
NY Hauppauge, Marshall Inds. 516-273-2424
NY Johnson City, Marshall Inds. 716-798-1611
NY Lynbrook, LI., Peerless Radio Corp. 516-593-2121
NY Rochester, Marshall Inds. 716-235-7620
NY Ronkonkoma, Hall-Mark Elctrns. 516-737-0600
NC Raleigh, Hall-Mark Elctrns. 919-872-0712
NC Raleigh, Marshall Inds. 919-878-9882
OH Dayton, Marshall Inds. 513-898-4480
OH Solon, Hall-Mark Elctrns. 216-349-4632
OH Solon, Marshall Inds. 214-248-1788
OH Worthington, Hall-Mark Elctrns. 614-888-3313
OR Beaverton, Almac Elctrns. 503-629-8090
OR Beaverton, Marshall Inds. 503-644-5050
PA Mt. Laurel, Marshall Inds. 215-627-1920
TX Austin, Hall-Mark Elctrns. 512-258-8848
TX Austin, Marshall Inds. 512-837-1991
TX Carrollton, Marshall Inds. 214-233-5200
TX Dallas, Hall-Mark Elctrns. 214-341-1147
TX El Paso, International Elctrns. 915-598-3406
TX Harper SID, Harper Sls. 214-621-0500
TX Houston, Hall-Mark Elctrns. 713-781-6100
TX Houston, Marshall Inds. 713-895-9200
UT Salt Lake City, Marshall Inds. 801-485-1551
UT West Valley, Hall-Mark Elctrns. 801-972-1008
WA Bellevue, Almac Elctrns. 206-643-9992
WA Bothell, Marshall Inds. 206-486-5747
WA Spokane, Almac Elctrns. 509-924-9500
WI New Berlin, Hall-Mark Elctrns. 414-797-7844
WI Waukesha, Marshall Inds. 414-797-8400
Can Burnaby, BC, RAE Indl. Elec. Ltd. 604-291-8866
Can Calgary, Alb., Cardinal Ind. Elec. Ltd. 403-259-6817
Can Calgary, Alta., Future Elctrns. 403-235-5325
Can Downsview, Ont., Future Elctrns. 416-638-4771
Can Edmonton, Alb., Cardinal Ind. Elec. Ltd. 403-483-6266
Can Edmonton, Alta., Future Elctrns. 403-438-2858
Can Montreal, Que., EMJ Data Sys. Ltd. 514-849-4171
Can Nepean, Ont., Carsten Elctrns., Ltd. 613-726-9250
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Scarborough, Ont., Carsten Elctrns., Ltd. 416-495-9999
Can St. Laurent, Que., Carsten Elctrns., Ltd. 514-334-8321
Can Vancouver, BC, EMJ Data Sys. Ltd. 604-732-7268
Can Vancouver, BC, Future Elctrns. 604-438-5545
CA Sunnyvale, Harper SID 408-943-9490

EEMCO DIV., Datron Systems Inc., 4585 Electronics Pl, Los Angeles, CA 90039, Tel: 818-247-7060, TWX: 910-497-2269, FAX: 818-244-6621; FSC No.: 72121; Empl.: 300; *Sls. Mgr.:* Russell Johnson

EEV INC., 4 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-6050, TELEX: 6818096, FAX: 914-682-8922; Empl.: 42; *Sls. Mgr.:* Jim Fisher

EFECTOR, INC., 805 Springdale Dr., Exton, PA 19341, Tel: 215-524-2000, 800-441-8246, TELEX: 84-6437, FAX: 215-524-2010; Empl.: 35; *Sls. Mgr.:* J. Kelly

EFI ELCTRNS., 2415 South 2300 West, Salt Lake City, UT 84119, Tel: 801-977-9009:800-221-1174, FAX: 801-977-0200; Empl.: 75; *Sls. Mgr.:* Mark A. Norrie

EFRATOM, See Ball Corp., Efratom Div.

ELECTRO NATIONAL, Matthews Ave., Canton, MS 39046, Tel: 601-859-5511, TWX: 810-990-0938, FAX: 601-859-5518; FSC No.: M-54208; Empl.: 40; *Sls. Mgr.:* Patsy Hicks

ELECTRONETICS, INC., Paine Field Bldg 335, Everett, WA 98204, Tel: 206-355-1855; Empl.: 10

ELECTRONIC APPLICATIONS CO., 4918 Santa Anita Ave., PO Box 4308, El Monte, CA 91734, Tel: 818-442-3212, TWX: 910-587-3351, FAX: 818-442-6873; Empl.: 60; *Sls. Mgr.:* Betsy Spencer

ELECTRONIC ASSOCIATES, INC., 185 Monmouth Pkwy, W. Long Branch, NJ 07764, Tel: 201-249-7069, FAX: 201-229-1329; *Dist. Mgr.:* Anthony Epifane

ELECTRONIC COIL CORP., Farmington Industrial Park, Farmington, CT 06032, Tel: 203-677-6731, FAX: 203-677-1902; Empl.: 67; *Sls. Mgr.:* Raymond Gorski, Jr.

ELECTRONIC COMPONENT ASSEMBLY, INC., 7181-Construction Ct., San Diego, CA 92121, Tel: 619-549-0808; Empl.: 180; *Sls. Mgr.:* Denise N. Winter

EG&G, INC., Electro-Optics Div., 35 Congress St., Salem, MA 01970, Tel: 508-745-3200, TELEX: 681-7405 EGGSA; FSC No.: 25506; Empl.: 500; *Sls. Mgr.:* J. Murachver

EG&G, INC., Electronics Components Div., 35 Congress St., Salem, MA 01970, Tel: 508-745-3200, TELEX: 681-7405 EGGSA; FSC No.: 25506; Empl.: 500; *Sls. Mgr.:* J. Murachver

EG&G, INC., Photon Devices, 35 Congress St., Salem, MA 01970, Tel: 617-745-3200, TELEX: 681-7405 EGSA; FSC No.: 25506; Empl.: 500; *Sls. Mgr.:* James Melnyk

EG & G ALMOND INSTRUMENTS, 1330 E. Cypress St., Covina, CA 91724, Tel: 818-967-9521, TWX: 910-584-1320, FAX: 818-967-3151; Empl.: 380; *Sls. Mgr.:* Dave Adams ..... **D•1734-1735**

Local Sales Offices & Reps

FL Orlando, Truex Assocs. 305-859-2160
NY Yonkers, Sonkin Assocs. 914-968-8282

EG & G BIRTCHER, EG & G, Inc., 4505 N. Arden Dr./P. O. Box 5268, El Monte, CA 91734-1268, Tel: 818-442-2572, TELEX: 247345 EGGUR, FAX: 818-442-8127; FSC No.: 18915; Empl.: 167; *Sls. Mgr.:* H. Robert Sproul; *Dist. Mgr.:* H. Robert Sproul ..... **C•1024-1025**

Local Sales Offices & Reps

AL Huntsville, Remco 205-533-3763
AZ Phoenix, Mercury Engrg. Sls. 602-244-0123
AZ Phoenix, Mercury Engrg. Sls., Inc. 602-265-0344
CA Brea, Masco 714-529-0866
CA San Diego, Masco 619-234-6905
CA Santa Clara, Nova-Tronix, Inc. 408-727-9530

CO Broomfield, Connors Co. 303-466-9628
FL Clearwater, HHP, Assocs. 813-797-4447
FL Pompano Beach, HHP Assocs., Inc. 305-971-5750
GA Atlanta, Remco 404-447-9637
IL Rollings Meadows, Heartland Technlg. Mktg., Inc. 312-577-9222
KS Shawnee Mission, M-S-B Assocs., Inc. 913-262-5500
MD Ellicott City, Eastern Tech. Corp. 301-461-7720
MA Needham Hgts., Coakley, Boyd & Abbett 617-444-5470
MN Minneapolis, Hsi-Lite Sls., Inc. 612-861-6051
NY Great Neck, Coakley, Boyd A Bett/Tylinsky 516-466-9070
NY Syracuse, IA Hotze Assocs. 315-479-6641
OH Cleveland, Jim Finnegan & Co. 216-398-6300
OH Dayton, Jim Finnegan & Co. 513-890-8322
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
PA Doylestown, Monteiro Assocs., Inc. 215-345-5855
PA Pittsburgh, Jim Finneagan & Co. 412-823-5400
TX Dallas, El-Com Mktg., Inc. 214-241-2166
TX Houston, El-Com Mktg. 713-350-8064
WA Redmond, Eclipse Mktg. Grp. 206-885-6991
Can Bolton, Ont., P.J. Heenan, Ltd. 416-857-4741

Local Distributors

CA Manhattan Beach, Prime Electro Prods. 213-379-3642
CO Aurora, Jet Elctrns. Supp. Co., Inc. 303-364-1000
CT S. Windsor, Car-Lac Elctrns. 203-282-0631
MA Milford, Car-Lac Elctrns. 508-478-7797
MA Winchester, Rush Inds., Inc. 617-729-5800
MN Minneapolis, Stark Elctrns., Inc. 612-332-1325
NY Bohemia, Car Lac Inds. Sls., Inc. 516-567-4200
NY Buffalo, Summit Distrs. 716-887-2800
NY Rochester, Summit Distrs. 716-334-8110
OH Englewood, Argent Inds. 513-836-8633
OR Beaverton, Murphy Elctrns. 503-642-2001
TX Ft. Worth, Industrial Elctrns. 817-731-7321
WA Redmond, Murphy Elctrns. 206-881-1234
Can Mississauga, Ont., Rush Elctrns. 416-677-7280

EG & G FLOW TECHNOLOGY, INC., Box 52103, Phoenix, AZ 85072, Tel: 602-437-1315, TELEX: 187-163; Empl.: 75; *Sls. Mgr.:* Ed Dahn

EG & G FREQUENCY PRODUCTS INC., EG & G Inc., 4914 Gray Rd., Cincinnati, OH 45232, Tel: 513-542-5555, TWX: 810-461-2749, FAX: 513-542-5146; FSC No.: 58997; Empl.: 300; *Sls. Mgr.:* G.Mullikin, M. Schwalje, W. Wilson

EG&G GAMMA SCIENTIFIC, Div. of EG&G Inc., 3777 Ruffin Rd., San Diego, CA 92123, Tel: 619-279-8034, TELEX: 697938, FAX: 619-576-9286; Empl.: 50; *Sls. Mgr.:* Robert Ruff

EG&G GEOMETRICS, Div. of EG&G Inc., 395 Java Dr., Sunnyvale, CA 94089, Tel: 408-734-4616, TELEX: 657435, FAX: 408-745-6131; FSC No.: 34314; *Dist. Mgr.:* Doug Crice

EG & G JUDSON, 221 Commerce Dr., Montgomeryville, PA 18936, Tel: 215-368-6900, TELEX: 846120, ESYLNK: 62820476, FAX: 215-362-6107; Empl.: 65

EG&G RETICON, Div. of EG&G, 345 Potrero Ave., Sunnyvale, CA 94086-4197, Tel: 408-738-4266, TWX: 910-339-9343, FAX: 408-738-6979; *Sls. Mgr.:* John Skurla

EG & G ROTRON, Custom Div., Hasbrouck La., Woodstock, NY 12498, Tel: 914-679-5201, FAX: 914-679-7080; FSC No.: 82877; *Sls. Mgr.:* Mike Lyon; *Dist. Mgr.:* Mary Fellows

EG&G ROTRON, Industrial Division, North Street, Saugerties, NY 12477, Tel: 914-246-3401, TELEX: 981511, FAX: 914-246-3802; FSC No.: 551496; Empl.: 55; *Sls. Mgr.:* Jay Jarboe; *Dist. Mgr.:* Jay Jarboe

EG & G VACTEC, 10900 Page Blvd., St. Louis, MO 63132, Tel: 314-423-4900, TWX: 910-764-0811, FAX: 314-423-3956; Empl.: 250; *Sls. Mgr.:* D. Hartley; *Dist. Mgr.:* D. Hartley ..... **B•1321**

Local Sales Offices & Reps

CA Encino, King-Way Assocs. 818-788-4124
CO Buena Vista, C-Tech 303-395-2025
FL Orlando, EAB Assocs. 305-898-7444
IL Highland Park, T. B. Hunter Assocs. 312-433-7000
IN Fort Wayne, Scott Elctrns. 219-484-7865
IN Indianapolis, Scott Elctrns. 317-841-0010
MD Laurel, R. W. Mitscher Co. 301-498-6090
MA Norwood, MacInnis Co. 617-762-8090
MI Southfield, O.E.M. Technical Sls. 313-444-1680
MN Eden Prairie, Rockmore Sls. 612-941-1390
MO St. Louis, Acorn Elctrns. 314-644-2510
NJ Marlton, B.G.R. Assocs. 609-428-2440
NY Pittsford, C. W. Beach Co. 716-586-3200
NY Syracuse, C. W. Beach Co. 315-446-9587
OH Cincinnati, Scott Elctrns. 513-791-2513
OH Cleveland, Scott Elctrns. 216-473-5050
OH Dayton, Scott Elctrns. 513-294-0539
OH Reynoldsburg, Scott Elctrns. 614-863-1281
TX Richardson, Interactive Comps. 214-669-2277
VA Shipman, R. W. Mitscher Co. 804-263-5154

Local Distributors

CA Encino, King Way West 818-788-4124
CA Palo Alto, Zack Elctrns. 415-326-5432
CA Santa Clara, Allied Elctrns. 408-727-1690
FL Orlando, Nico 305-898-7444
IL Chicago, Newark Elctrns. 312-638-4411
IL Elgin, Allied Elctrns. 312-697-8200
MO St. Louis, Olive Indl. Elec. 314-426-4500
OH Dayton, Televox, Inc. 513-294-4499
TX Fort Worth, Allied Elctrns. 817-336-5401

EG&G WAKEFIELD ENGINEERING

FAX: 617-246-0874

EG & G WAKEFIELD ENGINEERING, 60 Audubon Rd., Wakefield, MA 01880, Tel: 617-245-5900; Empl.: 250; *Sls. Mgr.:* Frank Casdia; *Dist. Mgr.:* Carl Swanson ..... **C•1651**

Local Sales Offices & Reps

AL Huntsville, Over & Over, Inc. 205-837-7105
AZ Phoenix, Sanford Sls. 602-957-3570
CA Los Altos, Recht Assocs. 415-964-6321
CA San Diego, Mesa Elctrns. 619-278-8021
CO Denver, Delltron Co. 303-373-0300
FL Tampa, Over & Over Inc. 813-626-9100
GA Norcross, Over & Over, Inc. 404-449-6205
IL Rolling Meadows, Sumer, Inc. 312-991-8500
IA Cedar Rapids, C. H. Horn Assocs. 319-393-8703
MD Timonium, Bresson Assocs. 215-664-6460
MI Livonia, Luebbe Sls. 313-477-3131
MN Mendota Heights, G-II Sls. 612-454-3086
MO St. Louis, John Macke Co. 314-432-2830
NY Commack, ERA, Inc. 516-543-0510
NY E. Rochester, Tri Tech Elctrns. 716-385-6500
NY Fayetteville, Tri Tech Elctrns. 315-446-2881
NC Charlotte, Over & Over, Inc. 704-542-9111
OH Cincinnati, Luebbe Sls. Co. 513-530-0600
OH Cleveland, Luebbe Sls. Co. 215-333-0425
OR Lake Oswego, RTS Inc. 503-244-4123
PA Narbeth, Bresson Assocs. 215-664-6460
TX Austin, Milco Mktg. 512-453-3023
TX Richardson, Milco Mktg. 214-783-2716
TX Stafford, Milco Mktg. 713-723-5003
UT Sandy, Delltron Co. 801-942-4678
VA Forrest, Bresson, Assocs. 215-664-6460
WA Vashon, RTS Inc. 206-285-1363
WI Brookfield, Sumer, Inc. 414-784-6641

Local Distributors

AL Birmingham, Newark 205-942-4044
AZ Phoenix, Wyle 602-249-2232
AZ Tempe, Bell 602-966-7800
AZ Tempe, Newark 602-968-7441
CA Buena Pk., Cypress 213-521-5230
CA El Segundo, Wyle 213-322-8100
CA Foster City, Newark 415-572-8300
CA Fountain Valley, Comp. Center 714-979-0433
CA Garden Grove, Bell 714-220-0681
CA Gardena, Bell 213-515-1800
CA Inglewood, Newark 213-678-0441
CA Irvine, Wyle 714-863-9953
CA Rancho Cordova, Wyle 916-638-5282
CA Roseville, Bell 916-969-3100
CA San Diego, Bell 619-268-1277
CA San Diego, Cypress 619-292-5611
CA San Diego, Newark 619-481-1251
CA San Diego, Wyle 619-565-9171
CA Santa Ana, Elcom 213-404-2961
CA Santa Ana, Wyle 408-727-2500
CA Santa Clara, Comps. Ctr. 408-988-3751
CA Santa Clara, Cypress 408-435-8400
CA Sunnyside, Bell 408-734-8570
CA Thousand Oaks, Bell 805-499-6821
CO Denver, Newark 303-757-3351
CO Thornton, Wyle 303-457-9953
CO Wheat Ridge, Bell 303-424-1985
CO Wheat Ridge, Cypress 303-431-2622
CT Bloomfield, Newark 203-243-1731
CT S. Windsor, Carlac 203-282-0631
CT Wallingford, Midan 203-265-2077
FL Casselberry, AFCOM 305-767-6565
FL Ft. Lauderdale, Newark 305-587-2372
FL Graham/Largo, Bell 813-541-4434
FL Lake Mary, Elctrn. Fasteners 305-321-4000
FL Miami, Elctrn. Equip. 305-871-3500
FL Orlando, Newark 305-896-8350
GA Atlanta, Newark 404-448-1300
GA Norcross, Bell 404-662-0923
GA Norcross, Specialty 404-458-6341
IL Chicago, Bell 312-640-1910
IL Chicago, Newark 312-784-5100
IL Elk Grove VL, GBL Elec. 312-593-3220
IN Carmel, Altex 317-848-1323
IN Ft. Wayne, Bell 219-423-3422
IN Indianapolis, Bell 317-634-8202
IN Indianapolis, Newark 317-298-7070
IN Lafayette, Bell 317-423-5564
IA Cedar Rapids, Bell 319-395-0730
IA Cedar Rapids, Dee Elctrns. 319-365-7551
IA Cedar Rapids, Newark 319-362-1171
KS Lenexa, Newark 913-492-6000
KS Wichita, RSC 316-267-5213
KY Louisville, Newark 502-423-0280
KY Metarie, Newark 504-888-5174
LA Shreveport, Indl. Elec. Supp. 318-222-9459
MD Beltsville, Newark 301-937-5085
MD Columbia, G.R.S. 301-995-6744
MD Rockville, Capitol Radio Whlsrs. 301-881-2270
MA Canton, Impact Sls. 617-821-1500
MA Milford, CAR-LAC 617-478-7797
MA Norwood, Emtel Elctrns. 617-769-9500
MA Winchester, Rush Inds. 617-729-5800
MA Woburn, JACO 617-933-7760
MA Woburn, Newark 617-935-8350
MI Ann Arbor, Bell 313-971-9093
MI Ann Arbor, Wedemeyer 313-665-8611
MI Grand Rapids, Newark 616-241-6681
MI Livonia, RS Elec. 313-525-1155
MN Minneapolis, Newark 612-331-6350
MN St. Paul, Gophers 612-483-3322
MO Hazelwood, Newark 314-731-1204
MO St. Louis, Newark 314-298-2505
NE Omaha, Newark 402-392-1221
NJ Camden, G.R.S. 609-964-8560
NJ Clifton, Engrd. Assemblies 201-340-0600
NJ E. Hanover, Delburn 201-884-0800
NJ Kenilworth, Newark 201-272-8410
NJ Penshauken, Newark 609-663-9490
NJ Springfield, Route Elec. 201-379-7710
NM Albuquerque, Bell 505-292-2700
NY Bohemia, Car-Lac 516-567-4200
NY Buffalo, Genesee Radio 716-873-9661
NY Buffalo, Summit 716-884-3450
NY Commack, CAR-LAC 516-282-0631
NY Farmingdale, Semispecialists 516-293-2710
NY Hauppauge, JACO 516-273-5500
NY Henrietta, CAM/RPC 716-334-5600
NY Rochester, Newark 716-473-6600
NY Rochester, Summit 716-334-8110
NY Suffern, Nobel Elec. 914-357-4500
NY Valley Stream, Newark 516-887-2100
NC Greensboro, Newark 919-292-7240
NC Raleigh, Southeastern Elctrns. 919-828-2311
NC Winston-Salem, Kirkman Elec. 919-722-9131
OH Cincinnati, Bell 513-772-1661
OH Cincinnati, Hughes Peters 513-351-2000
OH Cleveland, CAM/Ohio 216-461-4700
OH Cleveland, Darrah 216-631-0912
OH Columbia, Newark 614-451-0002
OH Columbus, Bell 614-895-1590
OH Columbus, Hughes Peters 614-294-5351
OH Dayton, Bell 513-434-8231
OH Dayton, Stotts Friedman 513-298-5555
OH Warren, REM Elec. 216-373-1300
OK Oklahoma City, Newark 405-495-5000
OK Tulsa, Altair 918-252-5781
OK Tulsa, Radio Inc. 918-587-9123
OR Beaverton, Comp. Resources 503-641-8488
OR Hillsboro, Wyle 503-640-6000
OR Lake Oswego, Bell 503-241-4115
OR Portland, Newark 503-620-1614
OR Wilsonville, Shelley-Ragon 503-682-2929
PA Allentown, Newark 215-434-7171
PA Montgomeryville, Pyttronic 215-643-2850
PA Pittsburgh, CAM-RPC 412-782-3770
PA Pittsburgh, Newark 412-787-7740
PA Reading, Barbey 215-376-7451
RI Knoxville, Newark 615-588-6493
RI Warwick, Newark 401-738-4010
TN Nashville, Bell 615-367-4400
TX Austin, Wyle 512-834-9957
TX Dallas, Cypress 214-869-1435
TX Dallas, Newark 214-494-5911
TX Houston, Altair 713-462-3029
TX Houston, Newark 713-782-4800
TX Houston, Wyle 713-879-9953
TX McKinney, Prime 214-542-7915
TX Richardson, Altair 214-231-5166
TX Richardson, JACO 214-235-9575
TX Richardson, Wyle 214-235-9953
TX Stafford, Harrison Equip. 713-879-2660
TX Sugarland, Quality Comps. 713-491-2255

UT Salt Lake City, Bell 801-972-6969
UT Salt Lake City, Newark 801-484-8611
UT Salt Lake City, Wyle 801-974-9953
VA Arlington, Newark 703-522-0880
VA Charlottesville, Virginia Elec. 804-296-4184
WA Bellevue, Bell 206-747-1515
WA Bellevue, Newark 206-641-9800
WA Bellevue, Wyle 206-453-8300
WA Redmond, Shelley-Ragon 206-241-1980
WI Milwaukee, Indl. Elec. 414-276-1212
WI Milwaukee, Newark 414-463-1100
WI Ocomonowoc, GW Elec. 414-567-9445
WI Waukesha, Bell 414-547-8879

EGIS CORPORATION, P. O. Box 751, Barrington, IL 60011-0751, Tel: 312-639-4448, TELEX: 650-336-1335 IMD, FAX: 312-639-8710; Empl.: 11

EH ELECTRONICS, INC., See Wavetek San Diego, Inc., Tel. 619-279-2200

EHRHORN TECHNOLOGICAL OPERS., INC., 4975. North 30th St., Colorado Springs, Colorado 80919, Tel: 719-260-1191, FAX: 719-260-0395; Empl.: 106; *Sls. Mgr.:* Rod Jensen; *Dist. Mgr.:* Rod Jensen

EI & S CORPORATION, 42 Pleasant St., Stoneham, MA 02180, Tel: 617-438-5300, FAX: 617-438-1662; FSC No.: 14908; Empl.: 100

FAX: 401-738-7154

EICHHOFF ELECTRONICS, 205 Hallene Rd., Warwick, RI 02886, Tel: 401-738-1440; Empl.: 280; *Sls. Mgr.:* David Leary ..... **A•1652-1655; B•1470-1471**

Local Sales Offices & Reps

CA Orange, E.T.A. 714-998-9241
CO Inglewood, Megatronics 303-799-3700
FL Tampa, Std. Mktg. Inc. 813-933-5833
FL W. Melbourne, Std. Mktg. Inc. 305-725-7073
IL Wheaton, Chadra-Schilke & Assocs. .. 312-653-8126
MI Livonia, Wenner & Assocs. 313-591-7955
MN Minneapolis, Electro-Serv Co. 612-338-3475
NH Nashua, Bell Controls, Inc. 613-882-6984
NY Liverpool, M.J. Sls. & Engrg. Inc.
NC Charlotte, W. L. Moorhead & Co. 704-366-2791
OH Mansfield, R. J. Goosman & Assocs. .. 419-756-5746
PA Washington Cross, Access Elctrns. 203-276-9303, 215-757-5504
TN Chattanooga, Stetco, Inc. 615-899-6831
UT Salt Lake City, Chuck Fields Assocs. .. 801-531-6177
UT Salt Lake City, Quorum 3 801-943-9227
Can Oakville, Ont., Haltronics Ltd. 416-844-2121

EIKONIX, 15 Wiggins Avenue, Bedford, MA 01730, Tel: 617-276-7161, TELEX: 951231, FAX: 617-276-5063; Empl.: 175; *Sls. Mgr.:* Jim LLoyd

EI MICROCIRCUITS, INC., 1650 Madison Ave., Mankato, MN 56001, Tel: 507-345-5786, FAX: 507-345-7559; Empl.: 40; *Sls. Mgr.:* Perry Eimers

EI NORTH AMERICA, 435 E. 79th St., New York, NY 10021, Tel: 212-517-5622, FAX: 212-517-5516

EIP MICROWAVE, INC., 2731 North First St., San Jose, CA 95134, Tel: 408-433-5900, TWX: 910-338-0155, FAX: 408-434-0258; FSC No.: 34257; Empl.: 100; *Sls. Mgr.:* Donn Mulder

EITEL MFG., 33208 Paseo Cerveza, Ste. G, San Juan Capistrano, CA 92675, Tel: 714-240-3933; Empl.: 6; *Sls. Mgr.:* H. Mengel

ELANTEC, INC., 1996 Tarob Ct., Milpitas, CA 95035, Tel: 408-945-1323, 800-821-7429, FAX: 408-945-9305; FSC No.: 64762; Empl.: 150; *Sls. Mgr.:* Ralph Granchelli

ELASTOMERIC TECHNOLOGIES, INC.

FAX: 215-672-4633

ELASTOMERIC TECHNOLOGIES, INC., 2940 Turnpike Dr., Hatboro, PA 19040, Tel: 215-672-0787, 215-672-4741, TWX: 387-236; FSC No.: 64914; *Sls. Mgr.:* John H. Seibert; *Dist. Mgr.:* George Glatts ..... **C•1344-1345**

Local Sales Offices & Reps

AL Huntsville, Remco 205-533-3763
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CA Fullerton, Libratronix 714-871-1513
CA San Jose, Western Indl. Network 408-559-8118
CO Broomfield, Sunbird Inds., Inc. 303-460-9199
CO Denver, Sunbird Inds. 719-481-2900
CT S. Dartmouth, Remtron 508-996-5594
FL Casselberry, Southern Elctrns. Sls. 407-332-4718
FL Melbourne, Southern Elctrns. Sls. 407-242-9662
FL W. Palm Beach, Southern Elctrns. Sls. 407-790-4369
GA Atlanta, Remco 404-447-6937
IL Barrington, Fisk Mktg. 312-381-0653
IN Ft. Wayne, R. L. Bontempo & Assocs. 219-478-1057
KS Wichita, Baka Corp. 316-682-8411
MA Needham Hgts., Remtron 617-444-9566
MI Troy, C. B. Jensen & Assocs. 313-643-0506
MN Brooklyn Center, Willman Assocs. 612-566-5010
MO Creve Coeur, Baka Corp. 314-878-4224
NJ Madison, Livera-Polk Assocs., Inc. 201-377-3220
NY Glen Head, Livera-Polk Assocs., Inc. .. 516-759-9300
NC Raleigh, C-Tech Sls. Co. 919-782-8100
OH Cincinnati, G & H Sls. 513-272-0580
OH Cleveland, Arthur Baier Co. 216-461-6161
OR Beaverton, L. D. Elctrns. 503-684-8221
PA Hatboro, J. S. Wurts 215-674-3562
TX Houston, Marcom 713-271-5635
UT Salt Lake City, Sunbird Inds. 801-943-5609
WA Snohomish, L. D. Elctrns. 206-568-0511
WA Spokane, LD Elctrns. 509-922-4883

ELCO CORP., Electronic Connector Div., Huntingdon Ind'l. Park, Huntingdon, PA 16652, Tel: 814-643-0700, TWX: 510-691-3117; Empl.: 500; *Sls. Mgr.:* W. J. Graef; *Dist. Mgr.:* W. G. Solomon

ELCOM INDUSTRIES, INC., 10268 Bach Blvd., St. Louis, MO 63132, Tel: 314-429-3100, FAX: 314-429-9706; Empl.: 20; *Sls. Mgr.:* Thomas C. Noel

ELCOM SYSTEMS, INC., 932 Clint Moore Rd., Boca Raton, FL 33487, Tel: 305-994-1774, FAX: 407-994-1770; FSC No.: 32424; Empl.: 8; *Sls. Mgr.:* D. Pollachek ..... **A•1779**

Local Sales Offices & Reps

EXP MA, Mattapoisett, Clark Export-Import Co. 617-758-6448

ELCON PRODUCTS INTERNATIONAL COMPANY, 42700 Lawrence Place, Fremont, CA 94538, Tel: 415-490-4200, FAX: 415-490-3740; FSC No.: 85901; Empl.: 33; *Sls. Mgr.:* Shirlee Gendreau (inside Sls. Mgr.)

Local Sales Offices & Reps

CA La Miranda, Isys West 714-738-1582
CA San Jose, Isys, Inc. 408-259-0800
CT Danbury, Hathaway Elctrns. 203-790-6993
KS Kansas City, Bonner & Assocs. 816-756-0082
MA Lexington, Hathaway Elctrns. 617-861-7010
MN Minneapolis, Boerger & Assocs. 612-560-3435
MO Kansas City, Bonner & Assocs. 816-756-0082
NJ Basking Ridge, Churchill Assocs. 201-204-0744
OR Lake Oswego, RTS, Inc. 503-635-4927
TX Dallas, Dynamark Tech. Sls. 214-437-3333
WA Vashon, RTS, Inc. 206-285-1363
Can Mississauga, Ont., Patlon Aircraft & Inds. 416-624-5572

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ELDEC CORP., Power Conversion Div., 16700 13th Ave. W., P.O. Box 100, Lynnwood, WA 98046-0100, Tel: 206-743-1313, TELEX: 497-0640, TWX: 910-449-2855; Empl.: 1400

ELDEC CORPORATION, Sensing Systems Div., 22000 Bothell Way-S.E., Bothell, WA 98041-3002, Tel: 206-487-4000, TELEX: 910-449-0873

ELDRE CORPORATION, 1500 Jefferson Rd., Rochester, NY 14623, Tel: 716-427-7280, TWX: 510-253-4347, FAX: 716-272-0018; FSC No.: 19648; Empl.: 220; *Sls. Mgr.:* James N. Fitzpatrick

ELECSYS,INC., Div. of C & C Jetronic, 320 Wall St., Princeton, NJ 08540, Tel: 609-921-2726, TELEX: 4971717, FAX: 609-921-7971; Empl.: 1; *Sls. Mgr.:* C. Jerry Chiang ..... **A•1739**

ELECTRAC, INC., 1614 Orangethrope Way, Anaheim, CA 92801, Tel: 714-879-6021, TELEX: 692433; FSC No.: 016154; Empl.: 35; *Sls. Mgr.:* Roland H. Wills

ELECTRA-TEC, Impert Industries, Inc., 557 W. M-89, Otsego, MI 49078, Tel: 800-225-3532, 616-694-2058, FAX: 616-694-2058; FSC No.: 4J966; Empl.: 20; *Sls. Mgr.:* William Robinson ..... **C•1026**

ELECTRICAL INDUSTRIES CORP., 691 Central Ave., Murray Hill, NJ 07974, Tel: 201-464-3200, FAX: 201-464-7619; FSC No.: 20093; Empl.: 300; *Sls. Mgr.:* D.V. Wilson

ELECTRICAL INSTRUMENT SERVICE, 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717, FAX: 914-699-9410; FSC No.: 32590;16034A; Empl.: 35 ..... **D•1344-1345**

Local Sales Offices & Reps

AZ Scottsdale, Williams Assocs. 602-947-4297
CO Commerce City, Williams Assocs. 303-289-5647
DC Washington, Whitcomb Assocs. 202-737-0763
IL Lincolnwood, Saffro & Assocs. 312-677-9722
LA Metairie, Data Mktg. Assocs. 504-833-3655
MA Lexington, Zieco 617-861-8300
MI Southfield, Comtel Instrs. Co. 313-358-2505
MN Minneapolis, Hei-Lite Sls. 612-861-6051
NM Albuquerque, Williams Assocs. 505-255-1638
NY Mount Vernon, Elctrl. Instr. Svc. 914-699-9717
OH Cleveland, Comtel Instrs. Co. 216-442-8080
OH Dayton, Comtel Instrs. Co. 513-426-5310
OH Hilliard, Comtel Instrs. Co. 614-876-8305
OK Tulsa, Data Mktg. Assocs. 918-494-2711
PA Pittsburgh, Comtel Instrs. Co. 412-922-5720
TX Austin, Data Mktg. Assocs. 512-443-7722
TX Dallas, Data Mktg. Assocs. 214-661-0300
TX Houston, Data Mktg. Assocs. 713-954-5020
TX San Antonio, Data Mktg. Assocs. 512-342-3031
UT Salt Lake City, William-Assocs. 801-485-6511
WI Lake Mills, Saffro & Assocs. 1-800-327-0312
Can Beaconsfield, Que., Mesurina Ltee/Ltd. 514-697-6581

ELECTRICAL STANDARDS DIV., E.S.R.S., Inc., 7337 Greenbush, N. Hollywood, CA 91605, Tel: 818-765-4224; Empl.: 6

ELECTRICAL WINDINGS, INC., 2015 N. Kolmar Ave., Chicago, IL 60639, Tel: 312-235-3360; FSC No.: 72128; Empl.: 160; *Sls. Mgr.:* Donal R. Murphy

ELECTRIC DEVICE, PO Box 337, Canfield, OH 44406, Tel: 216-533-1111, FAX: 216-533-2639

ELECTRIC INDICATOR COMPANY INC., 272 Main Ave., Norwalk, CT 06851, Tel: 203-847-5861; FSC No.: 73693; Empl.: 60

ELECTRIC MOTOR ENGINEERING, 1847 Victory Blvd., Glendale, CA 91201, Tel: 818-502-1866, FAX: 818-520-1780; Empl.: 5; *Sls. Mgr.:* Jerry Kibler; *Dist. Mgr.:* Jerry Kibler

Distributor

ELECTRIC SWITCHES, INC., 2478 Fletcher Dr., Los Angeles, CA 90039, Tel: 213-660-1310, TWX: 910-321-2971; Empl.: 42; *Sls. Mgr.:* Louis Lim ..... **B•**1730-1731 619, 621, 625, 639, 643, 645, 646, 666, 672, 684, 697, 711, 718, 720, 726, 731, 738, 744, 753, 757, 763, 781, 795, 799

ELECTRIC TACHOMETER, 68th & Upland Sts., Philadelphia, PA 19142, Tel: 215-726-7723, TELEX: 83-1475, FAX: 215-724-3682; FSC No.: 20049; Empl.: 50; *Sls. Mgr.:* F. M. Porter

Local Sales Offices & Reps

AL Huntsville, VESCO 205-881-1494
CA Belmont, TechSci. Intl., Inc. 415-592-6300
IL Hinsdale, Johnson Engrg. & Sls. Co. .. 312-325-2272
NY Pittsford, Holter Assocs. 716-381-7988
NY Valley Stream, Idalee Elctrns. Corp. 516-825-8955
NC Greensboro, Associated Agents 919-292-6508
OH Cincinnati, Kammerer Sls. Co. 513-271-0131
OH Cleveland, Fred R. Sharp Co. 216-464-3820
PA Pittsburgh, Technovation Assocs., Inc. 412-366-4760
TX Stafford, Jordan Equip. Co. 713-498-6212

ELECTRIC TIME COMPANY, INC., P.O. Box 466, Medfield, MA 02052, Tel: 617-359-4396, FAX: 617-359-4482; FSC No.: 6645; Empl.: 10

ELECTRO ASSEMBLIES CORP., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062, Tel: 312-498-6520, FAX: 312-272-2915; FSC No.: 09250; Empl.: 60; *Sls. Mgr.:* Greg Andrews

ELECTROCHEM INDUSTRIES

FAX: 716-759-7390

ELECTROCHEM INDUSTRIES, Wilson Greatbatch Ltd., 10000 Wehrle, Clarence, NY 14031, Tel: 716-759-7320, TELEX: 137-084; FSC No.: 6U589; Empl.: 300ò; *Dist. Mgr.:* P. Baker ..... **D•1489**

Local Sales Offices & Reps

CA	Garden Grove, Elsco Elctrns., Inc.	714-891-4621
CA	San Diego, Elsco Elctrns., Inc.	619-292-1771
IN	Indianapolis, STB & Assocs., Inc.	317-844-9227
MA	Waltham, Del Tech Sls.	617-894-4550
NJ	Medford, Champion Elctrn. Sls., Inc.	609-983-0932
OH	Beachwood, Electronic Salesmasters	216-831-8647

Local Distributors

AZ	Phoenix, Lynntronics	602-433-0288
AZ	Scottsdale, Electro Mktg.	602-991-0110
CA	Long bch., Battery Specialties	213-437-1809
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	San Jose, Battery Specialties	408-554-1501
CA	San Jose, Rose Elctrns.	408-943-0200
CO	Englewood, AVT, Inc.	303-779-8056
CO	Englewood, Shelley-Ragon, Inc.	303-762-0670
IL	Downers Grove, TDI, Inc.	312-971-3460
MA	Sharon, Adcour, Inc.	617-784-8123
MI	Ann Arbor, Wedemeyer Elctrns. Supp. Co.	313-665-8611
MN	St. Paul, Shelley-Ragon, Inc.	612-642-2858
NJ	Clifton, Engrd. Assemblies Corp.	201-340-0600
NC	Raleigh, Engrd. Assemblies Corp.	919-790-9700
PA	McKean, Advacom, Inc.	814-476-7774
TX	Houston, Kent/K. Tec	713-954-8407
WA	Redmond, Priebe Elctrns.	206-881-2363
Can	Calgary, Alberta, Saynor Varah Inc.	403-255-9550
Can	Don Mills, Ont., Saynor Varah Inc.	416-445-2340
Can	Edmonton, Alberta, Saynor Varah Inc.	403-461-2222
Can	Quebec, Saynor-Varah	514-630-7470
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ELECTRO CORPORATION, Sub. of Fasco Industries Inc., 1845 57th Street, P.O. Box 3049, Sarasota, FL 34230-3049, Tel: 813-355-8411, TELEX: 52683, FAX: 813-355-3120; FSC No.: 81692; Empl.: 300; *Sls. Mgr.:* Steve Anderson; *Dist. Mgr.:* Ron Essig

ELECTROCUBE, 1710 So. Del Mar Ave., San Gabriel, CA 91776, Tel: 818-573-3300, FAX: 818-280-9259; FSC No.: 14752; Empl.: 175; *Sls. Mgr.:* Gene Williams; *Dist. Mgr.:* Gene Williams

ELECTRODATA, INC., 23020 Miles Rd., Bedford Heights, OH 44128, Tel: 216-663-3333, TWX: 810-427-2280, FAX: 216-663-0507; FSC No.: 34-1173465; Empl.: 15; *Sls. Mgr.:* Philip Ardire; *Dist. Mgr.:* Philip Ardire

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ELECTRODYNAMICS, INC., A Talley Inds. Co., 1200 Hicks Rd., Rolling Meadows, IL 60008, Tel: 312-259-0740, TELEX: 28-1070; FSC No.: 10236; Empl.: 250; *Sls. Mgr.:* Frank Rafferty ..... **D•1145**

Local Sales Offices & Reps

CA	Alhambra, M. W. Riedel & Co.	213-283-7694
CA	Hayward, Liaison, Inc.	415-783-1131
CO	Denver, West High-Tech, JV	303-477-8180
CT	Old Saybrook, FJS Assocs.	203-388-5374
IA	Cedar Rapids, J.R. Sales Engrg.	319-393-2232
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MA	Burlington, FJS Assocs.	617-273-5959
MN	Minneapolis, TWC Sls.	612-636-1770
MO	St. Louis, Midwest Meridian Corp.	314-878-4441
NJ	Basking Ridge, Churchill Assocs.	201-204-0744
NY	Larchmont, Hingston Walsh Assocs., Inc.	914-834-5781
NY	Pittsford, Noeth Honsinger Assocs.	716-586-9002
OR	Tigard, ElTech, Inc.	503-684-3458
PA	Norristown, Rivco January Inc.	215-631-1414
TX	Roanoke, CMR	817-379-6540
WA	Bellevue, ElTech, Inc.	206-643-4330

ELECTRO-DYNAMICS DEV. CO., 475 Mt. Hood Dr. S.W., Issaquah, WA 98027-4038, Tel: 206-392-2493; FSC No.: 9J838; *Sls. Mgr.:* W. A. Pommer

ELECTROFILM, 27727 Avenue Scott, P.O. Box 55669, Valencia, CA 91355, Tel: 805-257-2240, TELEX: 65-1438; FSC No.: 85932; Empl.: 95; *Sls. Mgr.:* Richard W. Pearson

ELECTRO-FILMS

FAX: 401-738-4389

ELECTRO-FILMS, INC., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, Tel: 401-738-9150, TWX: 710-382-0405; FSC No.: 57252; Empl.: 260; *Sls. Mgr.:* Ted Petit, Corp. Sls. Dir. ..... **A•1781, 1944-1946**

Local Sales Offices & Reps

AL	Huntsville, BCI, Inc.	205-539-4411
CA	San Jose, NES Assocs.	408-293-2600
CA	Santa Ana, Weatherman Assocs.	714-544-1304
CA	Sunnyvale, NES Assocs.	408-738-3259
CO	Ft. Collins, Rep Sls.	303-226-1504
FL	St. Petersburg, QXI	813-894-4556
GA	Chamblee, BCI, Inc.	404-455-0405
IL	Palatine, M & S Sls.	312-934-1200
IN	Ft. Wayne, Corrao Marsh	219-482-2725
MA	Bedford, Vector Assocs.	617-271-0000
MA	Bedford, Vector Assocs.	617-275-5358
MI	Livonia, Electro Sls. Assocs.	313-421-7500
MN	Minneapolis, PSA	612-835-5281
NM	Albuquerque, Western High Tech. Mktg.	505-884-2256
NY	Plainview, Robert Smith Assocs.	516-681-3155
NY	Syracuse, Labtronics	315-455-7314
NJ	Whippany, Robert Smith Assocs.	201-340-0204
NC	Charlotte, BCI, Inc.	704-545-7657
NC	Winston-Salem, Comp. Concepts	919-765-3484
OH	Chesterland, Electro Sls. Assocs.	216-729-0190
OH	Dayton, Electro Sls. Assocs.	513-426-5551
OR	Aloha, Demarest Assocs., Inc.	503-642-4515
PA	Exton, Linear Sls.	215-524-8080
PA	Pittsburgh, Electro Sls. Assocs.	412-322-9000
PA	Trevose, PSA Inc.	215-245-0513
TX	Missouri City, Jackson Arnold Assocs.	713-261-0798
VA	Oakton, PSA, South	703-281-1806
WA	Seattle, Demarest Assocs.	206-523-3210
Can	Montreal, Que., Solid State Engr. Co.	514-481-3313

ELECTRO FORCE CORP., 727 Oakstone Way, Anaheim, CA 92806, Tel: 714-774-3666

ELECTROHOME LIMITED, Circuit Board Operations, 809 Wellington St. N., Kitchener, Ontario, Canada N2G 4J6, Tel: 519-744-7111, TELEX: 069-55449, FAX: 519-749-3131; Empl.: 2000; *Sls. Mgr.:* Joe Moser

Electro IMPULSE, INC.

FAX: 201-747-7153

ELECTRO IMPULSE, Box 870, Red Bank, NJ 07701-0870, Tel: 201-741-0404, TWX: 710-722-5717 EILRENK; FSC No.: 91161; Empl.: 105; *Sls. Mgr.:* Mark Rubin ..... **C•1652-1653; D•1243**

Local Sales Offices & Reps

CA	Los Angeles, RDH Assocs.	213-396-4100
FL	Indian Harbour Beach, Southeastern Comp. Sls., Inc.	407-773-3767
GA	Atlanta, Southeastern Comp. Sls., Inc.	404-451-5353
KS	Overland Park, WEB Assocs./Elctrns., Inc.	913-381-7986
MD	Ellicott City, Saltech	301-461-7350,
MA	Reading, Geder Assocs.	617-944-3105
MO	Florissant, WEB Assocs./Elctrns.	314-921-5720
NY	Plainview, B. D. Aaron & Co.	516-349-7399
TX	Richardson, Scientific Dvcs. Southwest	214-231-8106
WA	Seattle, Delcom Sls. Co., Inc.	206-248-0090

ELECTRO INDUSTRIES, Div. E.I. Elctrns., Inc., 1800 Shames Drive, Westbury, NY 11590, Tel: 516-334-0870, TELEX: 4948652 ELECTRO, FAX: 516-338-4741; Empl.: 20; *Sls. Mgr.:* S. Kagan ..... **D•1389**

For further information call toll free: 800-645-6342

ELEC-TROL, INC., 26477 N. Golden Valley Rd., Saugus, CA 91350, Tel: 805-252-8330, TELEX: 310-3720 331, FAX: 805-251-7147; FSC No.: 15636; Empl.: 650; *Sls. Mgr.:* Mark Smith

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ELECTROLOGIC, INC., 1359 28th St., Signal Hill, CA 90806, Tel: 213-595-0551, FAX: 213-595-0554; Empl.: 10; *Sls. Mgr.:* Tony Hudson

ELECTRO-MAGENTIC PROCESSES, INC.:MEMBER OF ISC DEFENSE & SPACE, 9616 Owensmouth Ave., Chatsworth, CA 91311-4858, Tel: 818-882-6333, TELEX: 499 2240 EMP UI; FSC No.: 51290; Empl.: 100; *Sls. Mgr.:* Kenneth A. Hacker, VP Sls.

ELECTROMATIC CONTROLS CORP., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010, Tel: 312-882-5757, TWX: 910-222-3452; FSC No.: 75203; Empl.: 400; *Sls. Mgr.:* Paul Capiello; *Dist. Mgr.:* Mike Meurer

ELECTROMECH, INC., 528 Elm Street, Kearny, NJ 07032, Tel: 201-997-0950, FAX: 201-997-9208; Empl.: 40; *Sls. Mgr.:* Solomon Ezra ..... **A•2280-2281; D•1737**

Local Sales Offices & Reps

NJ	Kearny, Electromech, Inc.	201-997-0950

ELECTRO MECHANICAL SYSTEMS, INC., 801 W. Bradley Ave., Champaign, IL 61820, Tel: 217-359-7125, FAX: 217-359-2075; Empl.: 20; *Sls. Mgr.:* Julie L. Redman

ELECTRO-MECHANISMS, INC., 2745 E. Huntington Dr., Duarte, CA 91010, Tel: 818-359-2535, FAX: 818-303-2189; FSC No.: 52592; Empl.: 27 ..... **B•1662-1663**

Local Sales Offices & Reps

CA	San Carlos, Hickey Indl. Sls.	415-594-9978
OH	Dayton, Harvey Teplitz	513-898-5282

ELECTRO-MECH CO., 707 Hathaway Dr., Colorado Springs, CO 80915, Tel: 719-597-1620, FAX: 719-597-1628; *Sls. Mgr.:* Eastern: Frank Pareso, Western: Michael Hagen

ELECTRO-MECH COMPONENTS, INC., 1826 N. Floradale Ave., South El Monte, CA 91733-3689, Tel: 818-442-7180, TWX: 510-601-8764, FAX: 818-350-8070; FSC No.: 07150; Empl.: 25; *Sls. Mgr.:* T. Trumbull; *Dist. Mgr.:* Terry Trumbull ..... **B•1728-1729**

Local Sales Offices & Reps

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CA	Santa Clara, Engrg. Assocs.	408-988-5001
CO	Englewood, Franklin Sls.	303-789-2526
CT	Milford, Todino Engrg.	203-874-6643
FL	Orlando, Publicover	305-898-9361
IL	Chicago, IRI	312-967-8430
MD	Baltimore, Callas Elctrns., Inc.	301-744-7711
MA	Needham Hgts., Todino Engrg.	617-444-7925
MI	Plymouth, Leading Edge Sls.	313-420-3344
MN	Minneapolis, D. A. Case Assocs.	612-869-3700
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NY	Orchard Pk., SHR	716-662-0555
OH	Cincinnati, KCH Co.	513-931-1686
OR	Forest Grove, Doran Sls.	503-357-3333
TX	Leander, McCoy Assocs.	512-259-1109
TX	Richardson, McCoy Assocs.	214-238-1017
WA	Redmond, Doran Sls.	206-885-1885
WI	Milwaukee, IRI	414-259-0965

Local Distributors

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CA	Los Angeles, Master Distrs.	213-452-1229
CA	Redwood City, SLD, Inc.	415-364-9881
NY	Buffalo, Industrial Elctrns.	716-873-9661
NY	Mamaroneck, Logicomp Elctrns.	800-431-2625

ELECTRO-METRICS, Penril Corp., 100 Church St., Amsterdam, NY 12010, Tel: 518-843-2600, TWX: 710-446-4798, FAX: 518-843-2812; FSC No.: 18581; Empl.: 105; *Sls. Mgr.:* James Labenz

ELECTRONIC COMPONENTS GROUPE

FAX: 612-375-1905

ELECTRONIC COMPONENTS GROUPE, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, Tel: 612-375-9639, 800-826-8719, TELEX: 62985650, TWX: 910-240-7878 (Overseas); *Sls. Mgr.:* Rick Hampton; *Dist. Mgr.:* Rick Hampton ..... **B•1733-1735**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
CA	Cupertino, F & F Assocs.	408-446-2349
CA	Irvine, Groh Assocs.	714-837-9871
CA	San Diego, Groh Assocs.	619-453-7572
CO	Denver, West Inc.	303-477-8180
FL	Margate, EPM Corp.	305-977-0331
FL	Orlando, EPM Corp.	305-977-0331
GA	Atlanta, Cartwright & Bean, Inc.;GA Div.	404-368-0160
GA	Norcross, Cartwright & Bean, Inc./GA Div.	404-368-0160
IL	Downers Grove, Richmar Elec.	312-968-0118
IN	Indianapolis, Richmar Elctrns.	317-577-9950
KS	Overland Pk., Electri-Rep	913-649-2168
LA	Covington, Cartwright & Bean, Inc.	504-892-1780
MI	Ypsilanti, Tech Rep	313-572-1950
MN	New Brighton, Complete Sls.	612-731-2923
MN	Oakdale, Complete Sls.	612-731-2923
MS	Jackson, Cartwright & Bean, Inc.	601-981-1170
MO	St. Louis, Electri-Rep	314-993-4421
NH	Londonderry, Bennetron	603-432-9092
NJ	Mtn. Lakes, Comps. Technlg.	201-334-2921
NM	Albequerque, Syntech	505-266-7951
NY	Islip, ABS Technlgs.	516-277-7101
NY	Rochester, Tech. Comp. Sls.	716-342-2406
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303
NC	Raleigh, Cartwright & Bean, Inc.	919-876-4130
OH	Centerville, Components Inc.	513-436-0255
OH	Cleveland, Components, Inc.	216-243-9200
OR	Portland, Elctrn. Engrg. Sls.	503-639-3978
PA	West Chester, TCA Assocs., Inc.	215-692-6853
TN	Knoxville, Cartwright & Bean	605-693-7450
TN	Memphis, Cartwright & Bean, Inc.	901-362-8345
TX	Dallas, Rem Air Comps. Corp.	214-234-1069
VA	Richmond, Glassock Assoc.	804-740-0063
WA	Redmond, Elctrn. Engrg. Sls.	206-883-3374
WI	Butler, Richmar Elctrns.	414-781-1730

Local Distributors

AL	Huntsville, C.D.I.	205-883-7501
AR	Little Rock, C.D.I.	501-227-6278
CA	Hollywood, Yale Elec.	213-465-3186
CA	Manhattan Beach, Prime Electro	213-379-3642
CA	San Carlos, Logan Elec.	415-594-0700
CA	San Diego, Sigma Elctrns.	619-565-7000
CA	Santa Ana, El-Com, Inc.	714-432-6630
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Sunnyvale, Target Elctrns.	408-734-5611
CA	Van Nuys, Wes-Garde Comps.	213-873-4802
CO	Englewood, Industrial Elctrns.	303-694-9444
CT	Hartford, Wes-Garde Comps.	203-527-7705
CT	Waterbury, Century Elec. Supp.	203-755-0405
FL	Ft. Lauderdale, KSM Elctrns.	305-971-5900
FL	Lakeland, Wes-Garde Comps.	813-644-7564
FL	Melbourne, C.D.I.	305-724-9910
GA	Atlanta, KSM Elctrns.	404-458-2013
GA	Norcross, C.D.I.	404-441-3320
IL	Carol Stream, Wes-Garde Comps.	312-653-1460
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KS	Wichita, Radio Inc.	316-264-2798
MD	Beltsville, PSI	301-937-4960
MD	Columbia, D. K. Elctrns.	301-995-1950
MA	Holliston, Add Elctrns. .. 800-541-7400,800-343-4933	
MA	Newton, Greene-Shaw Co.	617-969-8900
MN	New Brighton, Chris Elctrns.	612-631-2647
MO	Florrissant, Delltron Co., Inc.	314-839-0033
MO	St. Louis, Wes-Garde Comps.	314-567-7776
NH	Nashua, Wes-Garde Comps.	603-880-1971
NJ	Mt. Laurel, Wes-Garde Comps.	609-778-8190
NJ	W. Berlin, G.C.I.	609-768-6767
NY	E. Syracuse, Add Elctrns.	315-437-0300
NY	Victor, Add Elctrns. Corp.	716-924-4400
NC	Raleigh, C.D.I.	919-834-9465
OH	Westerville, Wes-Garde Comps.	614-885-0319
OH	Youngston, Add Elctrns.	216-792-6900
OK	Oklahoma City, Radio Inc.	405-789-0741
OK	Tulsa, Radio Inc.	918-587-9123
OR	Beaverton, Comp. Resources	503-641-8488
OR	Portland, Radar Elec.	503-232-3404
TX	Dallas, C.D.I.	214-644-0373
TX	Dallas, Off-the-Shelf Comps.	214-247-0052
TX	Dallas, Wes-Garde Comps.	214-357-1768
TX	Richardson, Off-the-Shelf Comps.	214-238-0808
WA	Kent, Comp. Resources	206-454-8666
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053

FAX: 201-542-0524

ELECTRONIC CONCEPTS, INC., Box 1278, Eatontown, NJ 07724, Tel: 201-542-7880, TELEX: 7107226661; FSC No.: 50558; Empl.: 240; *Sls. Mgr.:* Philip N. Lepore ..... **A•1070-1075**

Local Sales Offices & Reps

AZ	Tempe, Piper Sls. Co.	602-949-0048
CA	La Mirada, Select Elctrns.	714-739-8891
IL	Wheaton, Elctrn. Concepts, Inc.	312-668-8747
MN	Minneapolis, Components Grp.	612-374-1250
MO	Grandview, Harris-Hanson Co.	816-763-6200
NJ	Eatontown, Elctrn. Concepts, Inc.	201-542-7880
NM	Albuquerque, Piper Sls. Co.	505-883-9090
MO	St. Louis, Harris-Hanson Co.	314-432-3611
TX	Richardson, Milred Assocs., Inc.	214-644-6731

Local Distributors

NJ	Clifton, Elcon Sls.	201-546-5022

ELECTRONIC CONTROLS, INC., 431 Park Industrial Dr., La Habra, CA 90631, Tel: 213-697-4189; Empl.: 9

ELECTRONIC CONTROLS DESIGN, 13626 S. Freeman Rd., Mulino, OR 97042, Tel: 503-829-9108, TELEX: 703874 ECDINC UD, FAX: 503-829-4113; Empl.: 120; *Sls. Mgr.:* Steven Glass

ELECTRONIC DEVELOPMENT ASSOCIATED, INC., 1 Westcliff Drive, Dix Hills, New York 11746, Tel: 516-673-3881, FAX: 516-673-5979; FSC No.: 9V841

FAX: 617-268-6754

ELECTRONIC DEVELOPMENT CORP., EDC, 11 Hamlin St., Boston, MA 02127-4198, Tel: 617-268-9696, TELEX: 951596; FSC No.: 12619; *Sls. Mgr.:* R. B. Ross ..... **D•1244-1245**

Local Sales Offices & Reps

AL	Huntsville, MOCO	205-881-5968
AZ	Tempe, Mesa Technlg.	602-279-5243
CA	Canoga Park, F.L.W.	818-989-5238
CA	Carlsbad, F.L.W. Inc.	619-434-5251
CA	Carlsbad, FLW, Inc.	619-434-5251
CA	Costa Mesa, FLW, Inc.	714-751-7512
CA	Fremont, F.L.W.	415-651-6511
CO	Englewood, R. A. Mayes Co.	303-761-9447
FL	Orlando, Gentry Assocs.	305-859-7450
FL	Tampa, Gentry Assocs.	813-886-0720
IL	Hoffman Estates, Carvel Engrg.	312-885-8800
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Lenexa, Ramsey Assts.	913-541-1007
KS	Overland Park, Ramsey Assocs.	913-541-1007
MA	Needham, Addelco Corp.	617-444-4754
MI	Hazel Park, Tiby Co.	313-547-3550
MN	Edina, Carvel Engrg. & Sls.	612-835-7929
MO	St. Louis, Ramsey Assocs.	314-878-5042
NJ	Union, Friedman Assocs.	201-964-6200
NM	Albuquerque, Mesa Technlg.	505-292-2330
NY	Henrietta, Ossmann Instrs.	716-359-3801
NC	Raleigh, Lee Assocs.	919-848-8818
OH	Cleveland, Tiby Co.	216-371-5335
OH	Dayton, Tiby Co.	513-277-3822
OR	Portland, Topp Engrg. Sls.	503-244-7265
PA	Willow Grove, Rhodes Technlg.	215-657-0330
TX	Dallas, Tech Rep Mktg.	214-241-2434
TX	Farmers Branch, Tech Rep Mktg.	214-241-2434
TX	Kemah, Hi Tech Sys.	713-783-3856
WA	Bellevue, Topp Engrg. Sls.	206-747-5400
WI	Sheboygan, Carvel Engrg.	414-457-8800

ELECTRONIC DEVELOPMENT LABS., See EDL Inc.

ELECTRONIC DEVICES, INC., 21 Gray Oaks Ave., Yonkers, NY 10710, Tel: 914-965-4400, FAX: 914-965-5531; Empl.: 200; *Sls. Mgr.:* Paul Dengler; *Dist. Mgr.:* Paul Dengler ..... **A•2178-2179**

Local Sales Offices & Reps

AZ	Tempe, Cantec Sls.	602-345-1276
CA	San Jose, Nelson Elctrn. Sls., Inc.	408-293-2600
CO	Golden, Dossett Elctrn. Mktg. Inc.	303-278-4620
FL	Melbourne, Kennedy Assocs.	407-676-6875
IN	Carmel, Berndt Assocs.	317-844-0114
MA	Sharon, Cummings Assocs.	617-784-5600
MI	Grand Blanc, Inter-Comm, inc.	313-695-0665
MN	Brooklyn Ctr., P Lydon	612-535-6526
MO	St. Louis, Rep-tronics Inc.	314-576-9816
NY	Buffalo, Promark Elctrns.	716-877-3300
NY	Patchogue, Optimum Sls. Co.	516-758-0644
NC	Raleigh, B.T. Funderburk Inc.	919-846-2373
OR	Portland, IVC Inds. Vehicle Corp.	503-297-3364
PA	Pipersville, Yax Assocs.	215-776-2100
PA	Waterford, Bacon Elec. Sls.	814-796-2381
TX	Dallas, Kruvand Assocs. Inc.	214-437-3355
WI	Mequon, Stumm Sls.	414-241-8414
Can	Montreal, Que., Elcom GMB Inc.	514-668-3361

Local Distributors

AL	Huntsville, Comp. Dists.	205-883-7501
AR	Little Rock, Comp. Dists.	501-227-6278

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FL Melbourne, Comp. Dists. 305-724-9910
GA Norcross, Comp. Dists. 404-441-3320
IL Chicago, E M D 312-577-0067
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KY Louisville, Peerless Elctrn. Equip. 502-637-7674
MA Billerica, Mayer Elctrns. Inc. 617-667-6900
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MN Minneapolis, Bergquist Co. 612-835-2322
MO St. Louis, Ric-Tronics 314-576-9816
NJ Fairfield, Verdura Sls. Co. 201-227-0414
NY Albany, E. E. Taylor Co. 518-438-7811
NY Buffalo, Summit Dists. 716-887-2820
NY Mt. Vernon, QAR Elec. Sls. 914-699-2224
NY Rochester, Summit Dists. 716-334-8110
NC Raleigh, Century Elec. Comps. 919-782-2116
NC Raleigh, Comp. Dists. 919-787-7311
OH Willoughby, Gateway Megatech 216-953-0333
OH Worthington, Reptron/Ohio 614-436-6675
OK Oklahoma City, Trice Whlsl. Elec. 405-528-2632
OK Tulsa, Quality Comps. 918-664-8812
OR Portland, Radar Elec. Co. 503-232-3404
TX Addison, Quality Comps. 214-733-4300
TX Austin, Quality Comps. 512-835-0220
TX Sugarland, Quality Comps. 713-240-2255
VA Roanoke, Peoples Elctrns. 703-342-8933
WA Seattle, Radar Elec. 206-282-2511
WI Racine, Badger Elctrns. 414-637-1256
Can Downsview, Ont., Westburne 416-635-2980
Can Montreal, Que., Elctrn. Whlslrs. 514-769-8851
Can Ottawa, Ont., Elctrn. Whlslrs. 613-746-4413

ELECTRONIC ENCLOSURES, Div. Wyle Labs, 225 South Aviation Blvd., El Segundo, CA 90245, Tel: 213-643-8181, FAX: 213-643-8565; FSC No.: 09097; Empl.: 230; *Sls. Mgr.:* Hillard W. Sorey ..... **C•1027**

Local Sales Offices & Reps

AL Huntsville, Shivers Instrs. 205-881-7617
CA Campbell, Carlson & Assocs. 408-370-1284
CA El Segundo, Wyle Labs.;Elctrn. Encl. ... 213-643-8181
CA San Diego, Wyle Labs.;Elctrn. Encl. ... 619-489-2957
CO Wheat Ridge, Waugaman & Assocs., Inc. 303-423-1020
GA Duluth, Dixie Tech. Mktg. 404-381-5592
IL Arlington Heigts, Berndt Assocs., Inc. 312-632-0900
IN Carmel, Berndt Assocs., Inc. 317-844-0114
IA Cedar Rapids, C-Tron, Inc. 319-373-2029
KS Olathe, C-Tron Inc. 913-829-0073
MD Upperco, Imigtron Sls. Co. 301-374-5600
MA Needham Heights, Todino Engrg. Sls. Inc. 617-444-7925
MI Jackson, Norwood Scroggs Co. 517-750-1170
MO St. Charles, C-Tron, Inc. 314-928-8078
NE C-Tron Inc. 314-928-8078
NJ Pennsauken, Wyle Labs.;Elctrn. Encl. 609-665-6810
NJ Teaneck, Noreast Tech. Sls., Inc. 201-833-2044
NM Albuquerque, Brytec Sls. Inc. 505-884-1123
NY Sanquoit, JBR Engrg. Inc. 315-737-9432
OH Galion, J. R. Bright Agy. 419-468-3787
OR Eugene, H. Hogstrom & Assocs. 503-689-1076
TX Ft. Worth, Zonk Engrg. Co. 817-429-9551
TX Houston, Zonk Engrg. Co. 713-895-9131
TX Richardson, Zonk Engrg. Co. 214-238-7651
WI Milwaulkee, Berndt Assocs., Inc. 414-545-8400

ELECTRONIC ENGRG. CO. OF CAL., See EECO

ELECTRONIC ESSENTIALS, 60-20 34th Avenue, Woodside, NY 11377, Tel: 718-898-8300, TELEX: 384-873, ESYLNK: 6275-6172, FAX: 718-899-7995; Empl.: 49

ELECTRONIC FILM CAPACITORS, INC., Reidville Industrial Pk, 41 Interstate Ln., Waterbury, CT 06705, Tel: 203-755-5629, FAX: 203-755-0659; Empl.: 65; *Sls. Mgr.:* A. Jewel Quinn

ELECTRONIC HARDWARE, 320 Broad Hollow Rd., Farmingdale, NY 11735, Tel: 516-752-1950, FAX: 516-752-1971; Empl.: 100; *Sls. Mgr.:* V. DiSalvo

ELCTRN. INSTR. & SPEC. CORP., MC DIV., See Millen Comps.

ELECTRONIC MEASUREMENTS INC.

FAX: 201-922-9334

ELECTRONIC MEASUREMENTS, 405 Essex Rd., Neptune, NJ 07753, Tel: 201-922-9300, TELEX: 132-424; FSC No.: 89022; Empl.: 250; *Sls. Mgr.:* Charles Lehmann ..... **D•1738-1743**

Local Sales Offices & Reps

AZ Phoenix, Sci. Devices 602-957-0401
CA Huntington Beach, Sci. Devices 714-840-3501
CA San Diego, Sci. Devices 619-573-0157
CA San Jose, Sci. Devices 408-554-0455
CO Broomfield, Sci. Devices 303-469-5145
GA Marietta, Elctrn. Measurements 404-427-8660
IL Chicago, Comtel 312-539-4838
IN Indianapolis, Comtel 317-253-1681
IA Cedar Rapids, Comtel 319-377-9434
MA Winchester, FJS Assoc. 617-729-3135
MI Southfield, Comtel 313-358-2510
MN Wayzata, Comtel 612-476-1551
NM Albuquerque, Sci. Devices 505-883-3668
NY Syracuse, T-Squared 315-463-0355
OH Dayton, WKM Assoc. 513-434-7500
PA Pittsburgh, WKM Assoc. 412-892-2953
PA Plymouth Meeting, Electronic Mktg. Assocs. 215-828-7400
TX Austin, Alphatech 512-458-9179
WA Redmond, Sci. Dvcs. 206-885-0004
WI New Berlin, Comtel 414-544-6042

ELECTRONIC MODULAR SYSTEMS, INC., Pasadena Technology Corp., 1325 Capital Pkway, No. 109, Carrollton, TX 75006, Tel: 214-446-2900, TELEX: 791688, FAX: 214-245-1559; Empl.: 45; *Sls. Mgr.:* Dale R. Sparrow

ELECTRONIC NAVIGATION INDUSTRIES, See ENI, Inc.

ELECTRONIC PRECISION COMPONENTS CORPORATION, 519 South 5th Ave., Mt. Vernon, NY 10550, Tel: 914-664-2333, FAX: 914-664-4928; FSC No.: 59131; Empl.: 8; *Sls. Mgr.:* Don Edwards ..... **A•1692**

Local Sales Offices & Reps

CA Granada Hills, W. H. Inds., Inc. 213-363-3910
CO Denver, Midwest Meridian Corp. 303-341-7550
IL Elk Grove Village, Midwest Meridian Corp. 312-640-9540
IA Cedar Rapids, Midwest Meridian Corp. 319-365-6561
MA Andover, William Crawford Assocs. ... 617-470-2122
MN Prior Lake, Midwest Meridian Corp. ... 612-447-8222
MO Marylan Heights, Midwest Meridian Corp. 314-878-4441
OH Fairborn, Midwest Meridian Corp. 513-879-7100
TX Fort Worth, Midwest Meridian Corp. ... 817-654-2132
WA Kirkland, W.H. Industries 206-827-1024

ELECTRONIC RESEARCH CO., 7618 Wedd St, Overland Park, KS 66204, Tel: 913-631-6700, TWX: 910-749-6477; FSC No.: 13571; Empl.: 60; *Sls. Mgr.:* Charles Ditzler ..... **A•1399**

Local Sales Offices & Reps

NJ Riverdale, Comp-Tech Sls. 201-935-5454
NJ Union, Comp-Tech Sls. 201-687-2484
NY New Hyde Pk., Comp-Tech Sls. 516-593-2628

ELECTRONIC RESOURCES INC., 568 Weddell Dr., No. 8, Sunnyvale, CA 94089, Tel: 408-745-1420, TWX: 510-600-7616, FAX: 408-745-0533; Empl.: 6; *Dist. Mgr.:* Cari Ikya

THE ELECTRONICS GROUP, INC., 3300-L Woodpark Blvd., Charlotte, NC 28206, Tel: 704-597-9500, FAX: 704-597-9500 Ext. 20; Empl.: 35; *Sls. Mgr.:* Doug Mckenzie

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FAX: 619-452-9464

ELECTRONIC SOLUTIONS, A Unit of Zero Corp., 6790 Flanders Dr., San Diego, CA 92121, Tel: 619-452-9333, TELEX: 910-335-1169; Empl.: 150 ..... **C•1028-1030**

Local Sales Offices & Reps

AZ Phoenix, Holder Hauer 602-242-4025
CA Brentwood, Qualtech Assoc. North 415-634-0952
CA Orange, Qualtech South 714-639-9820
CA San Diego, Mesa Engrg. 619-278-8021
CA Sunnyvale, Qualtech North 408-732-4800
CA Woodland Hills, Qualtech South 818-999-6951
CO Denver, Holder Hauer 303-427-3443
CT Stamford, Tech. Applications Assocs. 203-327-2934
FL Casselberry, Dyne-A-Mark 407-831-2822
FL Clearwater, Dyne-A-Mark 813-441-4702
FL Ft. Lauderdale, Dyne-A-Mark 305-771-6501
GA Norcross, Mtn. Electro Prods. 404-448-5594
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IN Indianapolis, Meta Tech. Sls. 317-244-9901
KS Lenexa, Midtec 913-541-0505
MD Rockville, Spectro 301-294-9770
MA Westborough, Tech. Applications Assocs. 617-366-9781
MI Ypsilanti, Meta Tech. Sls. 313-485-0553
MN Edina, Micro Res. 612-830-1454
MO St. Louis, Midtec 314-275-8666
NM Albuquerque, S & S Technlgs. 505-255-5599
NY Mendon, Gebhardt Mktg. 716-624-1600
NJ Springfield, Gebhardt Mktg. 201-376-4415
NC Wake Forest, Mtn. Electro Prods. 919-556-7103
OH Aurora, Meta Tech. Sls. 216-562-8772
OH Columbus, Meta Tech. Sls. 614-847-1917
OH Richfield, Geotronix 216-659-6100
OK Stillwater, Acudata, Inc. 405-743-1886
OR Beaverton, Thorson Co., N.W. 503-644-5900
PA Blue Bell, Monument Tech. Assocs. ... 215-941-6980
PA Bridgeville, Meta Tech. Sls. 412-257-8352
TX Austin, Acudata 512-478-1018
TX Houston, Acudata 713-580-2451
TX Plano, Acudata 214-424-3567
UT Salt Lake City, Holder Hauer 801-532-2111
WA Bellevue, Thorson Co. N.W. 206-455-9180
WI Broodfield, Control Sys. 414-797-9500

ELECTRONIC SPACE SYSTEMS CORP., Old Powder Mill Rd., Concord, MA 01742, Tel: 508-369-7200, TELEX: 923480 ESSCO WCRD, FAX: 508-369-7641; FSC No.: 15175; Empl.: 150; *Sls. Mgr.:* Susan M. Cuevas

ELECTRONIC SPECIALISTS, 171 South Main St., Natick, MA 01760, Tel: 617-655-1532, 800-225-4876, TELEX: 955-329 ATTN: ESP; Empl.: 42; *Sls. Mgr.:* Frank Brown

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FAX: 206-573-4635

ELECTRONIC SPECIALTY CORP., 14511 N.E. 13th Ave., Vancouver, WA 98665, Tel: 206-574-5000; FSC No.: 98927; Empl.: 100; *Sls. Mgr.:* Leon Fuller ..... **B•1469, 1664**

Local Sales Offices & Reps

AL Huntsville, L & D Inc. 205-837-1469
CA Anaheim, Gabriel & Assocs. 714-666-0660
CA San Jose, Westron Assocs. 408-997-7332
CO Longmont, Tri Tec Sls. 303-440-7862
CT Bethel, Livera-Polk 203-748-4639
FL Deerfield Bch., Jack Krutek & Assocs. 407-427-4202
FL Lighthouse Point, Jack Krutek & Assocs. 305-427-4202
GA Atlanta, L & D Inc. 404-395-7079
IA Des Moines, SPS Assocs. Ltd. 515-225-0607
KS Olathe, SPS Assocs. Ltd. 913-764-4460
MD Baltimore, Eastern Comps. 301-788-7050
MD Gaithersburg, Eastern Comp. 215-825-8610
MA Lexington, Hathaway Elctrns. 617-861-7010
MN Hopkins, The Kits Co. 612-933-1888
MN Stillwater, The Kits Co. 612-439-8088
MO Earth City, SPS Assocs. Ltd. 314-291-0520
NE Panama, SPS Assocs. Ltd. 913-764-4460
NJ Madison, Livera-Polk Assocs. 201-377-3239
NM Albuquerque, Tri Tec Sls. 505-293-3730
NY Glen Head, Livera-Polk 516-759-9300
NC Raleigh, Eastern Comp. 919-787-3416
NC Raleigh, L & D Inc. 919-876-5301
OH Cleveland, Components Inc. 216-243-9200
OH Englewood, Newberry & Assocs. 513-832-2114
OR Beaverton, Earl & Brown Co., Inc. 503-643-5500
PA West Conshohocken, Eastern Comp. 215-825-8610
TX Dallas, Barry Sls. 214-234-0255
TX Houston, Barry Sls. Inc. 713-784-5860
TX Richardson, Barry Sls. Inc. 612-439-8088
VA Annandale, Eastern Comp. 703-354-0723
WA Redmond, Earl & Brown Co., Inc. 206-885-5064

ELECTRONICS RESEARCH ASSOCIATES INC., West Hill Rd., Winsted, CT 06098, Tel: 203-379-2731, TWX: 710-449-6464, FAX: 203-379-8861; FSC No.: 28564; Empl.: 200; *Sls. Mgr.:* Phillip J. Brown ... **B•1075, 1861**

Local Sales Offices & Reps

CA Long Bch, R.D. & D. Sls. Engrg. 213-988-1116
CA Los Altos, Elrepco, Inc. 415-961-0660
CA Los Angeles, ERA-Fred Bender 818-790-6822
CO Longmont, Luscombe Engrg. 303-772-3342
CT Kensington, Norman Stachelek Co. ... 203-828-6161

CT Winsted, ERA-Phil Brown 203-379-2731
FL Clearwater, Delmac Sls. 813-447-5192
FL Deerfield Bch., Delmac Sls. 305-427-7788
FL Longwood, Delmac Sls. 305-831-0040
GA Duluth, Dixie Tech. Mktg. 404-381-5592
IL Rolling Meadows, Eagle Tech. Sls. 312-991-0700
IN Indianapolis, D-M Assocs. 317-842-4424
MA Waltham, Datcom 617-891-4600
MI Farmington Hills, Elcon MI. Sls., Inc. ... 313-855-3240
MN Bloomington, Elctrns. Sls. Agy. 612-884-8291
MN Minneapolis, Holmgren Assocs. 612-786-7641
MO Florissant, Delltron Co., Inc. 314-839-0033
MO Kansas City, Delltron Co. 816-436-6445
MO St. Louis, Delltron Co. 314-839-0033
NH Claremont, Datcom 603-543-0696
NJ Englewood, Sprung/Nussbaum 201-560-5666
OH Dayton, Kelley & Assocs. 513-274-3224
PA Philadelphia, Beacon North 215-287-5479
TX Dallas, ERA-Darryl Bloom 214-357-7756
UT Salt Lake, Luscombe Engrg. Co. 801-532-4118
VA Sterling, Beacon North, Inc. 703-478-2480
Can Montreal, Que., Bestec Elctrns., Ltd. ... 514-643-1702
Can Rexdale, Ont., Bestec Elctrns., Ltd. 416-674-1330

Local Distributors

CA Hawthorne, Electrosonic Comps. 213-970-0997
CA Van Nuys, Electrosonic Comps. 818-988-4455
IN Indianapolis, Advent Elctrns. 317-872-4910
MA Wilmington, Heilind Elctrns., Inc. 617-657-4870
NE Lincoln, Scott Elctrn. Supp. 402-466-8221
NJ Frenchtown, Sintec Co. 201-996-4093
NJ Milford, Sintec Co. 201-996-4093
NY Farmingdale, SAI 516-293-2710
NY Melville, SAI 516-293-2710
OR Beaverton, Hansen Elctrns. Corp. 503-642-4455
TX Farmers Branch, Force Elctrns., Inc. 214-351-2050
Can Point Claire, Que., Future Elctrns. 514-694-7710

ELECTRONIC SYS. & PROGRAMMING, See Augat/ES)sP, Inc.

ELECTRONIC SYSTEMS DIV., Servo Corp. of America, 111 New South Rd., Hicksville, NY 11802, Tel: 516-938-9700, FAX: 516-349-9205; Empl.: 50; *Sls. Mgr.:* S. Klipper ..... **A•1782-1783**

Local Sales Offices & Reps

CA Los Angeles, EBA Microwave 213-822-7510
CA Orange, E. Bell Assocs. 714-857-6079
FL Orlando, CBA, Inc. 407-657-6004
NM Albuquerque, Vic Myers Assoc. 505-884-6878

ELECTRONICS SYSTEMS, INC., P.O. Box 5013, Sioux Falls, SD 57117, Tel: 605-338-6868, FAX: 605-338-5061; Empl.: 98; *Sls. Mgr.:* Leo Reynolds

ELECTRONIC TESTING & CONSULTING, 812 Carver St., Mesquite, TX 75149, Tel: 214-288-0331; Empl.: 3

ELECTRONIC TRANSFORMER CORP., P.O. Box 188, Totowa, NJ 07511, Tel: 201-942-2222, FAX: 201-942-9014; FSC No.: 72149; Empl.: 130; *Sls. Mgr.:* Dan Rovine

ELECTRON PRODUCTS, 5367 Third St., Irwindale, CA 91706, Tel: 818-960-2299, ESYLNK: 910-333-9810, FAX: 818-814-4434; FSC No.: 99515; Empl.: 65; *Sls. Mgr.:* Cliff Sailor; *Dist. Mgr.:* Ann Meunier

FAX: 714-250-0958

ELECTRO-NUMERICS, INC., 1811 Reynolds, Irvine, CA 92714, Tel: 714-250-1501, TELEX: 68-5612; FSC No.: 51666; Empl.: 18 ..... **D•1391**

Local Sales Offices & Reps

AL Huntsville, FLW S.E., Inc. 205-536-6207
CA Costa Mesa, FLW, Inc. 714-751-7512
CA Fremont, FLW of N.CA, Inc. 415-651-7512
CO Boulder, ABCO Indl. Sls. 303-444-1173
FL Orlando, FLW S.E., Inc. 407-894-9671
GA Atlanta, FLW S.E., Inc. 404-424-1731
IL Chicago, PVA Corp. 312-655-3355
KS Topeka, R. E. Pedrotti Co. 913-677-3366
KY Louisville, Instr. & Tech. Sys., Inc. 502-244-1498
LA Lafayette, Kemp Engrg. Co., Inc. 318-269-9452
CT Hartford, Di-Ana Sls. Co. 203-668-1664
MI Detroit, Satullo Assocs., Inc. 313-585-4811
MN Minneapolis, Kits Co. 612-439-8088
NY Hewlett, Metropolitan Sls. Co. 516-599-7900
NY Rochester, Tech NY Assocs. 716-288-0921
NC Charlotte, FLW S.E., Inc. 704-391-8812
OH Cleveland, Meas. Instr. E., Inc. 216-476-0277
OK Tulsa, Golden Rule Sls. Co. 918-836-7556
OR Portland, Topp Engrg. Sls. Corp. 503-244-7265
PA Philadelphia, FLW of PA, Inc. 215-251-9700
PA Pittsburgh, Meas. Instr. E., Inc. 412-459-8090
TN Oak Ridge, Instr. & Tech. Sys. 615-483-5715
TX Houston, E. V. Smith Sls. Co. 713-931-0403
WA Seattle, Topp Engrg. Sls. Corp. 206-747-5400
WI Milwaukee, Stapleman Corp. 414-352-5777

Local Distributors

AL Huntsville, FLW S.E., Inc. 205-536-6207
CA Costa Mesa, FLW, Inc. 714-751-7512
FL Orlando, FLW S.E., Inc. 407-894-9671
GA Atlanta, FLW S.E., Inc. 404-424-1731
MI Detroit, RAM Meter, Inc. 313-398-6767
NC Charlotte, FLW S.E., Inc. 704-391-8812
PA Philadelphia, FLW of PA, Inc. 215-251-9700
Can Toronto, Smart Control Sys. 416-474-0550

ELECTRO-OPTICAL INDUSTRIES, Box 3770, Santa Barbara, CA 93130, Tel: 805-964-6701 (ext. 280), TELEX: 65-8427 EOIND SNC, FAX: 805-967-8590; Empl.: 130

ELECTRO-PACIFIC, 5770 Thornwood Dr., Goleta, CA 93117, Tel: 805-964-0751; FSC No.: 29853; Empl.: 60; *Sls. Mgr.:* T. Calhoun

ELECTRO PHYSICS CO., INC., 3009 Central Ave., Waukegan, IL 60085, Tel: 312-249-5801; Empl.: 6; *Sls. Mgr.:* Abe Siegelman

ELECTROPHYSICS CORP., 48 Spruce St., Nutley, NJ 07110, Tel: 201-667-2262, TELEX: 642277

ELECTROPREP, INC., Rt 28A, P.O. Box 437, Cataumet, MA 02534, Tel: 617-563-5559; Empl.: 10; *Sls. Mgr.:* R. M. Sullivan

ELECTRORACK PRODUCTS CO., 1443 S. Sunkist St., Anaheim, CA 92806, Tel: 714-776-5420, FAX: 714-776-9683; FSC No.: 26073; Empl.: 50; *Sls. Mgr.:* Chris Allen

ELECTRO RENT CORP., 6060 Sepulveda Blvd., Van Nuys, CA 91411, Tel: 818-727-2100, FAX: 818-786-4224; Empl.: 500; *Sls. Mgr.:* Walt Kosmowski

ELECTRO-SCIENCE LABS., INC., 416 E. Church Rd., Po Box 1533, King of Prussia, PA 19406-1533, Tel: 215-272-8000, TELEX: 83-4788, FAX: 215-272-6759; Empl.: 120

ELECTRO SCIENTIFIC INDUSTRIES, INC. (ESI), 13900 N.W. Science Pk. Dr., Portland, OR 97229, Tel: 503-641-4141, TELEX: 474-2064; FSC No.: 11837; Empl.: 800; *Sls. Mgr.:* Dick Donaca, Sys./Gay Gasque-Instruments

FAX: 215-682-2133

ELECTRO SPACE FABRICATORS, 300 W. High St., P.O. BOX 67, Topton, PA 19562-0067, Tel: 215-682-7181; Empl.: 205; *Sls. Mgr.:* T. Roth ..... **C•1031-1034**

Local Sales Offices & Reps

CA Campbell, Shursales 408-374-5577
CA Irvine, Vale Assocs. 714-551-4004, 4821
FL Melbourne, Winter Assocs. 305-254-6556
FL Vero Beach, S.E. Pro. Sls. 407-778-0454
GA Norcross, Hollingsworth & Still 404-447-1700
MD Upperco, Imagitron Sls. Co. 800-638-3592
MA Waltham, Betronic Assocs. 617-894-8400
NJ Boonton, Winter Assocs. 201-334-3434
NY Morrisville, Promark Elctrns., Inc. 315-662-3310
OH Galion, James R. Bright 419-468-3787
OR Beaverton, Electronics Northwest, Inc. 503-629-9241
PA Huntingdon Valley, OMEGA Elctrn. Sls., Inc. 215-947-4135
PA McKean, Ecco Electrns. Sls. 814-476-1376
TX Dallas, Blair Engrg. 214-241-5655
WA Redmond, Electronics Northwest, Inc. 206-883-1959
WA Spokane, Electronic Northwest, Inc. ... 509-924-0450

Local Distributors

CA Irvine, McGillis Inds. 714-551-4004
CA Redwood City, HdB Elctrns. 415-368-1388
NJ Frenchtown, SINTEC 201-996-4093
NY Baldwin, Accessories for Elctrns. 516-546-1751

ELECTROSPACE SYSTEMS, INC., P. O. Box 831359, Richardson, TX 75083-1359, Tel: 214-470-2106/2107, TWX: 910-867-4768; FSC No.: 33875; Empl.: 1712

ELECTRO STANDARDS LAB., INC., P.O. Box 9144, Providence, RI 02940, Tel: 401-943-1164, FAX: 401-946-5790; Empl.: 25; *Sls. Mgr.:* R. B. Sepe; *Dist. Mgr.:* R. B. Sepe

ELECTROSTATICS, 7718 Clairemont Mesa Blvd., San Diego, CA 92111, Tel: 619-279-1414, FAX: 619-279-1126; FSC No.: 34538; Empl.: 10

ELECTRO-SUPPORT SYSTEMS, 28060 Del Rio Rd., Temecula, CA 92390, Tel: 714-676-2751; FSC No.: 66760; Empl.: 37; *Sls. Mgr.:* Don Pretot

ELECTROSWITCH, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188, Tel: 617-335-5200, FAX: 617-335-4253; FSC No.: 82121; Empl.: 290; *Sls. Mgr.:* W. M. Mello ..... **B•1736**

Local Sales Offices & Reps

AZ Phoenix, Howe & Howe Sls. 602-264-7971
CA Los Angeles, Electric Switches, Inc. ... 213-660-1310
CA Los Angeles, Wiley 213-666-1611
CA San Diego, Wiley Co. 619-453-9018
CA San Ramon, W. Nott & Co. 415-820-8102
CO Boulder, Comp. Prods. Sls. 303-530-2800
FL Apopka, Floritronics 305-886-4818
FL Ft. Lauderdale, Peerless Radio Corp. 305-973-4141
GA Atlanta, Georgia Control Ctr. 404-876-8833
GA Atlanta, Holman-Gillespie 404-992-8820
IL Bridgeview, MIDCO Comp. Sls., Inc. ... 312-599-7777
IL Elk Grove Village, Electroswitch 312-593-2225
IA Bettendorf, Weisler & Assocs. 319-355-5911
MD Gaithersburg, Naudain Assocs.-Southern 301-258-5040
MD Kensington, Marine Air Supp. 301-949-9560
MI Royal Oak, Hilltronics 313-435-0920
MN St. Paul, K.D.I. 612-645-7717
MN St. Paul, Kencotronics 612-645-7717
MO Chesterfield, Weisler & Assocs. 314-394-4543
MO Kansas City, Weisler & Assocs. 816-421-1703
NJ Fairfield, Electroswitch 201-227-6559
NJ Marlton, Naudain Assocs. 609-983-5300
NY Hempstead, Electronec Equip. Co., LTD. 516-538-5510
NY Rochester, Upstate Engrg. Sls. 716-227-4388
NY Utica, Upstate Engrg. Sls. 315-797-6721
NC Raleigh, Wholesale Elec. Supp. Co. ... 919-878-9400
NC Winston-Salem, L.G. White Southern .. 919-725-3612
OH Franklin, Rockford Controls 513-743-8066
OH Medina, Rockford Controls 216-725-3705
OH Medina, Rockford Controls OH, Inc. ... 216-725-3705
PA Pittsburgh, R. F. Clark 412-242-9500
SC Greenville, L.G. White Southern 803-271-0630
TX Dallas, Brice Co. 214-233-9808
TX Stafford, Barclay Wholesale Div. 713-240-1788
TX Stafford, Brice Co. 713-240-1788
VA Ashland, L.G. White Southern 804-752-7055
WA Kent, C.B. Parsons & Co. 206-762-7373
WA Kent, C.B. Parsons Co. 206-762-7373
WI Wauwatosa, Larsen Assocs. 414-258-0529

Local Distributors

CA Los Angeles, Electric Switches 213-660-1310
FL Ft. Lauderdale, Peerless Radio Corp. of Fla. 305-973-4141
GA Atlanta, Georgia Control Ctr. 404-876-8833
IL Bridgeview, Midco Comp. Sls. 312-599-7777
MD Kensington, Marine Air Supp. 301-949-9560
MN St. Paul, K. D. I. 612-645-7717
NY Hempstead, Electronic Equip. Co. 516-538-5510
NC Raleigh, Wholesale Elctrns. 919-878-9400
OH Medina, Rockford Controls Ohio 216-725-3705
TX Stafford, Barclay Whls. 713-240-1788
WA Seattle, C.B. Parsons Co. 206-762-7373

ELECTROSWITCH, SOUTHERN DIV., Electro Switch Corp., 2510 North Blvd., Raleigh, NC 27604, Tel: 919-833-0707, FAX: 919-833-8016; Empl.: 70; *Sls. Mgr.:* Steven M. Smith; *Dist. Mgr.:* Lisa C. Tillis ..... **B•1737**

Local Sales Offices & Reps

AL Huntsville, R. W. Mitscher Co., Inc. 205-882-6050
CA Campbell, Luscombe Engrg. Co. of S.F. 408-370-2020
CA Irvine, Vale Elctrns. 714-551-4004
CA San Diego, Vale Elctrns. 619-693-0113
FL Clearwater, Electrocraft, Inc. 813-578-2233
GA Lawrenceville, R. W. Mitscher Co. 404-923-3239
IL Itasca, Janus, Inc. 312-250-9650
IN Indianapolis, C.C. Electro Sls. 317-255-1508
KS Overland Pk., Electri Rep., Inc. 913-649-2168
MD Laurel, R. W. Mitscher Co., Inc. 301-498-6090
MI Canton, C.C. Electro Sls. 313-338-7400
MN Minneapolis, HMR, Inc. 612-888-2122
MO St. Louis, Electri Rep., Inc. 314-993-4421
NH Salem, Sls. Engrg. Co. 603-893-5521
NJ Collingswood, R.W. Mitscher Co. 609-854-7852
NJ Englewood, Sprung/Nussbaum, Inc. .. 201-569-5666
NY Clarence, R. W. Mitscher Co., Inc. 716-759-2350

NC Raleigh, R. W. Mitscher Co., Inc. 919-848-0941
OH Twinsburg, C.C. Electro Sls. 216-425-8338
OR Beaverton, Luscombe Engrg. Co. 503-636-6664
TN Johnson City, R. W. Mitscher Co., Inc. 615-929-7258
TX Austin, Allied Comps., Inc. 512-331-4494
TX Dallas, Allied Comps., Inc. 214-238-0408
VA Shipman, R. W. Mitscher Co., Inc. 804-263-5154
WI Hartland, Selective Sls. Co. 414-367-1133
Can Mississauga, Ont., Gidden-Morton Assocs., Inc. 416-671-8111

Local Distributors

CA San Diego, Sigma Elctrns. 619-565-2000
IL Lisle, Components, Inc. 312-852-7707
IL Wheeling, Hawk Elctrns. 312-459-4030
MA Canton, Impact Sls. 617-821-1500
MA Hingham, Sager Elctrns. 617-749-6700
NJ Cranford, Garden State Inds. 201-272-6400
NY Buffalo, Summit Distrs. 716-887-2800
NY Mt. Vernon, QAR Indl. Elctrns. 914-699-2224
NY Rome, Rome Elctrns. 315-337-5400
NY Woodside, Switches Unltd. 718-478-5000
NC Charlotte, Dixie Elctrns. 704-377-4348
OH Solon, Repco Elctrns., Inc. 216-248-8900
OR Portland, United Radio Supp. 503-233-5341
SC Columbia, Dixie Elctrns. 803-779-5332
WI Waukesha, Bell Inds. 414-547-8879
Can Scarborough, Carsten Elctrns. Ltd. 416-495-7705

ELECTRO-TECH SYSTEMS, INC., 115 E. Glenside Ave., Glenside, PA 19038, Tel: 215-887-2196, TELEX: 797137; Empl.: 13; *Sls. Mgr.:* Sharon Sandy; *Dist. Mgr.:* Stanley Weitz

ELECTRO VECTOR, INC., 6555 Covey Rd., Forestville, CA 95436, Tel: 707-887-2292, TWX: 510-746-6024; *Sls. Mgr.:* Wayne Brigden

ELECTROVERT, INC., 466 Main St., New Rochelle, NY 10801, Tel: 914-633-0222

ELECTRO WEAVE, 425 Shrewsbury St., Worcester, MA 01604, Tel: 617-752-8932, FAX: 617-753-2173; FSC No.: 54207; Empl.: 18; *Sls. Mgr.:* Peter Andrews

ELFAB CORPORATION, Augat, Inc., 1097 Yates Street, Lewisville, TX 75067, Tel: 214-221-8776, TWX: 910-860-5460, FAX: 214-221-9667; Empl.: 250 ..... **C•1346-1347**

Local Sales Offices & Reps

AL Huntsville, Rick Burns Assocs., Inc. ... 205-776-9481
AZ Phoenix, Spectrum 602-890-9000
CA Los Angeles, Wiley Co. 213-661-1611
CA San Diego, Wiley Co. 619-571-2881
CA San Jose, Augat Sys. Sls. 408-249-8801
CO Denver, Spectrum 303-480-9991
FL Casselberry, S.A. Inc. 305-695-6010
FL Coral Springs, Augat Sls. 305-755-4364
FL Orlando, Augat Corp. 407-345-5255
FL Tampa, SMI Assocs. 813-999-9999
FL Winter Pk., Elfab Corp. 305-678-7759
GA Atlanta, Rick Burns Assocs., Inc. 404-951-1181
IL Crystal Lake, Mid-American Reps., Inc. 815-455-5310
IL Downers Grove, Rockford Controls ... 312-960-2046
IA Marion, Ensco Rep, Inc. 319-377-8551
KS Shawnee Mission, Microtronics 913-262-1444
KS Wichita, Ensco Rep, Inc. 316-683-1070
MD Baltimore, Micro Comp Inc. 301-644-5700
MA Canton, Augat Sls. 617-762-3164
MA Fayesville, Marathon Sls. 617-875-3566
MA Faysville, Marathon Sls., Ltd. 617-875-3566
MI Southfield, Rathburg Assocs., Inc. 313-559-9700
MN Edina, Augat Sls. 612-925-0255
MN Edina, Mel Foster Tech. Sls. 612-941-9790
MO Maryland Hgts., Ensco-Rep, Inc. 314-423-3935
MO St. Charles, Microtronics 314-946-8500
NY N. Syracuse, Advanced Comps. 315-699-2671
NY Yonkers, David Sonkin Assocs. 914-968-8282
NC Raleigh, Rick Burns Assocs., Inc. 919-876-2224
OH Cincinnati, Luebbe Sls. 513-891-5770
OH Columbus, Luebbe Sls. 614-431-0474
OH Richfield, Geotronix, Inc. 216-659-6100
OH Trotwood, Geotronix, Inc. 513-252-6700
OR Portland, Augat Sls. 503-256-4596
OR Portland, Elctrn. Mktg. Grp. 503-684-5935
PA Allison Pk., Geotronix, Inc. 412-487-1770
PA Pittsburgh, Luebbe Sls. 412-364-0490
PA Prospect Pk., Elf Sls. Co. 215-534-3340
TX Dallas, Augat Sls. 214-788-4211
UT Murry, Butterworth Mktg. 801-268-2244
UT Ogden, Spectrum 801-972-8552
VA Huddleston, Micro-Comp Inc. 804-297-6295
WA Bellevue, Augat Sls. 206-451-9777
WA Redmond, Elctrn. Mktg. Grp., Inc. 206-882-0962
WI West Bend, Rockford Controls 312-960-2046
PR Rio Piedras, D.K. Mktg. 809-765-5380
Can Mississauga, Ont., Augat Elctrns., Inc. 416-677-9141
Can Nepean, Ont., Electro Source, Inc. 613-726-8834
Can Rexdale, Ont., Electro Source, Inc. 416-675-6871
Can Vancouver, Davetek Mktg. 604-430-3680

Local Distributors

AZ Phoenix, Cetec Elctrns. 602-272-7951
AZ Phoenix, Force Elctrns. 602-437-1060
CA Chatsworth, Cetec Elctrns. 213-700-0914
CA Irvine, Cetec Elctrns. 714-250-4141
CA Los Angeles, Cetec Elctrns. 213-773-6521
CA San Diego, Cetec Elctrns. 619-278-5020
CA Santa Clara, Cetec Elctrns. 408-748-8550
CT Bethel, Heilind Elctrns. 203-797-8600
MA Peabody, Time 617-532-6200
MA Wilmington, Heilind 617-657-4870
TX Dallas, Force Elctrns. 214-351-2050

ELFORM, INC., P.O. Box 7362, Reno, NV 89510, Tel: 702-356-1734, TWX: 510-600-5662 ELFORM, FAX: 702-356-1742; *Sls. Mgr.:* Roger R. Reinke

ELGAR

FAX: 619-458-0267

ELGAR ELECTRONICS CORPORATION, 9250 Brown Deer Rd., San Diego, CA 92121, Tel: 619-450-0085, 800-854-2213, TELEX: 211063 ELSD UR; FSC No.: 25965; Empl.: 275 ..... **D•1242, 2188-2194**

Local Sales Offices & Reps

AL Huntsville, Beacon 205-881-1136
AZ Tempe, Trembly Assoc. 602-967-2058
CA Redondo Beach, Ward/Davis Assocs. 213-643-6977
CA San Diego, Ward/Davis Assocs. 619-292-1000
CA Santa Clara, Ward Davis Assocs. 408-245-3700
CO Wheat Ridge, Trembly Assocs. 303-421-8900
FL Boca Raton, Beacon 305-997-5740
FL Clearwater, Beacon 813-796-2378
FL Longwood, Beacon 407-332-1940
GA Atlanta, Beacon 404-256-9640
IL Arlington Heights, Dytec/Midwest 312-255-3200
IN Indianapolis, Dytec/Midwest 317-297-5988
KS Lenexa, Dytec/South 913-888-0215
KS Wichita, Dytec/South, Inc. 316-945-7090
MD Laurel, Elctrn. Mktg. Assocs. 301-953-7800
MA Beverly, P. Jenks Assocs. 508-921-4600
MI Madison Heights, WKM Assocs. 313-588-2300
MN Edina, Dytec Instrs. 612-831-7169
MD Maryland Hgts., Dytec/South 314-739-0665
NV Las Vegas, Trembly Assocs. 702-739-9770
NM Albuquerque, Trembly Assoc. 505-266-8616
NY Great Neck, RTI 516-829-3770
NY Syracuse, Labtronics 315-455-7314
NC Raleigh, Beacon 919-787-0330
OH Dayton, WKM Assocs. 513-434-7500
OH Independence, WKM Assocs. 216-524-5930
TX Richardson, Testech, Inc. 214-644-5010
OR Wilsonville, Syntek 503-682-2750
PA Pittsburgh, WKM Assocs. 412-892-2953
PA Plymouth Meeting, Elctrn. Mktg. Assocs. 215-828-7400
UT Salt Lake City, Trembly Assocs. 801-295-4703
WA Bellevue, Syntek 206-462-7700
WI Brookfield, Dytec Midwest 414-792-0320
EXP CA, San Diego, Elgar Intl. Corp. 619-450-0085
PR Santurce, Beacon 809-728-5040

ELGAR/INTEPRO SYSTEMS, 9250 Brown Deer Road, San Diego, CA 92121, Tel: 619-458-0261, 1-800-854-2213, TELEX: 211063 ELSO UR, FAX: 619-458-0267; Empl.: 250; *Sls. Mgr.:* Sam Lewis ..... **D•1242**

Local Sales Offices & Reps

FL Huntsville, Beacon 205-881-1136
AZ Tempe, Trembly Assocs. 602-967-2058
CA Redondo Bch., Ward/Davis Assocs. .. 213-643-6977
CA San Diego, Ward/Davis Assocs. 619-292-1000
CA Santa Clara, Ward Davis Assocs. 408-245-3700
CO Wheat Ridge, Trembly Assocs. 303-421-8900
FL Boca Raton, Beacon 305-997-5740
FL Clearwater, Beacon 813-796-2378
FL Longwood, Beacon 407-332-1940
GA Atlanta, Beacon 404-256-9640
IL Arlington Heights, Dytec/Midwest 312-255-3200
IN Indianapolis, Dytec/Midwest 317-297-5988
KS Lenexa, Dytec/South 913-888-0215
KS Wichita, Dytec/South, Inc. 316-945-7090
MD Laurel, Elctrn. Mktg. Assocs. 301-953-7800
MD Maryland Hgts., Dytec/South 314-739-0665
MA Beverly, P. Jenks Assocs. 508-921-4600
MI Madison Hgts., WKM Assocs. 313-588-2300
MN Edina, Dytec Instrs. 612-831-7169
NV Las Vegas, Trembly Assocs. 702-739-9770
NM Albuquerque, Trembly Assocs. 505-266-8616
NY Great Neck, RTI 516-829-3770
NY Syracuse, Labtronics 315-455-7314
NC Raleigh, Beacon 919-787-0330
OH Dayton, WKM Assocs. 513-434-7500
OH Independence, WKM Assocs. 216-524-5930
OR Wilsonville, Syntek 503-682-2750
PA Pittsburgh, WKM Assocs. 412-892-2953
PA Plymouth Meeting, Elctrn. Mktg. Assocs. 215-828-7400
TX Richardson, Testech, Inc. 214-644-5010
UT Salt Lake City, Trembly Assocs. 801-295-4703
WA Bellevue, Syntek 206-462-7700
WI Brookfield, Dytec Midwest 414-792-0320
EXP CA/San Diego, Elgar Intl. Corp. 619-450-0085
PR Santurce, Beacon 809-728-5040

ELGENCO, INC., Box 460, Hurricane, UT 84737, Tel: 801-635-4954, FAX: 801-635-2158; FSC No.: 15455; *Sls. Mgr.:* D. E. Beecher ..... **D•1246-1251**

Local Sales Offices & Reps

CA Sherman Oaks, Windsor Dynamics ... 818-990-4173
CA Sunnyvale, N-S Westronics 408-745-1102
CT Meriden, Polytek Assoc. 203-634-4499
MA Ashland, Polytek Assoc. 508-881-4741
NJ Marmore, SWR Tech., Inc. 609-390-0094
NM Albuquerque, Technology Mktg. Assoc. 505-345-8921
PA Broomall, SWR Tech., Inc. 215-353-6639

ELGIN ELECTRONICS, Combustion Engineering, 5533 New Perry Hwy., Erie, PA 16509-3570, Tel: 814-864-4921, TWX: 510-699-6870, FAX: 814-864-1260; Empl.: 500; *Sls. Mgr.:* D. Selmon

ELITE ELECTRONIC ENGINEERING CO., 1516 Centre Circle, Downers Grove, IL 60515, Tel: 312-495-9770, FAX: 312-495-9785; FSC No.: 099-9999; Empl.: 34

ELITE ELECTRONICS, INC., 1408 Summit - Suite 65, Plano, TX 75074, Tel: 214-881-0026, 800-553-4376, FAX: 214-424-7299; Empl.: 4

Local Sales Offices & Reps

CA Fremont, Abel & Assocs. 415-794-4030
CO Englewood, Chinook Tech. Sls. 303-933-9007

FL Davie, Edwin Weisl 305-474-5601
MD Baltimore, Chesapeake Indl. Mktg. 301-653-0476
MN Golden Valley, Ambassador Indl. Mktg. Inc. 612-542-8437
RI Cumberland, Haddad Sls. 508-584-1880
EXP 800-553-4376
EXP Plano, TX, Elite Elctrns. Inc. 800-553-4376,

ELITE SOFTWARE DEVELOPMENT, INC., P.O. Drawer 1194, Bryan, TX 77806, Tel: 409-846-2340, FAX: 409-846-4367; Empl.: 9; *Sls. Mgr.:* Terri J. King

ELLIOTT JORDAN

FAX: 215-296-0657

ELLIOTT/JORDAN, A Sub. of Vishay Intertechnology, 63 Lincoln Highway, Malvern, PA 19355, Tel: 215-644-1300, TWX: 510-668-5812; Empl.: 500; *Dist. Mgr.:* Iris Demeritt ..... **A•1948-1949**

For sales office, representative, and distributor information, see Vishay Resistive Systems Group.

ELMA

FAX: 415-656-3783

ELMA ELECTRONIC INC., 41440 Christy Street, Fremont, CA 94538, Tel: 415-656-3400; Empl.: 35; *Sls. Mgr.:* Kris Holla ..... **B•1738; C•1036-1037, 1585; D•1120-1121**

Local Sales Offices & Reps

AL Huntsville, Pen-Tech 205-881-9298
AZ Scotsdale, I.M. Systems 602-948-1495
CA Cupertino, West-Comp, Inc. 408-245-3100
CA Fremont, Bear Resources 415-793-1064
CA Fremont, ELMA Elctrn. Inc. 415-656-3400
CA Irvine, Balzer-Woolf 714-261-6877
CA Orange, Viatek 714-634-8411
FL Boca Raton, Pen-Tech 407-394-7400
FL Orlando, E.M.S. 407-849-0245,800-824-0079
FL Oviedo, Pen-Tech 407-366-8706
GA Roswell, Pen-Tech 404-751-1604
IL Elmhurst, F.F./Hill Gray Inc. 312-832-4101
MD Lisbon, Samuel K. MacDonald Inc. 301-982-1088, 301-442-1590
MN Plymouth, James R. Johnson & Assocs. 612-478-9442
NH Nashua, Bell Controls Inc. 603-882-6984
NY Amsterdam, Traxonics Inc. 508-843-1445
NY Port Chester, Radiation Elctrns., Inc. .. 914-937-2300
NC Greensboro, Pen-Tech 407-366-8706
MA Beachwood, Land Elctrn. Supp. Co. ... 216-831-9555
OH Strongville, Dolfuss-Root & Co. 216-238-0300
PA King of Prussia, KSI 215-783-6400
PA Philadelphia, Samuel K. MacDonald Inc. 215-545-1205
TX Plano, Vielock Assocs. 214-881-1940
WA Bellevue, Cascade Data Mktg., Inc. 206-747-6190

Local Distributors

CT Wallingford, Sager Elctrl. Supp. Co. 203-265-4600
IL Villa Pk., Melvin Elctrns. 312-279-5010
MA Lynn, Land Elctrn. Cupp. Co. 617-592-2220
MA Waltham, Vantage Elctrns. Corp. 617-894-8690
NJ Cranford, Garden State Indl. Elect. 201-272-6400
NJ Cranford, Garden State Indl., Inc. 201-272-6400
PA Philadelphia, PEI-Genesis 215-568-7400

ELMA ENGINEERING, 1066 E. Meadow Circle, Palo Alto, CA 94303, Tel: 415-494-7303, TELEX: 345-560; FSC No.: 59810; Empl.: 38; *Sls. Mgr.:* T. A. Beno; *Dist. Mgr.:* T. A. Beno

ELMAG DIVISION, Lindgren RF Enclosures, 3750 Prospect Ave., Riviera Bch., FL 33404, Tel: 407-881-9292, FAX: 407-844-4175; FSC No.: 23160; Empl.: 15

ELMEC
DELAY LINE

FAX: 213-265-1908

ELMEC TECHNOLOGY OF AMERICA, 1225 Ridge Crest St., Monterey Pk., CA 91754, Tel: 213-265-1861; *Sls. Mgr.:* Steve Sameshima ..... **A•1558-1563**

ELM SYSTEMS, 1101 Brown St., Wauconda, IL 60084, Tel: 312-526-5003, FAX: 312-526-5022

HAWKER SIDDELEY
Elmwood Sensors

FAX: 401-728-5390

ELMWOOD SENSORS, 500 Narragansett Park Drive, Pawtucket, RI 02861, Tel: 401-727-1300, TELEX: 6814066 ELMWOOD; Empl.: 1,000; *Sls. Mgr.:* Steve Fox ..... **B•1894-1895**

Local Sales Offices & Reps

AL Decatur, Tenn. Tech. Sls. 205-350-0630
AZ Phoenix, O'Donnell SW 602-944-9542
CA San Diego, O'Donnell Assocs. 619-578-1645
CA San Jose, O'Donnell Assocs. 408-432-1940
CA Torrance, O'Donnell Assocs. 213-539-9664
CO Boulder, Front Range Mktg. 303-443-4780
FL Coral Springs, CBC Electronics 305-755-1111
FL Longwood, CBC Elctrns. 407-831-5390
FL Tampa, CBC Elctrns. 813-969-1901
GA Marietta, Tenn. Tech. Sls. 404-971-1417
IL Arlington Heights, Thermek 312-577-6900
IN Fort Wayne, O. Bromberg 219-456-6010
KY Louisville, O. Bromberg 502-456-1498
KY Southgate, O. H. Bromberg & Assocs. 606-781-0221
MD Glen Burnie, Faber-Renoff, Inc. 301-768-4554
MA Danvers, C. H. Burnham Assoc. 508-774-0111
MI Brooklyn, Engineered Comps. 419-475-4900
MN Minneapolis, C. Listug Sls. 612-881-8143
MO St. Louis, Hill & Co. 314-432-1136
NH Durham, C. H. Burnham Assoc. 603-868-2282
NJ Pitman, Colrud Corp. 609-589-5866
NM Albuquerque, O'Donnell Assocs. 609-889-4522
NY Fairport, Bastian Sls. 716-223-0237
NY Larchmont, G. M. Moch Co. 914-834-3530
NY Syracuse, R. M. Scanlon & Assocs. ... 315-437-1271
NC Raleigh, Tenn-Tech 919-779-3309
OH Cleveland, Allied Entprs. 216-779-0080
OH Dayton, O. H. Bromberg 513-434-8788
OR Hillsboro, Temco-Northwest 503-649-8375
PA Murrysville, Allied Entprs. 412-325-3200
NJ Pittman, Colrud Corp. 609-589-5866
RI Woonsocket, C. H. Burnham Assoc. ... 401-762-9889
TX Austin, Ion Assocs. 512-331-7251
TX Grand Prairie, Ion Assocs. 214-647-8225
TX Houston, Ion Assocs. 713-537-7717
UT Midvale, Front Range Mktg. 801-566-2500
VA Midlothian, Daniel E. Boehling Assocs. 804-794-5879
WA Bellevue, Lehr Assocs. 206-453-9993
WA Birch Bay, Temco B.C. 206-371-0423
WA Bothell, Temco Northwest 206-821-5434
WA Spokane, Temco Northwest 509-534-8635
WI Milwaukee, R. Zingler 414-351-5005
Can Mississauga, Ont., Andy Baumen Assocs. 416-828-2600

ELNA AMERICA, INC., 5686 Corporate Ave., Cypress, CA 90630, Tel: 714-761-8600, TELEX: 68-6427, TWX: 910-346-6730, FAX: 714-761-9188; *Sls. Mgr.:* Michael S. Olson; *Dist. Mgr.:* Michael S. Olson

Local Sales Offices & Reps

AL Huntsville, Jack Harvey & Assocs. 205-461-8591
CA Santa Clara, C-Com Sls. 408-727-2266
CA Westminster, West Elctrns. Sls. 714-898-0120
CO Boulder, R. G. Entprs., Inc. 303-447-9211
FL Lauderhill, Innovative Mktg. 305-485-6869
GA Norcross, Jack Harvey & Assocs. 404-449-4643
IL Berkeley, ESA Techn. Mktg. 312-544-0120
IN Ft. Wayne, M/S Sls. 219-436-3023
KS Prairie VL, Lima & Assocs. 913-642-7471
MA Norwood, JMG Inc. 617-762-5333
MI W. Bloomfield, Jack Harvey & Assocs. 313-737-9122
MN Bloomington, Murnco 612-854-4161
MN St. Paul, Murnco, Inc. 612-563-3594
NJ Kenilworth, Ventronic's 201-272-9262
NC Research Triangle Park, Jack Harvey & Assocs. 919-361-5885
TN Knoxville, Jack Harvey & Assocs. 615-524-7057
TX El Paso, Alexander, Gene Entprs. 915-542-0091
TX Euless, W. Pat Fralia Co. 817-267-3577
WA Bellevue, Caruso & Co. 206-455-8811
Can Islington, Ont., Pipe-Thompson Ltd. ... 416-236-2355

ELNETIC ELECTRONICS, INC., P.O. Box 88232, Los Angeles, CA 90009-8232, Tel: 213-515-1546; FSC No.: 98460; Empl.: 25; *Sls. Mgr.:* Ernest H. Carlson, Jr.

FAX: 714-241-7293

ELPAC COMPONENTS, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, Tel: 714-979-4440; Empl.: 130 ..... **A•1076-1077, 1656-1657**

Local Sales Offices & Reps

AZ Phoenix, Eltron 602-266-2164
CA San Diego, Digit Trust 714-498-5749
CA San Jose, Ruppert Sls. 408-998-8717
CA Santa Ana, Jim Degerstrom 714-979-4440
OR Beaverton, Harry Levinson 503-690-1312
FL Orlando, Honeyco Inc. 407-291-7931
IL Highland Park, Bransky Sls. 312-433-2375
IN Indianapolis, J.C. Hofstetter Co. 317-897-7914
MA Needham Heights, Todino Engr. Sls. .. 617-444-7925
MN Bloomington, Smiley-Scott Assocs. ... 612-888-5551
NJ Englewood, Harold Gray Assocs. 201-894-0894
OH Dayton, J. C. Hofstetter Co. 513-296-1010
OH Medina, J. C. Hofstetter Co. 216-241-4880
WA Seattle, Harry Levinson Co. 206-382-1300
WI Cedarburg, Bransky Sls. 414-377-6837

Local Distributors

CA Chatsworth, Mil-Comm 818-998-3111
CA Irvine, Kelex 714-863-1230
FL Melbourne, New Yorker 407-727-0955
FL Lighthouse Point, R.C. Simon 407-941-2757
WI Milwaukee, Progressive 414-321-4722
IL Northbrook, Classic Components 312-272-9650
IL Skokie, Kellner Elctrns. 312-677-1120
IA Cedar Rapids, Dee Elctrns. 319-365-7551
MA Andover, Aved Elctrns. 508-688-3800
NJ S. Hackensack, Waltech 201-641-7300
NY Mamaroneck, New Yorker Elec. 914-698-7600
NJ Wippany, American Distr. Inc. 201-428-0510
NY Elmsford, Ancar 914-592-7100
OH Dayton, Electro Supp. 513-299-5020
OK Tulsa, Altair Co. 918-252-5781
TX Houston, Altair Co. 713-462-3029
TX Richardson, Altair 214-231-5166
VA Charlotte, Kellner 802-425-3250
WA Seattle, Kam Elec. 206-382-1300
WI New Berlin, Classic 414-786-5300
WI Racine, Badger Elctrns. 414-637-1256

ELPAC

FAX: 714-241-7293

ELPAC POWER SYSTEMS, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, Tel: 714-979-4440; Empl.: 170; *Sls. Mgr.:* H. Myers; *Dist. Mgr.:* H. Myers ..... **D•1744-1746**

Local Sales Offices & Reps

CO Broomfiled, Hannah-Hill 303-460-0602

Local Distributors

MA Burlington, Marshall Inds. 617-272-8200
MA Burlington, QPL Elctrns. 617-229-2424
MI Livonia, Marshall Inds. 313-525-5850
MN Plymouth, Marshall Inds. 612-559-2211
NJ Cranford, Garden State Indl. 201-272-6400
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Mt. Laurel, Marshall Inds. 609-234-9100
NY Hauppauge, Broadline Elctrns. 212-895-6232
NY Hauppauge, Marshall Inds. 516-273-2424
NY Johnson City, Marshall Inds. 607-798-1611
NY Rochester, Marshall Inds. 716-235-7620
NC Greensboro, Hammond 919-275-6391
OH Dayton, Marshall Inds. 513-236-8088
PA Philadelphia, Shap Elctrns. 215-969-3300
SC Greenville, Hammond Elctrns. 803-233-4121
TN Austin, Marshall Inds. 512-458-5654
TX Dallas, Heilind Elec. 214-351-2050
TX Dallas, Marshall Inds. 214-233-5200
TX Houston, Marshall Inds. 713-789-6600
TX Houston, Newark Elctrns. 713-782-4800
WA Bellevue, Marshall Inds. 206-747-9100
WI New Berlin, Classic Comps. 414-786-5300

ELPAZ INSTRUMENTS, INC., 160 N. Craig St., Pittsburgh, PA 15213, Tel: 412-687-8700, FAX: 412-687-8702; FSC No.: OA2J2; Empl.: 15; *Sls. Mgr.:* Stephen Phelps; *Dist. Mgr.:* Stephen Phelps

E-L PRODUCTS CORP., Sub.of Astronics Co., 77 Olean Rd., E. Aurora, NY 14052, Tel: 716-655-0800, FAX: 716-655-0309; Empl.: 100; *Sls. Mgr.:* Patrick McCann

ELTEC INSTRUMENTS INC., P.O. Box 9610, Daytona Bch., FL 32020, Tel: 904-253-5328, TWX: 810-832-6294, FAX: 904-258-3791; Empl.: 120; *Sls. Mgr.:* Douglas S. Armstrong

ELTROL CORPORATION, 20942 Osborne Street, Bldg. I, Canoga Park, CA 91304, Tel: 818-709-0131, FAX: 818-709-0132; FSC No.: IER54; Empl.: 6; *Sls. Mgr.:* Terry E. Donovan ..... **B•1241**

Local Sales Offices & Reps

CA	Glendale, Halbar Assocs.	818-246-8263
OH	Broadview Hgts., Controlled Prods.	216-838-5700

ELVO:DIVISION OF ZUMBACH ELECTRONICS CORPORATION, 140 Kisco Avenue, Mt. Kisco, NY 10549, Tel: 914-241-1008, TWX: 910-250-5181, FAX: 914-241-7096; *Sls. Mgr.:* Thomas H. Stein

EMCA/ROHM & HAAS, 160 Commerce Dr., Montgomeryville, PA 18936, Tel: 215-855-1000, TWX: 710-566-1128; Empl.: 70; *Sls. Mgr.:* Charlie McBride; *Dist. Mgr.:* John Wagnon

EMCO ELECTRONICS, 31 Sheer Plaza, Plainview, NY 11803, Tel: 516-845-7080, TELEX: 276590, FAX: 516-845-7082; Empl.: 12; *Sls. Mgr.:* K. Berkowitz; *Dist. Mgr.:* Jay Robinson

EMCO HIGH VOLTAGE CO.

FAX: 209-223-2779

EMCO HIGH VOLTAGE CO., 11126 Ridge Road, Sutter Creek, CA 95685, Tel: 209-223-3626, TELEX: 5101008006; FSC No.: 3T243; Empl.: 38; *Sls. Mgr.:* Roxanne McCoy ..... **D•1751-1757**

E/M CORPORATION, 2801 Kent Avenue, P.O. Box 2400, W. Lafayette, IN 47906, Tel: 317-497-6346, FAX: 317-497-6348; FSC No.: 11770

EMCOR PRODUCTS, Crenlo, Inc., 1600 Fourth Ave. NW, Rochester, MN 55901, Tel: 507-289-3371, FAX: 507-287-3405; *Sls. Mgr.:* John Horton ..... **C•1039**

EMC TECHNOLOGY INC, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034, Tel: 609-429-7800, TWX: 710 896 0193, FAX: 609-429-6814; FSC No.: 24602; Empl.: 70; *Sls. Mgr.:* Peter Semitschew

EMDS, INC., 16618 Oakmont Ave., Gaithersburg, MD 20877, Tel: 301-840-5710, FAX: 301-840-8589; *Sls. Mgr.:* Patrick E. Roney ..... **D•1252**

EMERSON COMPUTER POWER, 330 Standard St., Santa Ana, CA 92702, Tel: 714-545-5581, TELEX: 67-8460, FAX: 714-540-6718; FSC No.: W. T. Brummett; Empl.: 800; *Sls. Mgr.:* R. L. Calvin; *Dist. Mgr.:* W. Rhodes

Please call factory for sales offices and nearest reps.

EMHART CANADA, LTD., See Mallory Components Div.

EMICO INC., Box 368, Dublin, PA 18917, Tel: 215-249-9330, FAX: 215-249-9336; FSC No.: 85925; Empl.: 100; *Sls. Mgr.:* C. Davis

EMI GENCOM INC., See THORN EMI Gencom Inc.

EMI TECHNOLOGY INC., See THORN EMI Technology Inc.

EMM SEMI, SUB OF EM & M, See GTE Microcircuits

Empro SHUNTS ®

FAX: 317-823-4835

EMPRO MANUFACTURING COMPANY, INC., P.O. Box 26060, Indianapolis, IN 46226, Tel: 317-823-4478; Empl.: 25 ..... **D•1253**

Local Sales Offices & Reps

CA	Chula Vista, Brooks-Moore & Assocs.	619-563-8520
CA	La Canada, Brooks-Moore & Assocs.	818-790-8358
CA	Santa Ana, Brooks-Moore & Assocs.	714-541-2044
GA	Atlanta, Brownell Electro Inc.	404-762-5181
IL	Chicago, Best Rep Co.	312-992-1055
MA	Burlington, E.I.L. Instr.	617-272-9450
NJ	Belleville, D. F. Tobias & Co.	201-751-8680
OH	Cleveland, Weschler Elec. Corp.	216-238-2550
PA	Philadelphia, Sunshine Sci. Instr. Inc.	215-673-5600
TX	Arlington, Ev Smith Sls.	817-572-2911
TX	Houston, Ev Smith Sls.	713-931-0403

Local Distributors

CA	Dublin, Std. Meter Lab	415-828-4837
CA	Glendale, Instr. Meter Specialties	818-243-0416
CA	S. Pasadena, Dae Instr. & Svc., Inc.	213-942-8843
LA	Harahan, Indl. Instrs. Works	504-733-8355
MD	Sparks, E.I.L. Instrs.	301-771-4800
NJ	Belleville, Miscorp	201-751-1190
PA	Norristown, Kimberly-James	215-666-7286
TX	Beaumont, Straughn Elctrns.	409-838-4563
TX	Houston, American Analog	713-941-7265
TX	Houston, Meters & Instrs.	713-644-1631
WI	Milwaukee, E-M Instrs.	414-272-7799

EMS

FAX: 714-838-2967

E.M.S., Div. of Sandberg Industries, 2922 Dow Street, Tustin, CA 92680, Tel: 714-669-9473, TWX: 910-595-2767; Empl.: 125; *Sls. Mgr.:* Duane Halverson, VP Sls.; *Dist. Mgr.:* Noel Kennedy ..... **C•1713-1715**

Local Sales Offices & Reps

TX	Austin, Allied Comps., Inc.	512-258-7558
TX	Dallas, Allied Comp., Inc.	214-238-0408
TX	Dallas, Allied Comps., Inc.	214-238-0408
VA	Reston, Tytronics Tech. Sls.	703-620-4600
VA	Reston, Tytronics Tech-Sls.	703-620-4600

E M S DEVELOPMENT CORP., 100 Sea La., Farmingdale, NY 11735, Tel: 516-293-7900, FAX: 516-694-1093; FSC No.: 51435; Empl.: 100; *Sls. Mgr.:* Bob Solomon

EMTRONIX CORPORATION, LEM, SA, Geneva Switzerland, N114 W. 19225 Clinton Dr., Germantown, WI 53022, Tel: 414-255-2620, ESYLNK: 629-38203, FAX: 414-255-0653; Empl.: 53; *Sls. Mgr.:* Richard Koerber

EMULATION TECHNOLOGY, INC., 2368B Walsh Ave, Bldg. D, Santa Clara, CA 95051, Tel: 408-982-0660, TELEX: 981866, FAX: 408-982-0664; Empl.: 9; *Sls. Mgr.:* Joseph J. Bagliere, Jr. ..... **C•1348**

Local Distributors

CA	Monterey, Adams/MacDonald Entrps.	408-373-3607
CO	Denver, Alliance Elctrns. CO	303-433-1648
MI	Bloomfield Hills, Mackellar Assocs.	313-335-4440
TX	Allen, Prime Distributing Co.	214-231-0170

ENCLOSURE CORP., 2900 Wharton Rd., Bristol, PA 19007, Tel: 215-785-2900, FAX: 215-785-2960; FSC No.: 32360; Empl.: 120; *Sls. Mgr.:* Gene Goldner

ENCODER DIV., LITTON SYSTEMS, INC., See Litton Encoder Div.

ENCODER PRODUCTS, 1601B Dover Rd., Sandpoint, ID 83864, Tel: 208-263-8541, FAX: 208-263-0541; Empl.: 100; *Sls. Mgr.:* Vance Conner

ENDEVCO, 30700 Rancho Viejo Rd., San Juan Capistrano, CA 92675, Tel: 714-493-8181, TELEX: 68-5608, TWX: 910-596-1415; FSC No.: 95411; Empl.: 400; *Sls. Mgr.:* D. McMahon

ENDICOTT COIL CO., INC., 24 Charlotte St., Binghamton, NY 13905, Tel: 607-797-1263, FAX: 607-797-0151; Empl.: 110; *Sls. Mgr.:* Thomas E. Frank

ERG™ Endicott Research Group, Inc.

FAX: 607-754-9255

ENDICOTT RESEARCH GROUP, 2601 Wayne St., P.O. Box 269, Endicott, NY 13760, Tel: 607-754-9187, TWX: 510-252-0155; FSC No.: 63312; Empl.: 150 ..... **B•1076-1077, 1142; D•1758-1759**

Local Sales Offices & Reps

AZ	Phoenix, Finn-Pat Co., Inc.	602-954-0301
CA	Saratoga, Testco	408-253-1900
CO	Littleton, MRC	303-794-4684
CT	Bloomfield, Sands Co./Sir Assocs.	203-243-9343
FL	Maitland, EIR, Inc.	305-660-9600
GA	Atlanta, Wallace Electronics	800-334-3518
IL	Elk Grove Village, Carlson Elctrn. Sls.	312-956-8240
IN	Indianapolis, Precision Elctrn. Comps.	317-842-3740
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-377-6341
KS	Wichita, Palatine	319-365-8071
MA	Westford, SIR Assocs.	617-692-2500
MI	West Bloomfield, Granneman & Mize	317-849-2000
MN	Minneapolis, OEM Prods.	612-541-0236
MO	Hazelwood, Palatine	314-839-0800
NJ	Livingston, Eagle Sls. Co.	201-992-2030
NC	Kernersville, Wallace Electronics	919-996-2742
OH	Worthington, Elctrn. Sls. & Technlg.	614-438-2622
PA	Glenshaw, H. C. Johnson Agencies	412-487-1246
PA	King of Prussia, Freedman-Malta Assocs.	215-337-9211
UT	Salt Lake City, MRC	303-794-4684
WA	Bellevue, Testco	206-454-7422
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790
Can	Toronto, Ont., Norgay Entprs., Ltd.	416-259-9663

ENERCO, INC., 9615 W. Marginal Way S., Seattle, WA 98108, Tel: 206-762-1422; Empl.: 5; *Sls. Mgr.:* Lee Rabie

ENERGY CONCEPTS INC., 6351-A Yarrow Drive, Carlsbad, CA 92009, Tel: 619-438-2202, TELEX: 01830, FAX: 619-438-0694; FSC No.: 01830; Empl.: 16; *Sls. Mgr.:* Pete Steinmetz

ENERGY ELECTRONIC SYSTEMS, INC, 9486 Deereco Rd., Timonium, MD 21093, Tel: 301-252-2240, 800-233-4544, FAX: 301-561-5412; Empl.: 35; *Sls. Mgr.:* Mike Lynch

ENERGY

FAX: 301-699-8107

ENERGY, LTD., 4714 Upshur Street, Bladensburg, MD 20710, Tel: 301-699-1144; Empl.: 10 ..... **D•2195**

Local Sales Offices & Reps

MD	Bladensburg, Energy, Ltd.	301-699-1144

Local Distributors

MD	Bladensburg, Energy, Ltd.	301-699-1144

ENERGY SYSTEMS

ENERGY SYSTEMS, 21550 Oxnard St., Woodland Hills, CA 91367, Tel: 818-716-9004; Empl.: 25 ..... **D•1254-1255, 2196-2197**

ENGINEERED ASSEMBLIES CORP., 429 Getty Ave., Clifton, NJ 07011, Tel: 201-340-0600, 1-800-950-9111, FAX: 201-340-0623; Empl.: 50; *Sls. Mgr.:* P. Teen; *Dist. Mgr.:* P. Teen ..... **D•1491**

Local Sales Offices & Reps

FL	Orlando, Engrd. Assemblies Corp.	407-291-6710
GA	Atlanta, Engrd. Assemblies Corp.	404-525-0676
MA	Boston, Engrd. Assemblies Corp.	617-227-5455
NC	Raleigh, Engrd. Assemblies Corp.	919-790-9700

ENGINEERED COMPONENTS CO., P. O. Box 8121, San Luis Obispo, CA 93403-8121, Tel: 805-544-3800, FAX: 805-544-8091; FSC No.: 32440; Empl.: 250

ENGINEERED MAGNETICS, INC., A Fleet Aerospace Company, 18435 Susana Rd., Rancho Dominguez, CA 90221, Tel: 213-635-9555, TWX: 910-325-6208; FSC No.: 06509; Empl.: 250

ENGINEERING DESIGN & SLS., One E.D.S. Way, Danville, VA 24541, Tel: 804-792-6405, FAX: 804-792-6415; Empl.: 75; *Sls. Mgr.:* Mark Gignac

ENGINE SYSTEMS DIVISION, Simmonds Precision, P.O. Box 310, Norwich, NY 13815, Tel: 607-335-5000, TWX: 510-261-7776; Empl.: 750; *Sls. Mgr.:* G. D. Cummings

ENGLER INSTRUMENTS OPERATION, See Stemço Instruments, Colt Inds.

ENI, INC., Emerson Electric Co., 100 Highpower Road, Rochester, NY 14623, Tel: 716-427-8300, TELEX: 671-1542 ENI UW, FAX: 716-427-7839; Empl.: 348 ..... **D•1011**

Local Sales Offices & Reps

AL	Huntsville, Teqspec	205-721-1701
AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Los Angeles, Scientific Devices	213-477-8556
CA	Santa Clara, ENI, Inc.	408-727-0993
CO	Wheat Ridge, Trembly Assocs.	303-421-8900
FL	Palm Harbor, Teqspec	813-785-2276
GA	Norcross, Teqspec	404-242-7215
IL	Elmhurst, Sector Engrg.	312-530-7850
IN	Indianapolis, Sector Engrg.	317-842-1120
KS	Lenexa, Ramsey Assocs.	913-541-1007
MD	Silver Spring, Gawler Knoop Co.	301-589-4406
MA	Westford, ICS Assocs.	617-692-3545
MI	Madison Heights, WKM Assocs.	313-588-2300
MN	Minneapolis, Sector Engrg.	612-593-1809
MO	St. Louis, Ramsey Assocs.	314-532-9386
NV	Las Vegas, Trembly Assocs.	702-739-9770
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Great Neck, RTI, Inc.	516-829-3770
NY	Rochester, Taerep, Inc.	716-586-8710
NY	Whitney Pt., Taerep, Inc.	607-692-3705
NC	Winston Salem, Teqspec	919-765-5553
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
PA	Holicong, John Bell Assocs.	215-794-7075
PA	Philadelphia, WKM Assocs.	215-924-6228
TX	Houston, Lear Assocs.	713-488-7893
TX	Richardson, Lear Assocs.	214-231-5388
UT	N. Salt Lake, Trembly Assocs.	801-295-4703
WI	Milwaukee, Sector Engrg.	414-352-8280
Can	Downsview, Rayonics Scientific	416-736-1600
Can	St. Laurent, Que., Rayonics Sci., Inc.	514-335-0105

ENPROTECH CORP., 445 West Michigan Ave., Kalamazoo, MI 49007, Tel: 616-381-0665, FAX: 616-381-9810; Empl.: 125 ..... **B•1953**

Local Sales Offices & Reps

AZ	Phoenix, Trembly Assoc.	602-967-2058
CA	Simi Valley, Motion Technlg. Inc.	805-581-9493
CO	Denver, Trembly Assoc.	303-421-8900
FL	Melbourne, Reynolds & Assoc.	407-259-7000
GA	Lilburn, Reynolds & Assoc.	800-255-1965
IA	Davenport, H & H Vega Sls.	319-326-5664
KS	Kansas City, H & H Vega Sls.	913-432-6363
MI	Detroit, Xanthus, Inc.	313-528-2000
MN	Minneapolis, Mackubin Grp.	612-636-5533
NV	Las Vegas, Trembly Assocs.	702-739-9770
NH	Salem, Servo Comps., Inc.	603-898-6798
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Rochester, A & D Devices	716-385-2778
OH	Columbus, Oyl-Air Specialty	614-882-5066
SC	Greenville, Reynolds & Assoc.	800-255-1965
TX	Dallas, Seaton Corp.	214-980-9860
UT	Salt Lake City, Trembly Assoc.	801-295-4703
WI	Milwaukee, Sensus Co.	414-964-1553

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FAX: 203-658-2740

ENTECH CORPORATION, 17A Herman Drive, Simsbury, CT 06070, Tel: 203-658-2740, 203-651-9557 ..... **B•1739**

ENTECH SYSTEMS, INC., 17B Herman Dr., Simsbury, CT 06070, Tel: 203-651-9557, FAX: 203-658-2740; *Sls. Mgr.:* A. D. Jorczak

ENTRA CORPORATION, 8651 Castle Park Drive, Indianapolis, IN 46151, Tel: 317-849-8270, FAX: 317-849-7041; Empl.: 50; *Sls. Mgr.:* Paul D. Nelson

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FAX: 201-227-6865

ENTRAN DEVICES, 10 Washington Ave., Fairfield, NJ 07006, Tel: 201-227-1002, 800-635-0650, TELEX: 130-361; *Sls. Mgr.:* Daniel M. Slavik ..... **B•1954-1955**

Local Sales Offices & Reps

AZ	Phoenix, J. Smith & Assocs.	602-267-0981
CA	Long Beach, Saber Entprs.	213-595-5646
CA	Mtn. View, Saber Entprs.	415-968-0427
CA	San Diego, Saber Entprs.	619-271-1523
CO	Colorado Springs, J. Smith & Assoc.	303-597-5343
CT	Wallingford, Pond Tech. Sls.	203-284-1500,
FL	Clearwater, Structural Engrg. & Test Svc.	813-442-7767
GA	Smyrna, Quantum Meas.	404-433-0093
IL	Woodstock, TMI Inc.	815-385-2212
MA	Waltham, Pond Tech. Sls.	617-890-5535,
MI	Huntington Woods, Stress Analysis Svcs.	313-542-8260
NJ	Budd Lake, Measurements, Inc.	201-770-1281
NM	Albuquerque, J. Smith & Assocs.	505-345-6501,
NY	Clarence, Trott Electrns.	716-634-8500
NY	Pittsford, Trott Elctrns.	716-586-8251
NC	Chapel Hill, Quantum Meas.	919-933-7408
OH	Medina, Stress Analysis Svc.	216-725-7733
OH	Middleton, Stress Analysis Svcs.	513-422-7900
OR	Bend, Data Signal	503-389-2661,
PA	Carnegie, Stress Analysis	412-276-7755
PA	Exton, Measurements, Inc.	215-524-0310
TX	Dallas, Pace Tech. Sls.	214-368-0135
TX	San Antonio, Pace Tech. Sls.	512-826-7181
VA	Fredericksburg, Measurements, Inc.	703-373-5520
WI	Oregon, TMI Inc.	608-835-5527
Can	Ontario, Intertechnology	416-445-5500

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ENVIRONMENTAL COMM., 3150 Pullman St., Costa Mesa, CA 92627, Tel: 714-557-7800, FAX: 714-957-3160; FSC No.: 16450; Empl.: 65; *Sls. Mgr.:* Robert Denish

ENVIRONMENTAL CONTAINER SYS., INC., See ECS Composites

EOG, INC., OMX, INC., 10947 Golden West Drive, Hunt Valley, MD 21030, Tel: 301-785-3000, TWX: 87932, FAX: 301-771-5814; FSC No.: 17521; Empl.: 150; *Sls. Mgr.:* Arthur C. Rutledge, Jr.; *Dist. Mgr.:* Arthur C. Rutledge, Jr.

EPC IDENTIFICATION SYS., 505 Martin Ave., Rohnert Park, CA 94928, Tel: 707-585-8811, TWX: 910-3382-311, FAX: 707-585-8688; FSC No.: 67041; Empl.: 16; *Sls. Mgr.:* Astrid Harper; *Dist. Mgr.:* Astrid Harper

EPCO PRODUCTS INC., P.O. Box N. Cottage St., Wallkill, NY 12589, Tel: 914-895-2033, FAX: 914-895-2279; Empl.: 45; *Sls. Mgr.:* Mark Giegel

E.P.D./GENERAL POWER CORP., 1045 So. East Street, Anaheim, CA 92805-8508, Tel: 714-520-0881, 1-800-343-1813, TELEX: 678870 ATTN:EPD, FAX: 714-491-8644; Empl.: 150; *Sls. Mgr.:* Don Royer,Sls. Dir.; *Dist. Mgr.:* Connie Kouri

EPD ELECTRONICS INC.

FAX: 213-515-5011

EPD ELECTRONICS, INC., 16921 S. Western Ave., Ste. 110, Gardena, CA 90247, Tel: 213-515-4996, TELEX: 691-738; Empl.: 6 ..... **C•1349; D•1256-1257, 1760**

Local Sales Offices & Reps

IA	Burlington, JS Ridge Entprs., Inc.	319-754-8745
NJ	Bricktown, Bryan Elctrn. Sls. Co.	201-840-8487
OR	Portland, Dale G. Weber Co.	503-234-0686
TN	White House, Apple Sls. & Mktg.	615-672-4498

EPE TECHNOLOGIES, INC., 1660 Scenic Avenue, Costa Mesa, CA 92626, Tel: 714-557-1636, FAX: 714-957-1103; Empl.: 350; *Sls. Mgr.:* Joe T. Amos, Jr.

EPH ENGINEERING ASSOCIATES, INC., 31 E. 400 St., Orem, UT 84058, Tel: 801-226-1383, TWX: 453161 EPHYCERAM, FAX: 801-226-1437

EPIC, INC., 150 Nassau St., New York, NY 10038, Tel: 212-349-2470, TELEX: 12-6231, FAX: 212-406-2508; Empl.: 8; *Sls. Mgr.:* Peter Letica

EPOXYLITE CORP., 9400 Toledo Way, P.O. Box 19671, Irvine, CA 92713, Tel: 714-951-3231, FAX: 714-472-0980; FSC No.: 11147; Empl.: 60

EPOXY TECHNOLOGY, INC., 14 Fortune Dr., Billerica, MA 01821, Tel: 508-667-3805, 800-227-2201, TELEX: 94-7140, FAX: 508-663-9782; FSC No.: 33246; Empl.: 18

EPSCO, 1020 W. Fullerton Ave., Ste. D, Addison, IL 60101, Tel: 312-543-0410, FAX: 312-543-0592; FSC No.: 53003; Empl.: 8; *Sls. Mgr.:* Wendie Amerena ..... **D•1750**

Local Distributors

AZ	Phoenix, Fisher Sci.	602-995-1556
AR	Little Rock, Carlton-Bates Co.	501-562-9100
CA	Santa Barbara, Abbecon Cal Inc.	805-966-0810
CO	Denver, Sargent-Welch	303-399-8220
FL	Mirimar, Aero Quality Sls.	305-432-2288
IL	Elmhurst, McMaster-Carr Supp.	312-834-9600
IL	Niles, Joseph Elctrns.	312-297-4200
IN	East Chicago, Acro Elctrns. Corp.	219-397-8681
KY	Louisville, Peerless Elctrn. Equip.	502-637-7674
LA	New Orleans, Radio Parts	504-581-5959
MA	Rockville, Capital Radio Whlsrs.	301-881-2270
MA	Westwood, VWR Scientific	617-461-1880
MI	Lansing, Fulton Radio Supp.	517-394-5020
MN	Eden Prairie, Allied Elctrns.	612-829-7554
NJ	Teterboro, Mars Aircraft Radio	201-288-0222
NM	Albuquerque, Walker Elec. Supp.	505-883-2992
NY	Amherst, Standard Elctrns.	716-691-3801
OH	Warren, Rem Elctrns. Supp.	216-373-1300
PA	Pittsburgh, Allied Elctrns.	412-367-4124
RI	Providence, A & J Distrs., Inc.	401-421-0991
SC	Charleston, Wholesale Inds. Elec.	803-722-2634
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Angie Elctrns.	713-659-8686
WA	Kent, Fisher Scientific	206-872-0330
WI	Milwaukee, Industrial Elctrns. Supp.	414-276-1212

EPSILON-LAMBDA ELCTRNS. CORP., 427 Stevens St., Geneva, IL 60134, Tel: 312-232-9611, FAX: 312-232-9613; Empl.: 30; *Sls. Mgr.:* R. Knox

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FAX: 213-534-4449

EPSON AMERICA, INC./OEM DIV., 3415 Kashiwa St., Torrance, CA 90505, Tel: 213-534-4500; Empl.: 900; *Sls. Mgr.:* John R. Confrey ..... **A•1401-1403**

Local Sales Offices & Reps

AL	Huntsville, The Novus Grp., Inc.	205-534-0044
CA	Canoga Pk., Bager Elctrns., Inc.	818-712-0011
CA	Cupertino, Costar Inc.	408-446-9339
CA	Encinitas, Bager Elctrns., Inc.	619-944-4188
CA	Fountain Valley, Bager Elctrns., Inc.	714-957-3367
CA	Los Angeles, Epson America, Inc.-OEM Div.	213-768-7474
CA	San Francisco, Epson America,Inc.-OEM Div.	408-257-6730
CO	Westminster, Intl. Magnaproducts, Inc.	303-650-1903
CO	Westminster, Western Region Mktg., Inc.	303-469-8088
FL	Casselberry, Dyne-A-Mark Corp.	305-831-2822
FL	Clearwater, Dyne-A-Mark Corp.	407-441-4702
FL	Ft. Lauderdale, Dyne-A-Mark Corp.	305-771-6501
GA	Lilburn, The Novus Grp., Inc.	404-263-0320
IL	Chicago, Epson America, Inc. - OEM Div	815-455-7630
IL	Itasca, LTD Technlgs.	312-773-2900

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IN	Valparaiso, Intl. Magnaproducts, Inc.	219-465-1988
KS	Shawnee Mission, Microtronics, Inc.	913-262-1444
MD	Ellicott City, Technlg. Sls. Assocs.	301-461-7802
MA	Boston, Epson America, Inc.-OEM Div.	617-245-8007
MA	Needham Hgts., Rosen Assocs., Inc.	617-449-4700
NJ	Parlin, JMR Sls., Inc.	201-254-8484
NY	Pittsford, Elcom Sls., Inc.	716-385-1400
NY	Skaneateles, Elcom Sls., Inc.	315-685-8967
NY	Wading River, JMR Sls., Inc.	516-929-5756
NC	Raleigh, The Novus Grp., Inc.	919-833-7771
OH	Elyria, J. D. Babb Assocs.	216-323-7081
OR	Portland, Elctrn. Engrg. Sls., Inc.	503-639-3978
PA	Huntingdon Valley, Omega Elctrn., Inc.	215-947-4135
TX	Austin, Component Technlg.	512-250-2450
TX	Dallas, Component Technlg.	214-783-8831
TX	Houston, Component Technlg.	713-961-1262
UT	Salt Lake City, Western Region Mktg., Inc.	801-486-1646
WA	Redmond, Elctrn. Engrg. Sls., Inc.	206-883-3374
WI	Milwaukee, LTD Technlgs.	414-774-1000

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IN	Indianapolis, Mar Elctrns.	317-633-6699
MA	Needham, Cronin Elctrns.	617-449-5000
PA	Philadelphia, Almo Corp.	215-698-4000
TX	Dallas, Omni Pro Elctrns.	214-233-9368

EPSON AMERICA, INC., 23530 Hawthrone Blvd., Torrance, CA 90505, Tel: 213-373-9511, 213-373-3161, FAX: 213-378-9575

EQUIPTO, 225 S. Highland Ave., Aurora, IL 60506, Tel: 312-859-1000, 800-323-0801, TWX: 910-232-0845, FAX: 312-859-3255; Empl.: 300; *Sls. Mgr.:* Ralph Zettinger

EQUIPTO ELECTRONICS CORP., 351 Woodlawn Ave., Aurora, IL 60506, Tel: 312-897-4691, FAX: 312-897-5314; FSC No.: 14002;Multiple; Empl.: 100; *Sls. Mgr.:* Kent Jarnig **C•1040-1052**

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ERASER CO., Box 4961, Syracuse, NY 13221, Tel: 315-454-3237, TELEX: 93-7442, FAX: 315-454-3090; Empl.: 45; *Sls. Mgr.:* Linda S. Cahill

ERBTEC ENGINEERING, INC., 2760 29th St., Boulder, CO 80301, Tel: 303-447-8750, TELEX: 386292, ESYLNK: 62757032, FAX: 303-442-7960; Empl.: 18; *Sls. Mgr.:* Allan L. Kreibach

ERC, See Electronic Research Co.

ERCONA, 979 North Ocean Ave., Patchogue, NY 11772, Tel: 516-758-0700, FAX: 516-758-0422; Empl.: 10; *Sls. Mgr.:* G. Moore; *Dist. Mgr.:* L. Mills

ERDIE PAPER TUBE COMPANY, 1205 Colorado Avenue, Lorain, OH 44052, Tel: 216-288-0166

ERGOTRON, INC., 3450 Yankee Dr., Eagan, MN 55121, Tel: 612-452-8135, TELEX: 4310015, FAX: 612-452-8346; Empl.: 50; *Sls. Mgr.:* Keith A. Jentoft

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FAX: 214-680-1059

ERICSSON COMPONENTS, INC., 403 International Pkwy., Ste. 500, Richardson, TX 75081, Tel: 214-480-8300, TELEX: 735389 ERICS RCHN **D•1761-1763**

Local Sales Offices & Reps

AL	Huntsville, EMA, Inc.	205-880-8050
AZ	Phoenix, CPS Assocs., Inc.	602-246-1097
CA	Garden Grove, Elsco Elctrns.	714-891-4621
CA	Grass Valley, Unitronics, Inc.	916-268-1737
CA	Los Altos, PEI	415-968-1803
CA	San Diego, Elsco Elctrns.	619-292-1771
CO	Denver, FG Mktg. Co.	303-795-9176
CT	Greenwich, Ericsson Comps. Inc.	203-625-7300
FL	India Atlantic, Burke Assoc.	407-723-0618
FL	Largo, Burke Assoc.	813-536-4335
FL	Oldsmar, Burke Assoc. Inc.	813-786-8105
FL	W. Palm Bch., Burke Assoc., Inc.	407-790-5722
GA	Atlanta, EMA, Inc.	404-448-1215
IL	Elk Grove Village, Carlson Elctrns. Sls.	312-956-8240
IL	O'Fallon, J & J Entprs.	618-632-8221
IA	Cedar Rapids, Carlson Elec. Sls. Assoc.	319-377-6341
MD	Hunt Valley, Eagle Sls.	301-666-3930
MA	Whitinsville, Power Factor & Assoc.	508-234-6415
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Minneapolis, Holmgren Assocs.	612-786-7641
MO	Joplin, J & J Entprs.	417-624-4302
NJ	Marlton, Naudain Assocs., Inc.	609-983-5300
NJ	Parlin, JMR Sls., Inc.	201-254-8484
NY	Clifton Pk., H.C. Johnson	518-383-2239
NY	Rochester, H.C. Johnson	716-586-0777
NY	Wading River, JMR Sls.	516-929-5756
NC	Raleigh, EMA, Inc.	919-847-8800
OH	Cincinnati, G & H Sls. Co.	513-272-0580
PA	Glenshaw, H. C. Johnson	412-487-1246
SC	Greenville, EMA, Inc.	803-233-4637
TX	Austin, Tesco, Inc.	512-834-8374
TX	Dallas, Tesco, Inc.	214-553-1200
TX	Houston, Tesco, Inc.	713-370-8117
WA	Redmond, EMG-Elec. Mktg. Grp.	206-882-0962
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AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Mesa, Sedco Sls.	602-461-9069
CA	Culver City, Westaironics	213-641-4122
CA	Santa Clara, Rodgers Assocs.	408-984-8110
CO	Denver, Donohue Sls. Co.	303-455-1719
FL	Clearwater, Sigma Tech. Assocs.	813-791-0271
FL	Ft. Lauderdale, Sigma Tech. Assocs.	305-731-5995
IL	Elk Grove, Carlson Elctrn. Sls. Co.	312-956-8240
IN	Indianapolis, Precision Elctrn. Comps.	317-842-3740
IA	Cedar Rapids, Carlson Elctrn. Sls. Co.	319-377-6341
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MA	Taunton, Focus Elctrn. Sls., Inc.	508-824-3840
MI	Grosse Point Park, Greiner Assoc.	313-499-0188
MN	Minneapolis, R-J, Inc.	612-866-3661
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ESE, 142 Sierra St., El Segundo, CA 90245, Tel: 213-322-2136, FAX: 213-322-7033; FSC No.: 58525; Empl.: 25; *Sls. Mgr.:* R. Mayers; *Dist. Mgr.:* R. Mayers

ESICO/TRITON, Triton Industries Inc., Box 247, Deep River, CT 06417, Tel: 203-526-5361, TELEX: 955439, FAX: 203-526-9524; FSC No.: 54195; *Sls. Mgr.:* Robert W. Mead

E-SQUARED TECHNOLOGY CORP., 4475 Dupont Ct 69, Ventura, CA 93003, Tel: 805-644-9544, TELEX: 887971 E Sq. Tech.UD, FAX: 805-644-9584; Empl.: 19; *Sls. Mgr.:* Larry D. Emery

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Local Sales Offices & Reps

AZ	Tucson, Clemick & Assoc.	602-749-4003
CA	Los Angeles, Sierra-Pacific Eng.	714-731-3411
CA	San Francisco, Moulthrop Sls.	415-463-0450
CO	Denver, Candal, Inc.	303-935-7128
CT	East Haven, Eagle Assocs.	203-467-6542
FL	Orlando, EAB Inc.	305-898-7444
IN	Ft. Wayne, Needler Sls. Co.	219-447-2123
IN	Indianapolis, Needler Sls. Co.	317-255-8056
KS	Kansas City, Midtec Assoc.	913-541-0505
MA	Boston, Eagle Assocs.	617-444-3446
MI	Grand Haven, Hilltronics, Inc.	616-847-1010
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	Minneapolis, PWC, Inc.	612-934-1409
MO	St. Louis, Midtec Assoc.	314-275-8666
NY	Islandia, Schmitt Inds.	516-582-5888
NY	Rochester, Lamb Comps.	716-272-7720
NC	Raleigh, EAB, Inc.	919-848-4624
OH	Cleveland, Del Steffen & Assoc.	216-461-8333
OH	Columbus, Del Steffen & Assoc.	419-884-2313
OH	Dayton, Del Steffen & Assoc.	513-293-3145
PA	Philadelphia, Jacobsen Assoc.	215-674-2937
PA	Pittsburgh, Del Steffen & Assoc.	412-276-7366
TX	Dallas, Delta Comps.	214-287-6333
UT	Salt Lake City, Frank Merchant	801-277-3775
VA	Sterling, Beacon North Inc.	703-478--2480
WI	Milwaukee, Star Engineering	414-645-3680

ETA POWER, See JETA Power Systems

ETI SYSTEMS

FAX: 619-757-2305

ETI SYSTEMS, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, Tel: 619-757-7770; FSC No.: 952 762672; *Sls. Mgr.:* Bill Tice; *Dist. Mgr.:* Bill Tice
..... **A•2108-2109; B•1242-1244; D•1146**

Local Distributors

AZ	Tempe, Anjon Enterprises	602-894-1332
CA	Anaheim, A To Z Elctrns.	714-632-1620
CA	Garden Grove, Allied Elctrns.	714-544-0731
CA	Hayward, Allied Elctrns.	415-487-5250
CA	Los Angeles, Allied Elctrns.	213-725-7111
CA	San Jose, Allied Elctrns.	408-727-1690
CO	Wheatridge, Allied Elctrns.	303-425-7144
CT	Hamden, Allied Elctrns.	203-248-8900
FL	Ft. Lauderdale, Allied Elctrns.	305-486-0500
GA	Atlanta, Allied Elctrns.	404-237-3366
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Lisle, Components, Inc.	312-852-7707
MD	Marlow Heights, Allied Elctrns.	301-423-0161
MA	Holliston, Mac Bearing Co.	617-429-7945
MA	Wilmington, Allied Elctrns.	617-942-0150
MA	Woburn, Mac Bearing Co.	617-933-2110
NY	E. Syracuse, Add Elctrns.	315-437-0300
NY	Mineola, Allied Elctrns.	516-248-2360
NY	Victor, Add Elctrns.	716-924-4760
NC	Raleigh, Allied Elctrns.	919-467-0720
OH	Cleveland, Specialized Comp. Sls.	216-464-0405
OK	Oklahoma City, Trice Wholesales Elec.	405-524-4411
OK	Tulsa, Allied Elctrns.	918-663-7630
PA	Bala Cynwyd, Allied Elctrns.	215-667-6940
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Lenert Co.	713-225-1465
TX	Humble, Allied Elctrns.	713-852-3730
WA	Seattle, Allied Elctrns.	206-767-5772
WI	Milwaukee, Allied Elctrns.	414-235-4233
WI	Oshkosh, Electronic Inds.	414-235-4233

ETM ELECTROMATIC INC, 35451 Dumbarton Ct., Newark, CA 94560, Tel: 415-797-1100, FAX: 415-797-4358; Empl.: 85; *Sls. Mgr.:* Kenneth F. Lillis

ETRI, INC., 1503 Rocky River Rd., North, Monroe, NC 28110, Tel: 704-289-5423, FAX: 704-283-7170; *Sls. Mgr.:* G. Wolf ..... **C•1654-1658**

Local Sales Offices & Reps

CA	Los Gatos, Norwest Elctrns.	408-395-1190
CA	San Diego, Bestronics	619-693-1111
CA	Westminster, West Elctrn. Sls.	714-898-0120
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Ft. Lauderdale, QXI, Inc.	305-978-0120
FL	Melbourne, OXI, Inc.	407-255-0352
FL	Orlando, QXI, Inc.	407-423-3682
FL	St. Petersburg, QXI, Inc.	813-894-4556
IL	Des Plaines, Lincoln, Hodges & Assocs.	312-297-3810
KS	Overland Pk., Spectrum Sls.	913-648-6811
MI	Farmington Hills, Tritech Sls., Inc.	313-553-3370
MI	Kalamazoo, Tritech Sls., Inc.	616-382-5570
MN	Minneapolis, Milt Westlund Assocs.	612-866-5002
MO	Hazelwood, Spectrum Sls.	314-731-5151
NH	Salem, Sls. Engrg. Co.	603-893-5521
NY	Marcellus, Noeth-Honsinger	315-673-1052
NY	Pittsford, Noeth-Honsinger	716-586-9002
NY	Port Washington, Ashtec, Inc.	516-767-0336
NC	Raleigh, Tingen Tech. Sls., Inc.	919-878-4440
OH	Cincinnati, Makin & Assocs., Inc.	513-871-2424
OH	Columbus, Makin & Assocs., Inc.	614-848-5454
OH	Solon, Makin & Assocs., Inc.	216-248-7370
OK	Tulsa, Nova Mktg.	918-660-5105
OR	Lake Oswego, RTS, Inc.	503-244-4123
TX	Austin, Nova Mktg.	512-343-2321
TX	Dallas, Nova Mktg.	214-750-6082
TX	Houston, Nova Mktg.	713-988-6082
WA	Seattle, RTS, Inc.	206-527-7945
WA	Vashon, RTS, Inc.	206-285-1363
WI	Janesville, Antek/Lincoln Hodges & Assocs.	608-754-4214
Can	Mississauga, Ont., R-Theta	416-890-0221

Local Distributors

AZ	Tempe, Acacia/Deanco	602-894-2874
AZ	Tempe, Harper, S.I.D.	602-967-1464
CA	Alhambra, Harper, S.I.D.	213-979-5090
CA	Fountain Valley, Components Ctr.	714-979-0433
CA	Irvine, Acacia/Deanco	714-660-0834
CA	San Diego, Acacia/Deanco	619-565-4365
CA	San Diego, Harper, S.I.D.	619-578-2500
CA	San Jose, Dansco	408-292-9740
CA	San Jose, Harper, S.I.D.	408-943-9490
CA	Santa Clara, Comp. Ctr., Inc.	408-988-3751
CA	Sunnyvale, Acacia/Deanco	408-745-7200
CO	Lakewood, Acacia/Deanco	303-232-2882
CT	Milford, Jaco Elctrns., Inc.	203-874-0006
CT	Milford, Milgray Elctrns.	203-878-5538
FL	Altamonte Springs, Pioneer Elctrns.	305-834-9090
FL	Deerfield Beach, Pioneer Elctrns.	305-428-8877
FL	Winter Park, Milgray Elctrns.	407-647-5747
GA	Norcross, Milgray Elctrns.	404-446-9777
IL	Bensenville, Milgray Elctrns.	312-350-0490
IL	Bensenville, Voyager Elctrns.	312-860-1300
IL	Palatine, OHM Elctrns.	312-359-5500
IN	Indianapolis, Advent Elctrns.	317-872-4910
KS	Overland Park, Milgray Elctrns.	913-236-8800
KS	Wichita, L-Comp	316-265-5100
MD	Columbia, Milgray Elctrns.	301-621-8169
MD	Gaithersburg, MS Elctrns.	301-921-0200
MA	Wilmington, Jaco Elctrns., Inc.	617-273-1860
MA	Wilmington, MilGray Elctrns.	508-657-5900
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MN	Minneapolis, Stark Elctrns.	612-332-1325
NH	Hudson, Bell Inds.	603-882-1133
NJ	Marlton, Milgray Elctrns.	609-983-5010
NY	Bohemia, Key Comps.	516-567-7500
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	Rochester, Milgray Elctrns.	716-235-0830
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Charlotte, Electronic Mktg. Corp.	704-394-6195
OH	Cleveland, Milgray Elctrns.	216-447-1520
OH	Columbus, Electronic Mktg. Corp.	614-299-4161
OH	Dayton, Electronic Mktg. Corp.	513-439-4711
OH	Highland Heights, Electronic Mktg. Corp.	216-442-3441
OK	Tulsa, Norvell Elctrns.	918-254-8606
OR	Beaverton, Acacia/Deanco	503-646-3377
PA	Allentown, P.A. Peters	215-434-5237
PA	Montgomeryville, Pyttronics Inds.	215-643-2850
TX	Austin, Norvell Elctrns.	512-837-5555
TX	Dallas, Milgray Elctrns.	214-248-1603
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Houston, Norvell Elctrns.	713-777-1666
TX	Irving, Harper, S.I.D.	214-621-0500
UT	Midvale, Bell Inds.	801-255-9611
VA	Charlottesville, Virginia Elctrn. Comps.	804-296-4184
WI	Milwaukee, Indl. Elctrns.	414-276-1212
Can	Mississauga, Ont., R-Theta	416-890-0221
Can	Vancouver B.C., Intek Elctrns.	604-324-6831

E-TRONICS, 16774 Schoenborn, Sepulveda, CA 91343, Tel: 818-892-7279; FSC No.: 29077; Empl.: 28

ET. TECH INC., Empire Telecommunications, 15 S. Van Brunt St., Englewood, NJ 07631, Tel: 201-569-3339, FAX: 201-569-5838; Empl.: 12; *Sls. Mgr.:* Burton Green

EUBANKS ENGINEERING, 1307 So. Myrtle Ave., Monrovia, CA 91016, Tel: 818-357-7011, TELEX: 675403, FAX: 818-357-4718; Empl.: 90; *Sls. Mgr.:* Joe Dillon

EURO-DIP, See Preci-Dip

EURO QUARZ GMBH, See Raltron Electronics Corp.

EVANS ELECTRONICS, Box 5055, Berkeley, CA 94705, Tel: 415-653-3083

EVAPORATED COATINGS, INC., 2365 Maryland Rd., Willow Grove, PA 19090, Tel: 215-659-3080, FAX: 215-659-1275; Empl.: 24; *Sls. Mgr.:* Stephen L. Schaffer

EVENTIDE, INC., One Alsan Way, Little Ferry, NJ 07643, Tel: 201-641-1200, 800-446-7878, TWX: 710-991-8715; Empl.: 48; *Sls. Mgr.:* Gil Griffith; *Dist. Mgr.:* Gil Griffith

EVEREADY®

FAX: 314-982-4078

EVEREADY BATTERY CO. INC., Checkerboard Square, St. Louis, MO 63164, Tel: 314-982-2000
..... **D•1492-1493**

Local Sales Offices & Reps

CA	Fountain Valley	714-964-5258
GA	Duluth	404-279-0228
IL	Lisle	312-964-8668
MO	St. Louis	314-982-2000
NJ	Saddle Brook	201-845-5400
OH	Independence	216-447-1127
TX	Dallas	214-241-9100

EVEREST ELECTRONIC EQUIPMENT, 1800-G MacLeod Dr., Lawrenceville, GA 30243, Tel: 404-995-8688, FAX: 404-995-9371; Empl.: 200; *Sls. Mgr.:* Barry Holman; *Dist. Mgr.:* Mike Bullock ..... **C•1053**

Local Sales Offices & Reps

CA	Anaheim, Everest Elctrn. Equip., Inc.	714-634-2200
CO	Broomfield, B-5, Inc.	303-466-1761
CT	Tariffville, OEM Mktg. & Sls	203-241-1612
FL	Orlando, Honeyco, Inc.	305-299-1000
GA	Lawrenceville, Everest Elctrn. Equip., Inc.	404-995-8688
GA	Lawrenceville, Tek-Rep Mktg.	404-963-1600
GA	Marietta, Southern Equip. Add-On, Inc.	404-953-3970
MD	Linthicum, KD Assocs.	301-859-5151
MA	Dedham, Pall Assocs.	617-461-0402
MA	Franklin, OEM Mktg. & Sls.	617-528-4983
MN	Eden Prairie, Choice-Tech, Inc.	612-941-5099
MN	Golden Valley, Tech Resources, Inc.	612-546-6099
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NY	Port Washington, Ashtec, Inc.	516-767-0336
NC	Winston-Salem, Southern Equip. Add-On, Inc.	919-724-1187
OH	Akron, Augnat Assocs.	216-239-2499
PA	Blue Bell, Techparts	215-628-3200
PA	Mendenhall, Clark H. Bach & Assocs.	215-388-7903
TX	Austin, Kruvand Assocs., Inc.	512-441-6777
TX	Dallas, Kruvand Assocs., Inc.	214-437-3355
TX	Houston, Kruvand Assocs., Inc.	713-956-6741
TX	Plano, Digital Elctrn. Sys.	214-423-6056

EVEREST ELECTRONIC EQUIPMENT, INC., 2100 E. Orangewood Avenue, Anaheim, CA 92806, Tel: 714-634-2200, FAX: 714-634-1369; Empl.: 200; *Sls. Mgr.:* Barry Holman; *Dist. Mgr.:* Mike Bullock ..... **C•1053**

EVEREST INTERSCIENCE, INC., P. O. Box 3640, Fullerton, CA 92634-3640, Tel: 714-992-4461, TELEX: 295368 EVER UR, FAX: 714-992-1178; Empl.: 20; *Sls. Mgr.:* Steve A. Giffin; *Dist. Mgr.:* Marilyn M. Everest

EVERETT/CHARLES CONTACT PRODUCTS, 700 E. Harrison Ave., Pomona, CA 91767, Tel: 714-625-5551, TELEX: 67-55-78, TWX: 910-581-1210; Empl.: 75; *Sls. Mgr.:* Bud Fabian

EVERETT/CHARLES TEST EQUIPMENT, INC., 2887 N. Towne Ave., Pomona, CA 91767, Tel: 714-621-9511, FAX: 714-626-4540; Empl.: 110; *Sls. Mgr.:* Raymond Berggren

EVERLIGHT USA

FAX: 213-690-8067

EVERLIGHT - USA, 614 W. Alosta Ave., Ste. 303, Glendora, CA 91740, Tel: 213-697-5067; *Sls. Mgr.:* John Cox; *Dist. Mgr.:* John Cox ..... **B•1143**

EVERSHED & VIGNOLES, LTD., Meggitt Holdings P. L. C., Acton Lane, Chiswick, London, England W4 5HJ, Tel: 01-994-3670, TELEX: 22583, FAX: 01-994-5246; Empl.: 300; *Sls. Mgr.:* J. Gilpin

EVI, INC., 8300 Guilford Rd., Ste. A, Columbia, MD 21046, Tel: 301-290-9550, FAX: 301-381-5687; Empl.: 20

EVOX-RIFA INC., 100 Tri State International, Ste. 290, Lincolnshire, IL 60069, Tel: 708-948-9511, FAX: 708-948-9320; Empl.: 2000; *Sls. Mgr.:* D.A. Price; *Dist. Mgr.:* D.A. Price ..... **A•1078-1079**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assoc.	205-533-9108
AZ	Phoenix, ISDS	602-971-6250
CA	Burbank, DeAngelo, Rothman & Co.	818-504-2425
CA	Santa Clara, Caltron Comps.	408-980-0181
CT	Wallingford, Apex Assocs.	203-269-8401
FL	Deerfield Beach, Sales Engrg. Concepts	305-426-4601
GA	Norcross, Hughes Assoc.	404-662-1561
ID	Boise, Cascade Comps.	208-343-9886
IL	Chicago, M. Gottlieb Assoc.	312-775-1151
IN	Kokomo, M. Gottlieb Assoc.	317-455-0444
MA	Westwood, Apex Assoc.	617-326-5042
MN	Bloomington, Murnco	612-854-4161
MS	Corinth, Hughes Assoc.	601-287-2915
NJ	Kenilworth, Ventronics	201-272-9262
OH	Cincinnati, G&H Sls.	513-272-0582
OR	Portland, Westmark	503-641-8780
TN	Nashville, Hughes Assoc.	615-871-0908
TX	Dallas, Tesco, Inc.	214-553-1200
VA	Manassas, FBD Sls.	703-369-7212
WA	Seattle, Westmark	206-281-4025
Can	Markham, Ont., SP Intl.	416-475-5305

Local Distributors

CA	Burbank, TAW	818-846-3911
CA	Garden Grove, Natl. Capacitor	714-892-7749
CA	Industry, Ital Elctrn. Sls.	818-968-8515
CA	Milpitas, California Capacitors	408-262-6000
CA	Santa Ana, Projections Unltd.	714-261-2323
CT	Norwalk, Delta Elctrns.	203-847-7285
FL	Ft. Lauderdale, NRC	305-772-4500
IL	Addison, Belford Elctrns.	312-691-1100
IL	Chicago, Bell Inds.	312-982-9210
MD	Bletsville, Resco/Washington	301-937-9100
MA	Burlington, TLC	617-273-0140
MA	Wilmington, JV Elctrns.	617-657-6523
MN	Eitzen, Capacitor Assocs.	507-495-3130
MN	New Brighton, Chris Elctrns.	612-631-2647
NJ	E. Brunswick, Varitech	516-593-9300
NJ	Kenilworth, Ventronics/Mutronics	201-272-9262
NY	Farmingdale, SAI	516-293-2710
NY	Hauppauge, JACO Elctrns.	516-273-5500
NY	Ronkonkoma, Prime	516-737-1730
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Philadelphia, JAN Indl.	215-922-1321
TX	Ft. Worth, C & W Supp.	817-831-0395

EWALD INSTRUMENTS CORP., Rte. 7R, Kent, CT 06757, Tel: 203-927-3278, FAX: 203-927-3031

EWC® INC.

FAX: 201-245-8430

EWC, INC., 725 Federal Ave., Kenilworth, NJ 07033, Tel: 201-245-3200, 800-526-4048, TWX: 710-996-5993; FSC No.: 15387;MIL-T-27D; Empl.: 175; *Sls. Mgr.:* Jay Stevenson; *Dist. Mgr.:* Jay Stevenson ..... **A•1247, 2284-2298**

Local Sales Offices & Reps

AL	Huntsville, Rakes Engrg. & Mktg.	205-533-3763
CA	Canoga Park, Cummings & Assocs.	818-340-6035
CA	Los Gatos, Featherstone Sls.	408-356-3243
CO	Denver, AKI Entprs.	303-388-4488
FL	Clearwater, Tech-Rep Assocs.	813-576-9900
GA	Atlanta, Rakes Engrg. & Mktg.	404-447-6937
IL	Schaumburg, Delta Tech. Sls. Corp.	312-310-0280
IA	Cedar Rapids, Pattison Sls.	319-395-9866
MD	Gaithersburg, Deltatronics	301-253-0615
MA	Chelmsford, Interstate Sls. Assocs.	617-256-2287
MO	St. Louis, Clyde Logsdon & Assocs.	314-849-5125
NJ	E. Brunswick, Winch Assoc.	201-828-4615
NY	Pittsford, James E. Zimmerman Sls.	716-381-3186
NY	Plainview, Winch Assocs.	516-681-3163
OH	Chagrin Falls, Crest Comp. Sls.	216-543-9808
OR	Portland, SPS Elctrns.	203-243-9343
PA	Chestnut Hill, Deltatronics, Inc.	215-248-0294
PA	Youngwood, Pro-Mark	412-925-1905
TX	Dallas, Rem Air Comps.	214-234-1069
VA	Powhatan, Deltatronics Inc.	703-492-9027
WI	Mequon, Tumy Assocs.	414-473-6997

Local Distributors

CA	Mountain View, Abacus Elctrns.	415-961-1500

EXAR CORP., 2222 Qume Dr., P.O.Box 49007, San Jose, CA 95161-9007, Tel: 408-732-7970, TWX: 910-339-9233; Empl.: 600; *Dist. Mgr.:* Tom Wargo

EXATRON AUTOMATIC TEST EQUIP., 2842 Aiello Dr., San Jose, CA 95111, Tel: 408-629-7600, 800-EXA-TRON, TELEX: 172-090, FAX: 408-629-2832; Empl.: 24; *Sls. Mgr.:* Kathryn Henderson

Local Sales Offices & Reps

AZ	Tempe, Turner & Assocs.	602-967-5649
CA	Covina, Romar Intl.	818-332-8548
CA	San Jose, Paragon	408-246-8415
FL	Largo, Synergetic Rep. Inc.	813-586-2871
MA	Tyngsboro, J.R. Sls.	617-692-4110
MN	New Brighton, Pragmatic Technlg.	612-631-1981
NJ	Medford, E.E. Sys.	609-953-1414
NC	Apex, Miller Technlg.	919-362-7587
OH	Hudson, Technical Sls.	216-656-3978
TX	Austin, Eldredge Entprs.	512-869-4500
TX	Dallas, Eldredge Entprs.	214-907-2402
WA	Lacy, Olympia Hunter	206-491-8668

EXCEL SPECIALTY CORP., 6335 N. Broadway, Chicago, IL 60660, Tel: 312-262-4781, FAX: 312-262-1330; Empl.: 50

XCEL

FAX: 201-874-3278

EXCEL TECHNOLOGY INTL. CORP., 5-4 Stryker La., Belle Mead, NJ 08502, Tel: 201-874-4747, TWX: 910-333-9588; *Sls. Mgr.:* Michi Chen ..... **B•1078-1079**

Local Sales Offices & Reps

CA	Los Angeles, Electro-Optical Mktg.	818-890-1749
IL	Westchester, W. G. Brouillette & Assocs., Inc.	312-345-6500
MO	Independence, Engrg. Svcs. Co.	816-254-3600
MO	St. Louis, Engrg. Svcs. Co.	314-997-1515
OR	Portland, Frank Jackson, Assoc.	503-292-2638
TX	Dallas, Southwest Elctrn. Inds.	214-690-9881

Local Distributors

CA	Los Angeles	213-824-0988

EXCELTA CORPORATION, 3740 Skypark Dr., Torrance, CA 90505, Tel: 213-772-0751, FAX: 213-378-4923; Empl.: 25; *Sls. Mgr.:* G. Johnson; *Dist. Mgr.:* L. Johnson

EXEL MICROELECTRONICS, INC., Sub. of Exar Corp., 2150 Commerce Dr., San Jose, CA 95131, Tel: 408-432-0500, TELEX: 171339, TWX: 910-338-2116, FAX: 408-434-6444; Empl.: 180; *Sls. Mgr.:* Victor Okumoto

EXFO E.O. ENGINEERING, 352 St.-Sacrement Ave., Quebec City, Quebec, Canada G1N 3Y2, Tel: 418-683-0211, TELEX: 051-3786, FAX: 418-683-2170; Empl.: 20; *Sls. Mgr.:* Germain Lamonde; *Dist. Mgr.:* Ginette Bourgeois

EXIDE CORPORATION, 645 Penn St., Reading, PA 19601, Tel: 215-378-0500, TWX: 510-651-5288, FAX: 215-378-0345; Empl.: 2200

EXPRESS TEST CORP., 1161 D San Antonio Rd., Mountain View, CA 94043, Tel: 415-968-8818, TELEX: 4942091, FAX: 415-968-0649; *Sls. Mgr.:* Frank S. Gavin

EXTECH INSTRUMENTS CORP., 150 Bear Hill Rd., Waltham, MA 02154, Tel: 617-890-7440, TELEX: 940913; *Sls. Mgr.:* Robert M. Shipione

EYRING RESEARCH INST., INC., 1455 W. 820 N., Provo, UT 84601, Tel: 801-375-2434, TELEX: 882000, FAX: 801-374-8339; Empl.: 150

E-Z HOOK, Tektest Inc., 225 N. Second Ave., Arcadia, CA 91006, Tel: 818-446-6175, TELEX: 910-582-1614, FAX: 818-446-0972; FSC No.: 08505; Empl.: 23; *Sls. Mgr.:* Charles Haskin; *Dist. Mgr.:* Charles Haskin ..... **C•1350-1352**

Local Sales Offices & Reps

CA	Arcadia, Ash M. Wood Co.	213-447-3511
CA	Arcadia, E-Z-Hook	818-446-6175
CA	Santa Clara, David H. Ross Co.	415-591-4411

Fabricast, Inc.

FABRICAST, 2517 Seaman Ave., P.O. Box 3176, S. El Monte, CA 91733, Tel: 818-443-3247; FSC No.: 13345; Empl.: 8 ..... **B•1246-1251**

FACET ENTERPRISES, INC., 3 Miracle Mile, P.O. Box 1502, Elmira, NY 14902, Tel: 607-737-8011, TELEX: 6854130, FAX: 607-737-8335; FSC No.: 72850; Empl.: 400; *Sls. Mgr.:* Gene Ebbrecht

FAGOR ELCTRN. COMPS., INC., CORP. HDQTRS. & SLS. OFF., Fagor Electronica S. Coop., 121 W. 27th St., 4th Fl, New York, NY 10001, Tel: 212-463-7168, 800-283-8383, FAX: 212-463-7199; *Sls. Mgr.:* Marvin R. Zidel, VP Mktg.

FAGOR ELCTRN. COMPS., INC., NATL. MKTG. SLS. OFFS., Fagor Electrotecnica S. Coop., 8419 Canoga Ave., Canoga Pk, CA 91304, Tel: 818-718-2500, 800-624-5367, TWX: 910-494-1948, FAX: 818-341-2860; Empl.: 18,000; *Sls. Mgr.:* Marvin R. Zidel, VP Mktg.; *Dist. Mgr.:* Marvin R. Zidel, VP Mktg.

FAIRBANKS SCALES:FAIRBANKS INC., 711 E. St. Johnsbury Rd., St. Johnsbury, VT 05819, Tel: 800-451-4107, 802-748-5111

FAIRCHILD WESTON, DATA RECORDERS, Fairchild Weston Sys., Inc., P.O. Box 3041, Sarasota, FL 34230, Tel: 813-371-0811, FAX: 813-378-1893; FSC No.: GS-00K-8301-S0078; Empl.: 750; *Sls. Mgr.:* Ron Johnson

FAIRCHILD WESTON SYSTEMS, INC., CCD Imaging Division, 1801 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-433-2500, TWX: 910-373-2110, FAX: 408-433-2508; *Sls. Mgr.:* Jim Johnson; *Dist. Mgr.:* Patricia A. Lippe

FAIRCHILD - WESTON - TELEMETRY, P.O. Box 3041, Sarasota, FL 34230, Tel: 813-371-0811, FAX: 813-378-1893; FSC No.: 06141; Empl.: 825; *Sls. Mgr.:* F. V. Bud Hinkel

Fair-Rite Products Corp.

FAIR-RITE PRODS., PO Box J, Wallkill, NY 12589, Tel: 914-895-2055, TWX: 510-249-4819; FSC No.: 34899; Empl.: 200; *Sls. Mgr.:* B. G. Tolen ..... **C•1735**

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FL	Deerfield Bch., Cartwright & Bean	305-429-3400
FL	Orlando, Cartwright & Bean	407-422-4531
IL	Wheaton, Charles D. Atwater Assocs.	312-668-2303
IN	Ft. Wayne, Frank J. Campisano Co.	219-486-6443
IN	Indianapolis, Frank J. Campisano Co.	317-253-7651
MI	Farmington Hills, J. L. Montgomery Assocs.	313-489-0099
MN	Bloomington, Holmes & Ladky Assocs.	612-884-2125/2126
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OH Medina, Frank J. Campisano Co. 216-722-5550
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PA Coraopolis, Frank J. Campisano Co. .. 412-264-5151
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TX Vidor, SEI (S.W. Elec. Inds.) 409-786-1028
VA Front Royal, Eltron Sls., Ltd. 703-635-7201
VA Roanoke, A. B. Kreger & Co. 703-989-4738
WA Bellevue, Quest Mktg, Inc. 206-747-9424
WI West Bend, Charles D. Atwater 414-338-3881
Can Islington, Ont., Pipe-Thompson Ltd. ... 416-236-2355

Local Distributors
CA Sunnyvale, Permag 408-738-1000

FANCORT INDUSTRIES, INC., 31 Fairfield Place, W. Caldwell, NJ 07006, Tel: 201-575-0610, TELEX: 130540, FAX: 201-575-9234; Empl.: 20; *Sls. Mgr.:* Ron Corey; *Dist. Mgr.:* Ron Corey

FAN-S CORP., See Qualtek Electronics Corp.

FARIA, THOMAS G., CORP., P.O. Box 983, Uncasville, CT 06382-0983, Tel: 203-848-9271, FAX: 203-848-2704; FSC No.: 09527; Empl.: 250; *Sls. Mgr.:* A. Knupp

FARRAND CONTROLS, Div. of Farrand Industries, Inc., 99 Wall St, Valhalla, NY 10595, Tel: 914-761-2600, TELEX: 646-640, FAX: 914-761-0405; Empl.: 120; *Sls. Mgr.:* George A. Quinn; *Dist. Mgr.:* George A. Quinn

FASTEK TEST SYSTEMS, Div. of International Fastek Corp., 1198 Joshua Way, Vista, CA 92083, Tel: 619-598-9990, TELEX: 188912 ATSD UT, FAX: 619-598-9994; *Sls. Mgr.:* Jim Falk, Sls. Mgr.,No. Amer.

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FDK AMERICA, INC., Fuji Electrochemical Co., Ltd., 17326 Edwards Rd, Ste. A-130, Cerritos, CA 90701, Tel: 213-404-1770, FAX: 213-404-2850; *Sls. Mgr.:* Yasu Yasutani ..... **A•1328, 1658-1659; D•1495**

Local Sales Offices & Reps
CA San Jose, FDK America, Inc. 408-432-8331
NJ Englewood Cliffs, FDK America, Inc. .. 201-567-1900

F-DYNE ELCTRNS., 449 Howard Ave., Bridgeport, CT 06605, Tel: 203-367-6431, TWX: 710-453-0087; Empl.: 175; *Sls. Mgr.:* Robert Furst

FEDERAL ELECTRONICS, 75 Stamp Farm Rd, Cranston, RI 02921, Tel: 401-944-6200, FAX: 401-946-6280; FSC No.: 69343; Empl.: 150; *Sls. Mgr.:* Timothy Collins

FEEDBACK, 620 Springfield Ave., Berkeley Hghts., NJ 07922, Tel: 201-464-5181; Empl.: 28; *Sls. Mgr.:* John Lawson

FEI MICROWAVE, INC., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086, Tel: 408-732-0880, TWX: 910-339-9207, FAX: 408-733-7434; FSC No.: 21847; Empl.: 450; *Sls. Mgr.:* P. Thesing

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FEME ELECTRONICS, INC., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462, Tel: 215-941-0366, TWX: 910-240-4181, ESYLNK: 62773739, FAX: 215-941-0377

FENWAL INC., 400 Main St, Ashland, MA 01721, Tel: 508-881-2000, TELEX: 948421, FAX: 508-881-6729; Empl.: 1000; *Sls. Mgr.:* F. R. Shea

FENWAL ELECTRONICS/APD, Kidde, Inc., 450 Fortune Blvd., Milford, MA 01757, Tel: 508-478-6000, TELEX: 29550, FAX: 508-473-6035; Empl.: 450; *Sls. Mgr.:* Bernard Mikula; *Dist. Mgr.:* Chester Tricca ..... **B•1896**

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CA Cupertino, Codella Mktg. Grp., Inc. 408-257-2561
CA Garden Grove, Elsco Elctrns., Inc. 714-891-4621
CO Denver, Spectrum Mktg. Assocs., Inc. 303-480-9991
CT Southington, The Orion Grp. Inc. 203-621-8371
FL Orlando, Col-Ins-Co./Datarep 407-423-7615
GA Norcross, Macro Mktg. Assocs., Inc. ... 404-662-5580
IL Chicago, Century Elctrns. Corp. 312-777-9700
IN Greenwood, Valentine & Assocs. 317-888-2260
IN South Bend, Valentine & Assocs. 219-288-7070
IA Cedar Rapids, Palatine Engrg. & Sls., Inc. 319-365-8071
MD Gaithersburg, Naudain Assoc. So., Inc. 301-258-5040
MA Wakefield, The Orion Grp., Inc. 508-245-5220
MI Royal Oak, Hilltronics, Inc. 313-435-0920
MN So. St. Paul, Northport Engrg., Inc. 612-457-8000
MO Blue Springs, Palatine Engrg. & Sls., Inc. 816-229-4007
MO Hazelwood, Palatine Engrg. & Sls., Inc. 314-839-0800
NY Huntington, CDB Entprs. 516-692-5200
NY Penfield, Upstate Comps. Sls., Inc. 716-381-6070
NC Raleigh, Prime Comps., Inc. 919-850-9866
OH Cleveland, Arthur H. Baier Co. 216-461-6161
OH Dayton, Arthur H. Baier Co. 513-276-4128
OH Westchester, Arthur H. Bair Co. 513-779-2395
OH Worthington, Arthur H. Baier Co. 614-764-1144
OR Tigard, Elctrn. Comp. Sls. 503-245-2342
PA Pittsburgh, Bear Mktg, Inc. 412-531-2002
PA Wynnewood, Metz-Benham Assoc., Inc. 215-896-7300
TX Austin, W. Pat Fralia Co. & Assoc., Inc. 512-835-7911
TX Evless, W. Pat Fralia Co. & Assoc., Inc. 817-267-3577
TX Houston, W. Pat Fralia Co. & Assoc., Inc. 713-772-1572
UT Ogden, Spectrum Mktg. Assocs., Inc. .. 801-972-8552
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301
WI Milwaukee, Century Elctrns. Corp. 414-645-3680
EXP MA, Milford, Fenwal Elctrns. 508-478-5255
Can Que., John G. Weiss Co., Ltd. 514-337-5022

Local Distributors
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CO Denver, Newark-Denver Elctrn. Supp. 303-757-3351
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FL Clearwater, Newark Elctrns. 813-443-0661
GA Norcross, Newark Elctrns. 404-448-1300
IL Chicago, Newark Elctrns. Corp. 312-784-5100
IN Indianapolis, Bell Inds. 317-875-8200
MD Ellicott City, Newark Elctrns. 301-461-2300
MA Woburn, Newark Elctrns. 617-935-8350
MI Oak Park, Newark Elctrns. 313-967-0600
MN Hopkins, The Joel Co. 612-935-6202
MN Minneapolis, Stark Elec. 612-332-1325
NJ Pennsauken, Newark Elctrns. 609-663-9490
NY Buffalo, Summit Dists. 716-887-2800
NY Huntington, CDB Dev. Corp. 516-692-5200
NY Rochester, Summit Elctrns. 716-334-8110
NY Ronkonkoma, Arrow Elctrns., Inc. 516-467-1000
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cleveland, Newark Elctrns. 216-391-9330
OK Tulsa, Radio, Inc. 918-587-9123
PA Wynnewood, Metz-Benham Assoc., Inc. 215-896-7300
TX Fort Worth, Patco Supply 817-429-8596
TX Garland, Newark Elctrns. 214-494-5911
UT Salt Lake City, Standard Supp. 801-486-3371
WI Grafton, Lake-View Elctrns. Corp. 414-377-8250
Can Que., John G. Weiss Co., Ltd. 514-337-5022

FERNO-SALESMAKER, Ferno-Washington, Inc., 70 Weil Way, Wilmington, OH 45177, Tel: 513-382-1451, TELEX: 214282, FAX: 513-382-1191; Empl.: 450

FERRANTI INTERDESIGN, INC., 1500 Green Hills Rd., Scotts Valley, CA 95066, Tel: 408-438-2900, TELEX: 4940840, TWX: 910-339-9374; Empl.: 240

FERRANTI INTERNATIONAL
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FAX: 516-752-7976

FERRANTI VENUS, INC., Ferranti International, 399 Smith St., Farmingdale, NY 11735, Tel: 516-293-4100, TWX: 510-224-6492; Empl.: 450; *Sls. Mgr.:* Joseph T. McCabe ..... **D•1764-1765**

Local Sales Offices & Reps
AZ Scottsdale, Ferranti Venus, Inc. 602-991-9684
MA Norwood, MPS Electronics Inc. 617-769-8700
NY Hartsdale, Spectrum Sls. 914-472-8600
Can Nepean, Ont., Subtec Ltd. 613-723-7720

FERRAZ CORPORATION, 14 Eastmans Rd, Parsippany, NJ 07054, Tel: 201-428-8400, 800-526-9067, TELEX: 136045, FAX: 201-428-0599; Empl.: 100; *Sls. Mgr.:* Douglas L. Bennett; *Dist. Mgr.:* Douglas L. Bennett

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FERRO CORPORATION, Powder Coatings Div., 4150 East 56th St, Cleveland, OH 44101, Tel: 216-641-8580, TELEX: 98-0165

FERRO CORPORATION, Stryker Plastic Colorants & Dispersions Div., 3 Railroad Ave., P.O. Box 603, Stryker, OH 43557, Tel: 419-682-3311; *Sls. Mgr.:* Bruce Heine

FERRO CORPORATION, Transelco Div., P.O. Box 217, Penn Yan, NY 14527-0127, Tel: 315-536-3357, TELEX: 98-0165; *Sls. Mgr.:* J. F. Arthur/W. Germond

FERRONICS, 45 O'Connor Rd., Fairport, NY 14450, Tel: 716-388-1020, TELEX: 256549, FAX: 716-388-0036; FSC No.: 33062; Empl.: 35; *Sls. Mgr.:* Thayne Wilbur

FERROXCUBE, Amperex Electronic Corp., 5083 Kings Hwy., Saugerties, NY 12477, Tel: 914-246-2811, TWX: 510-247-5410, FAX: 914-246-2811(Ext 427); FSC No.: 02114; Empl.: 400; *Sls. Mgr.:* B. Grindle; *Dist. Mgr.:* Terry Parisian

FG ENGINEERING, Box 476, Fredonia, AZ 86022, Tel: 602-643-7375; Empl.: 6; *Sls. Mgr.:* F. Griswold

FIBERGUIDE INDUSTRIES INC., 1 Bay St., Stirling, NJ 07980, Tel: 201-647-6601, TWX: 510-100-9180, FAX: 201-647-8464; Empl.: 25; *Sls. Mgr.:* Kelly Moran

FIBEROPTICS TECHNOLOGY, INC., Quassett Rd, Pomfret, CT 06258, Tel: 203-928-0443, 800-433-5248, FAX: 203-928-7664, 800-543-2558

FAX: 805-583-4018

FIBEROPTIC SYSTEMS, INC., 4680-B E. Los Angeles Ave., Simi Valley, CA 93063, Tel: 805-583-2088; Empl.: 30; *Sls. Mgr.:* Richard Lockett ..... **B•1205**

FIBRONICS INTERNATIONAL INC., Communications Way, Independence Park, Hyannis, MA 02601-1892, Tel: 508-778-0700, TELEX: 951297; Empl.: 500; *Sls. Mgr.:* Dr. Joseph Garodnick; *Dist. Mgr.:* Hal Spurney

FAX: 301-881-0530

FIC CORP., 12216 Parklawn Dr., Rockville, MD 20852, Tel: 301-881-8124, 800-638-6594, TWX: 710-828-9809; FSC No.: 3613; Empl.: 46; *Sls. Mgr.:* Robert E. Frye; *Dist. Mgr.:* Robert E. Frye ..... **B•1367**

FIDELITY CHEMICAL PRODUCTS CORP., 472 Frelinghuysen Ave., Newark, NJ 07114, Tel: 201-242-4110, FAX: 201-242-5796; Empl.: 35

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FAX: 609-599-9508

FIFTH DIMENSION, INC., 801 New York Ave., Trenton, NJ 08638, Tel: 609-393-8350, TWX: 510-681-8412; Empl.: 60; *Sls. Mgr.:* Dick Clawges, Prod. Mgr. ..... **B•1474-1475, 1740-1741**

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NJ Trenton, Fifth Dimension 609-393-8350

FIL-COIL COMPANY, INC., 800 Axinn Ave., Garden City, NY 11530, Tel: 516-228-9445, TELEX: 960127 SWIFT NYK, FAX: 516-228-9064; FSC No.: 56528; Empl.: 85; *Sls. Mgr.:* William Goldman

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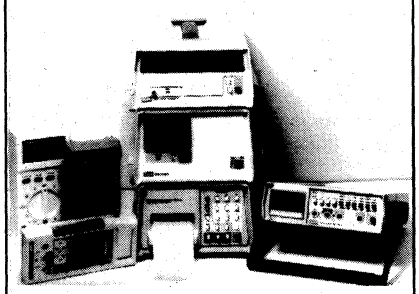

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FILTER PRODUCTS, Rockwell International, 2990 Airway Ave., Costa Mesa, CA 92626, Tel: 714-641-5311, TELEX: 685532(COLLINS CSMA), FAX: 714-641-5380; FSC No.: 2X491; Empl.: 70; *Sls. Mgr.:* Bob Johnson

FILTRON CO., INC., Sub. of ARX Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, Tel: 516-752-1144, FAX: 516-752-0905; FSC No.: 81831; Empl.: 90; *Sls. Mgr.:* Richard Michelson ..... **A•1694**

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AL	Huntsville, Rakes Engrg. & Mktg.	205-533-3763
MA	Lowell, Underwood Sls. Corp.	508-256-8191
MN	Bloomington, Electronic Sls. Agcy.	612-884-8291
NM	Corrales, WJM Electronics	505-898-5628
CA	Sunnyvale, Esco Assoc.	408-745-1410
CA	Tarzana, High Voltage Sls.	818-881-9194
CO	Boulder, A. Bissell Co.	303-444-1173
OH	Kettering, J. May Assocs.	513-296-1746
PA	Furlong, Avenir, Inc.	215-348-8290
KS	Olathe, Technical Sls. Assoc.	913-829-2800
MD	Baltimore, Bernard White & Co.	301-484-5400
Can	Lachine, Que., Electrodesign Ltd.	514-636-4838
MA	Lowell, Underwood Sls. Corp.	508-256-8191
MN	Bloomington, Elctrn. Sls. Agy.	612-884-8291
MO	Ferguson, Technical Sls. Assocs.	314-521-2044
MS	Jackson, Benton Ballard Co.	956-3560
MO	Ferguson, Tech. Sls. Assocs.	314-521-2044
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NM	Corrales, WJM Elctrns.	505-898-5628
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NY	Melville, Carnes Assocs.	516-694-1600
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PA	Furlong, Avenir, Inc.	215-348-8290
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TX	Bedford, DeArmond Entprs.	817-267-2048
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FINISHERS, INC., 517 Aldo Avenue, Santa Clara, CA 94054, Tel: 408-988-0222; Empl.: 10; *Sls. Mgr.:* Denise Firebaugh

THE FIRST ELECTRONICS CORP., 71 Von Hillern St., Boston, MA 02125, Tel: 617-288-2430, FAX: 617-288-0332; FSC No.: 14532; Empl.: 65; *Sls. Mgr.:* Chris Nastopoulos

FISCHER CONNECTORS
FAX: 805-295-0090

FISCHER CONNECTORS, 28245 Avenue Crocker, Valencia, CA 91355, Tel: 818-362-9395 ,800-344-0445, TELEX: 499-4182; *Sls. Mgr.:* Steve DeFeo ..... **C•1353-1360**

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CA	Fairfield, Baribeault Assocs.	707-428-6095
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CO	Englewood, Omega Ltd.	303-762-1921
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EXP	Switzerland/CH-1143 Apples, W. W. Fischer SA	021-800-3711
Can	Oakville, Ont., Haltronics	416-844-2233

FISHERCAST, Fisher Gauge Limited, 194 Sophia Street, P.O. Box 179, Peterborough, Ontario, Canada K9J 6Y9, Tel: 705-748-9522, TELEX: 06-962943, FAX: 705-745-8818; Empl.: 180ò; *Sls. Mgr.:* Larry Hatfield

FISHERTECH, Fisher Gauge Limited, 194 Sophia Street, P.O. Box 179, Peterborough, Ontario, Canada K9J 6Y9, Tel: 705-748-9522, TELEX: 06-962838, FAX: 705-748-6312; Empl.: 200ò; *Sls. Mgr.:* Larry Curtis

FISKARS ELECTRONICS CORPORATION, Newtown Rd. PO Box 1490, Littleton, MA 01460, Tel: 508-486-9551, FAX: 508-486-9601; FSC No.: 214-341-1804; *Sls. Mgr.:* Jack Conn

FISONS INSTRUMENTS, 24911 Stanford Ave., Valencia, CA 91355, Tel: 805-295-0019, TELEX: 4720130, FAX: 805-295-0419; Empl.: 200; *Sls. Mgr.:* Robert Boyd

FITCHBURG COATED PRODUCTS, Technographics, Inc., P.O. Box 1106, Scranton, PA 18501, Tel: 717-347-2035; Empl.: 300

THE FIVE STAR CO., 120 W. Main St., Plantsville, CT 06479, Tel: 203-628-5561, FAX: 203-621-2405; *Sls. Mgr.:* Robert Murphy

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FLAMBEAU PRODUCTS CORP., P. O. Box 97, Middlefield, OH 44062, Tel: 216-632-1631, FAX: 216-632-1581; Empl.: 184; *Sls. Mgr.:* Elmer J. Sunyog

FLANN MICROWAVE, INC., 6290 Sunset Blvd, Ste. 1126, Los Angeles, CA 90028, Tel: 213-463-5120, TWX: 910-321-2903, FAX: 213-463-4319; *Sls. Mgr.:* Norman Sutherland

FLEX-CORE DIV., Morlan & Assocs., Inc., 6625 McVey Blvd., Worthington, OH 43235, Tel: 614-889-6152, FAX: 614-876-8538; Empl.: 7; *Sls. Mgr.:* D. Morlan ..... **A•2299**

FLEXIBLE TECHNOLOGIES DIVISION, Arlon, Inc., 199 Amaral St., E. Providence, RI 02914, Tel: 800-556-7683, FAX: 401-434-2557; Empl.: 60; *Sls. Mgr.:* Herb Howard

For sales offices and reps. in the Northeastern region, call Ron Sencer- 401-434-2340 For sale offices and reps. in California, call Rick Kirchhoff- 714-540-2811 For sales offices and reps. in Michigan, Ohio, and Indiana, call STAFFCO- 216-331-5100 For sales offices and reps in Chicago, Minnesota, and Colorado, call Phil Hansen- 612-942-9902

FLEX-KEY CORP., Sub. of Astronics Corp., 18 Sargent St., Gloucester, MA 01930, Tel: 508-281-2040, TELEX: 94-0333, FAX: 617-281-4730; FSC No.: 51163; Empl.: 50; *Sls. Mgr.:* Dick Pork ..... **B•1863**

Local Sales Offices & Reps

DC	Rockville, MD., Marketron	301-251-8990
IA	Cedar Rapids, Tech. Elctrns. Inc.	319-366-5443
MI	Birmingham, Riley-Cotter Sls.	616-264-5744
NY	Huntington, J. A. Keeneth Co.	516-351-7008

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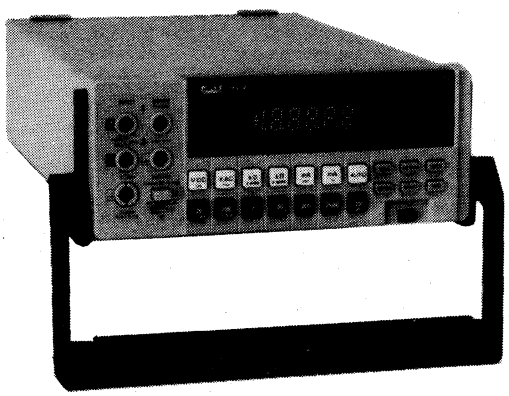

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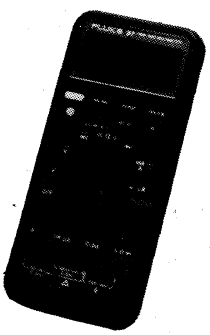

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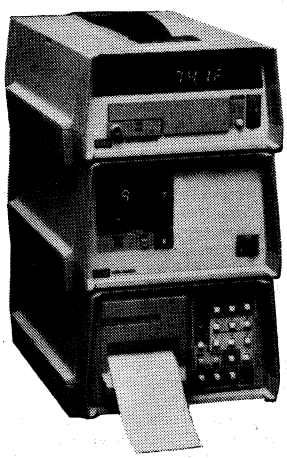

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WI	Genoa City, Vine Tech. Sls.	414-279-3871

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FL	Ft. Lauderdale, Semtronic Assocs.	305-731-2484
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AZ	Phoenix, Marshall Inds.	602-496-0290
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CA	San Diego, Marshall Inds.	619-578-9600
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MI	Grand Rapids, EC Elctrns. Inc.	616-530-0576
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FREQUENCY ELECTRONICS, INC., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, Tel: 516-794-4500, TWX: 510-223-0418; Empl.: 950; *Sls. Mgr.:* Gene Kushner ..... **A•1408-1409**

Local Sales Offices & Reps

CA Mountainview, Disman-Baker 415-969-3010
CO Boulder, Herb Bass Assoc. 303-530-7509
FL Orlando, Truex Assoc. 305-859-2160
MD Hunt Valley, Marktron 301-628-1111
MD Rockville, Marktron 301-251-8990
MA Cochituate, High-Tech Sls. 508-653-3838
NJ East Windsor, Micro Lambda 609-443-3113
NJ Totawa, Technical Mktg. 201-812-0356
NY E. Syracuse, EM-Tech Assocs., Inc. ... 315-437-6410
OH Cleveland, Tiby Co. 216-371-5335
VA Charlottesville, Marktron 804-973-5874

FREQUENCY SELECTIVE NETWORKS, 69-20 Garfield Ave., Woodside, NY 11377, Tel: 718-424-7500, FAX: 718-424-3459; FSC No.: 56662; Empl.: 30; *Sls. Mgr.:* Michael L. Izzolo ..... **A•1410**

Local Sales Offices & Reps

NY Huntington, Carnes Assocs. 516-694-1600
OH Dayton, Aschbacher Assocs. 513-252-7785

FREQUENCY SOURCES, INC., Semiconductor Div., 16 Maple Rd., Chelmsford, MA 01824, Tel: 508-256-4113/8101, TWX: 710-343-0404, FAX: 508-937-3748; FSC No.: 26629; Empl.: 90; *Sls. Mgr.:* D. Langan

FRONTIER ELECTRONICS CO., LTD.

FAX: 818-709-9897

FRONTIER ELECTRONICS, 9301-101 Jordan Ave., Chatsworth, CA 91311, Tel: 818-709-9888; Empl.: 200 ..... **A•1248-1250; D•2052-2055**

FRONT PANEL DEVICES, INC., 2140-5 Pond Rd., Ronkonkoma, NY 11779, Tel: 516-737-3322, FAX: 516-737-3326; Empl.: 20; *Sls. Mgr.:* John B. Powers

FSI/FORK STANDARDS, INC., 666 Western Ave., Lombard, IL 60148, Tel: 312-231-3511, 312-932-9380, FAX: 312-932-0016; FSC No.: 14986; Empl.: 20; *Sls. Mgr.:* Alfredo J. Ramirez; *Dist. Mgr.:* A. E. Toht

FTS SYSTEMS, INC., Rte. 209, P.O. Box 158, Stone Ridge, NY 12484, Tel: 914-687-0071, TWX: 510-247-0547, FAX: 914-687-7481; Empl.: 100ò; *Sls. Mgr.:* Brian Adams

FUJI ELECTRIC CORP. OF AMERICA, 727 W. 7 St, Ste. 235, Los Angeles, CA 90017, Tel: 213-622-4490, TELEX: 677318, FAX: 213-488-9382; Empl.: Yasuko Suzuki; *Sls. Mgr.:* Hisao Ohno; *Dist. Mgr.:* Masanao Deguchi

FUJITSU

FUJITSU AMERICA, INC., Computer Products Group, 3055 Orchard Dr., San Jose, CA 95134, Tel: 408-432-1300, TWX: 910-338-2193; *Sls. Mgr.:* Roger Baldelli; *Dist. Mgr.:* Al Connelly ..... **D•1088-1095**

Local Sales Offices & Reps

CA Irvine, Fujitsu America 714-553-1250
CA San Jose, Fujitsu America 408-434-9250
CA San Jose, Fujitsu America 408-452-0890
CA Sherman Oaks, Fujitsu America 818-905-1985
CO Golden, Fujitsu America 303-278-8717
FL Ft. Lauderdale, Fujitsu America 305-771-7705
GA Atlanta, Fujitsu America 404-953-0130
GA Marietta, Fujitsu America 404-953-0130
IL Itasca, Fujitsu America 312-250-8230
MA Burlington, Fujitsu America 617-273-1341
MA Burlington, Fujitsu America 617-229-6310
MN Minnetonka, Fujitsu America 612-932-9800
NJ Manasquan, Fujitsu America 201-223-8222
OR Beaverton, Fujitsu America 503-643-6098
PA Malvern, Fujitsu America 215-648-3958
TX Austin, Fujitsu America 512-343-4514
TX Richardson, Fujitsu America 214-437-9377
Can Mississauga, Fujitsu Canada 416-673-8666

Local Distributors

AL Huntsville, Gentry Assocs. 205-837-0692
AZ Phoenix, Wyle Laborotories 602-866-2888
CA Irvine, Wyle Laborotories 714-863-9953
CA Richmond, Gates/FA Distrbg. 415-526-2345
CA Santa Clara, Wyle Laboratories 408-727-2500
CA Torrance, Schweber Elctrns. 213-320-8090
CO Englewood, R2 Distrbg. 303-799-9292
CT Danbury, Schweber Elctrns. 203-748-7080
FL Ft. Lauderdale, Gentry Assocs. 305-791-8405
GA Atlanta, Gentry Assocs. 404-998-2828
IL Elmhurst, Fast Access 312-530-2450
IA Cedar Rapids, Schweber Elctrns. 319-373-1417
LA Gretna, Gentry Assocs. 504-367-3975
MA Bedford, Schweber Elctrns. 617-275-5100
MN Minneaplis, Datalink 612-944-3462
OH Columbus, Cranel, Inc. 614-433-0045
OK Tulsa, Schweber Elctrns. 918-622-8000
OR Hillsboro, Wyle Laborotories 503-640-6000
TX Houston, Dallas Digtal 713-469-7151
TX Plano, Dallas Digital 214-424-2800
WA Kirkland, Gates/FA Distrbg. 206-822-5552

FUJITSU

FAX: 408-727-0355

FUJITSU OF AMERICA, 3330 Scott Blvd., Santa Clara, CA 95054, Tel: 408-562-1000, TWX: 910-338-0190; Empl.: 40; *Sls. Mgr.:* Jack Foster (acting); *Dist. Mgr.:* Hal Mumma ..... **B•1040, 1080, 1477-1487; C•1361-1366**

Local Sales Offices & Reps

AL Huntsville, C.S.R. Elctrn. 205-533-2444
CA San Diego, Earle Assocs., Inc. 619-278-5441
CA Santa Clara, Norcomp 408-727-7707
CA Tustin, Hi-Tech Rep Co.(HTRC) 714-730-9561
CA Westlake Village, Hi-Tech Rep Co.(HTRC) 818-706-2916
CO Lakewood, Candal 303-935-7128
CT Cheshire, Connecticut Applied Technlg. 203-272-6564
FL Altamonte Springs, Semtronics Assocs. 305-831-8233
FL Clearwater, Semtronics 813-461-4675
FL Ft. Lauderdale, Semtronics 305-731-2484
GA Atlanta, C.S.R. Elctrns. 404-396-3720
IL Highland Park, Bransky Sls. 312-433-2375
IA Cedar Rapids, Electromec Sls., Inc. ... 319-362-6413
KS Lenexa, A.E.M. Inc. 913-888-0022
MA Woburn, Mill-Bern Assocs., Inc. 617-932-3311
MI Farmington Hills, W. R. Hummon Assocs. 313-474-0661
MN Burnsville, Electromec Sls., Inc. 612-894-8200
MO St. Louis, A.E.M. Inc. 314-298-9900
NJ Fairfield, Tech. Applications & Mktg. ... 201-575-4130
NJ Marlton, BGR Assocs. 609-983-1020
NM Albuqueque, F.P. Sls. 505-345-5553
NY Rochester, H.C. Johnson Agy. 716-586-0777
NC Mathews, C.S.R. Elec. 704-847-5806
NC Raleigh, C.S.R. Elctrn. 919-878-9200
OH Columbus, McFadden Sls. Inc. 614-761-3177
OR Beaverton, L-Squared Ltd. 503-629-8555
PA Glenshaw, H.C. Johnson Agy. 412-487-1246
TN Knoxville, C.S.R. Elctrn. 615-577-1317
UT Salt Lake City, Hendrickson Sls. 801-467-1445
WA Seattle, L-Squared Ltd. 206-827-8555
WI Cedarburg, Bransky Sls. 414-377-6837
Can St. Laurent, Que., John G. Weiss Co. .. 514-337-5022
Can Vancouver, Davetek Mktg. 604-430-3680

See Schweber &/or Marshall in your local city.

FUJITSU MICROELECTRONICS, INC., Sub. of Fujitsu Limited, 3545 North First St., San Jose, CA 95134, Tel: 408-922-9000, TWX: 910-338-0190; FSC No.: 408-432-9044; Empl.: 1000; *Sls. Mgr.:* Rich Christopher, Sr. VP & GM; *Dist. Mgr.:* Dan Buist, Dir. Hdqtr. Sls.

FURANE PRODUCTS, A Ciba-Geigy Co., 99 Cook St., Lincoln, RI 02865, Tel: 401-723-2100, TWX: 510-601-1913, FAX: 401-723-2930; Empl.: 26; *Sls. Mgr.:* W. Lott

FURMAN SOUND, INC., 30 Rich St., Greenbrae, CA 94904, Tel: 415-927-1225, TELEX: 425900, FAX: 415-927-4548; FSC No.: 5830; Empl.: 32; *Sls. Mgr.:* Joe Desmond; *Dist. Mgr.:* Joe Desmond

FURNAS ELEC., 1197 McKee St., Batavia, IL 60510, Tel: 312-879-6000, TELEX: 72-0458; Empl.: 1,500; *Sls. Mgr.:* Thomas J. McGavin; *Dist. Mgr.:* Paul P. Welch

FUSES UNLIMITED, D.E.I., 9300 Mason Av., Chatsworth, CA 91311, Tel: 818-882-1515, FAX: 818-885-7390; Empl.: 35; *Sls. Mgr.:* Ray Norris; *Dist. Mgr.:* Pat White

FUSION INC., 4658 E. 355th. St., Willoughby, OH 44094, Tel: 216-946-3300, TELEX: 275300; Empl.: 85; *Sls. Mgr.:* Raymond C. Yuhasz

FUTABA CORPORATION OF AMERICA, Electronic Components Div., 711 East State Pkwy., Schaumburg, IL 60173, Tel: 312-884-1444, TELEX: 23-206833, FAX: 312-884-1635; Empl.: 50; *Sls. Mgr.:* Bill Lichtner; *Dist. Mgr.:* Bill Lichtner

F. W. CAPACITORS INC., 98 Toledo Rd. Hwy. 3015, Florence, SC 29504-0636, Tel: 803-662-4728, TELEX: 220 883 TAUR, FAX: 803-667-6142; FSC No.: 58368; Empl.: 20; *Sls. Mgr.:* Joseph A. (Jay) Falcone Jr.

GABRIEL ELECTRONICS, Box 70, Scarborough Indl. Pk., Scarborough, ME 04074, Tel: 207-883-5161, TELEX: 95-0113, ESYLNK: 62042511, FAX: 207-883-4469; Empl.: 225; *Sls. Mgr.:* D. B. Crisman

GAGE APPLIED SCIENCES INC., 5905 St Francois Rd., St. Laurent, Que., Canada H4S1B6, Tel: 514-337-6893, FAX: 514-337-8411; Empl.: 4; *Sls. Mgr.:* Mark Diamond; *Dist. Mgr.:* Stanley M. Diamond

GALILEO ELECTRO-OPTICS CORP., Galileo Park, P.O. Box 550, Sturbridge, MA 01566, Tel: 508-347-9191, TELEX: 4999014; FSC No.: 28719; Empl.: 500

GALIL MOTION CONTROL, INC., 1054 Elwell Ct, Palo Alto, CA 94303, Tel: 415-964-6494, TELEX: 171409, FAX: 415-964-0426; Empl.: 10; *Sls. Mgr.:* Lisa Wade

GAMMA-F CORP., Electromagnetic Sciences, Inc., 3051 Fujita St., Torrance, CA 90505, Tel: 213-539-6704, TELEX: ITT 429694, FAX: 213-539-7463; FSC No.: (CAGE) 50478; Empl.: 70; *Sls. Mgr.:* Dennis L. Deck

FAX: 904-677-3039

GAMMA HIGH VOLTAGE RESCH. INC., 1096 N. U.S. Hwy, No. 1, Ormond Beach, FL 32074, Tel: 904-677-7070; Empl.: 15 ..... **D•1766-1769**

Local Sales Offices & Reps

CA	Pasadena, A-F Sls. Engrg.	213-681-5631
CA	Santa Cruz, Le Rep	408-458-0667
NJ	Nutley, Irwin Brill Sls.	201-667-0653
NM	Albuquerque, Cleveland Entprs.	505-265-7893

GAMMA SCIENTIFIC INC., 3777 Ruffin Rd., San Diego, CA 92123, Tel: 619-279-8034, TELEX: 69-7938; Empl.: 65; *Sls. Mgr.:* Robert Ruff

GANDALF DATA INC., Gandalf Technologies Inc., 1020 S. Noel Ave., Wheeling, IL 60090, Tel: 312-541-6060, 800-GANDALF, FAX: 312-541-6803; Empl.: 350ò; *Sls. Mgr.:* Kerry Hawkins

GANDALF TECHNOLOGIES, INC, See Gandalf Data, Inc.

GAP INSTRUMENT CORP., 40 Oser Ave., Hauppauge, NY 11788, Tel: 516-273-0909, FAX: 516-273-0948; FSC No.: 00607; Empl.: 50

GARDINER SOLDER CO., Div. of Gardiner Metal Co., 4820 S. Campbell Ave., Chicago, IL 60632, Tel: 312-847-0100, FAX: 312-847-2314; Empl.: 100; *Sls. Mgr.:* Robert Nesnidal

GAR ENTERPRISES, 2029 N. Lincoln Ave., Pasadena, CA 91103, Tel: 818-798-0785, FAX: 818-798-1466; FSC No.: 16017; Empl.: 45

GARNER GLASS CO., 177 S. Indian Hill Blvd., Claremont, CA 91711, Tel: 714-624-5071, FAX: 714-624-7212; FSC No.: 53101; Empl.: 50; *Sls. Mgr.:* Joseph C. Hyatt

GARRY ELECTRONICS, Div. of Brintec Corp., 9 Queen Anne Ct., Laghorne, PA 19047, Tel: 215-949-2300; Empl.: 100; *Sls. Mgr.:* Tom Malek; *Dist. Mgr.:* Kate Simpson

GASKETDYNAMICS

FAX: 609-261-7300

GASKET DYNAMICS, INC., 14 King St., P.O. Box 45, Mt. Holly, NJ 08060, Tel: 609-261-8100, 800-541-2500, 215-922-6046; Empl.: 19; *Sls. Mgr.:* Edward Rosenthal; *Dist. Mgr.:* Robert LaVigne ..... **C•1618**

GASKET INTERNATIONAL INC., 49 Ackerman St., Bloomfield, NJ 07003, Tel: 201-338-6814; Empl.: 5; *Sls. Mgr.:* Russell L. Steinman

GATES, GEO. W., & CO., INC., 1209 Hempstead Tpke., Franklin Sq., NY 11010, Tel: 516-352-2904; Empl.: 10; *Sls. Mgr.:* T. E. Schulz, Jr

GATES ENERGY PRODUCTS, P.O. Box 114, Gainesville, FL 32602, Tel: 904-462-3911, TWX: 810-836-8500, FAX: 904-462-4726; Empl.: 3300; *Sls. Mgr.:* C. W. Garstang; *Dist. Mgr.:* K. Sparks ..... **D•1496-1499**

Local Sales Offices & Reps

CA	Brea	714-529-2117
CT	Meriden	203-238-6812
GA	Atlanta	404-446-8090
IL	Itasca	312-250-0015

Local Distributors

CA	Los Angeles, Battery Specialties	213-437-1809
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	San Jose, Rose Elctrns.	408-943-0200
GA	Norcross, Applied Power	404-263-0421
IL	Chicago, Joseph Elctrns.	312-297-4200
IL	Chicago, Power-Pak, Inc.	312-966-6000
MA	Boston, Adcour	617-784-8123
MI	Brighton, Applied Power	313-229-6550
MN	St. Paul, Shelley-Ragon	800-328-9427
NJ	Clifton, Engrd. Assemblies	800-422-8837
NC	Raleigh, Engrd. Assemblies	800-950-9111
OH	Columbus, Promark	614-876-8885
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, Southwest Elctrns.	713-240-4000
WA	Redmond, Priebe Elctrns., Inc.	206-881-2363

GAVITT WIRE & CABLE, Brookfield, MA 01506, Tel: 508-867-6476, FAX: 508-867-5126; Empl.: 75

GAYNOR ELECTRIC CO., 135 South Main St, P.O. Box 316, Thomaston, CT 06787-0316, Tel: 203-283-4388, FAX: 203-283-4107; Empl.: 50; *Sls. Mgr.:* Robert Heche; *Dist. Mgr.:* Robert Heche

GC-THORSEN, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209, Tel: 815-968-9661, TELEX: 383956 GC Elect; Empl.: 260; *Sls. Mgr.:* Larry Adams, VP Sls.; *Dist. Mgr.:* Raymond D. Camacho

GEBEX CORPORATION, 2221 Walnut Hill Ln., Irving, TX 75038, Tel: 214-550-8955, FAX: 214-580-0173; Empl.: 35

GECO, 145 Penn St., Millheim, PA 16854, Tel: 814-349-5656, FAX: 814-349-5657; Empl.: 25

GEMINI, 103 Mensing Way, Cannon Falls, MN 55009, Tel: 507-263-3957, 800-533-3631, FAX: 507-263-5987; *Sls. Mgr.:* Gary Pearson ..... **C•1054-1055**

Local Sales Offices & Reps

AR	North Little Rock, Leo Barker Co.	501-834-2537
CA	San Diego, Gemini Inc.	800-533-3631
CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CA	Victorville, Gemini Inc.	800-533-3631
CO	Broomfield, Conners Co.	303-466-9628
FL	Orlando, Gemini Inc.	800-533-3631
GA	Atlanta, Wallace Elctrn. Sls.	404-634-3159
IL	Palatine, JRS Assocs.	312-991-6626
IN	Noblesville, R & D Elctrns.	317-849-2026
MD	Glen Burnie, Freedman-Malta Assocs.	301-837-3155
MA	Brookline, Harman Assocs.	617-232-6687
MI	Dearborn, Pitcher-Poulin, Inc.	315-582-5450
MO	St. Louis, Harris Hanson Co.	816-763-6200
NY	Endwell, Reagan Compar Inc.	607-754-2171
NY	New Hartsford, Reagan Compar	315-732-3775
NY	Rochester, Reagan Compar Inc.	716-271-2230
NC	Kernersville, Wallace ELctrns. Sls.	919-996-2742
OH	Cincinnati, Bob Gilbert & Assocs.	513-574-1932
OR	Forest Grove, Doran Sls., Inc.	503-357-3333
PA	King of Prussia, Freedman-Malta Assocs.	215-337-9211
TX	Dallas, Kay Todd Assoc.	214-458-8833
TX	Taylor, Gemini, Inc.	512-352-5207
UT	Salt Lake City, Conners Co.	800-533-3631
WA	Redmond, Doran Sls., Inc.	206-885-1885
WI	Wauwatosa, Larsen Assocs.	414-258-0529
Can	Markham, Ont., Avotronics, Ltd.	416-475-2024

GEMS SENSORS DIVISION, IMO Delaval Inc., Cowles Rd, Plainville, CT 0602-1198, Tel: 203-677-1311, TELEX: 99-306, FAX: 203-747-4244; Empl.: 203; *Sls. Mgr.:* M. W. Brown; *Dist. Mgr.:* M. W. Brown

GEN/COMP INC., 6 Algonquin Rd., Canton, MA 02021, Tel: 617-828-2008; *Sls. Mgr.:* G. Nutter

GENCO PRECISION CORP., 247 Skidmore Road, Deer Park, NY 11729, Tel: 516-242-3006, FAX: 516-242-3118

GENERAL AUTOMATIC CORP., See E-Tron Corp.

GENERAL BUSINESS TECH., 1891 McGaw Ave., Irvine, CA 92714, Tel: 714-261-1891, FAX: 714-261-8285; Empl.: 44; *Dist. Mgr.:* Barbara A. Foy

GENERAL CABLE CO., Fiber Optics Div., 1 Cragwood Rd., S. Plainfield, NJ 07080, Tel: 201-769-3200, TELEX: 642892; *Sls. Mgr.:* Pieter deBruijn

General Cable

FAX: 919-284-5148

GENERAL CABLE CO., 250 Overton Dr., Kenly, NC 27542, Tel: 919-284-5144; *Sls. Mgr.:* Dee Stinnette ..... **C•1855-1857**

Local Sales Offices & Reps

AL	Madison, Mock Assocs., Inc.	205-355-1402
IL	Wheaton, Chadra-Schilke	312-653-8126
MN	Minneapolis, Northstar Comps.	612-553-1888
NJ	Mountainside, Henry G. Richter, Inc.	201-233-4615
NY	Fayetteville, Henry G. Richter, Inc.	315-637-6713
NC	Cary, Wagcon Elctrns., Inc.	919-481-1327
OH	Rocky River, Hiltebrant Indl. Sls.	216-333-5600
PA	Phoenixville, Henry G. Richter, Inc.	215-495-6176

GENERAL CHEMICAL CORPORATION, Nichols Road, Pittsburg, CA 94565, Tel: 415-685-1450, FAX: 415-458-9271

Distributor

GENERAL CONTROLS, INC., 2350 Brickvale Ave., Elk Grove Village, IL 60007, Tel: 312-595-2152 ..... 651, 784

GENERAL DEVICES
Electronic Hardware Manufacturers

FAX: 317-898-2917

GENERAL DEVICES CO., INC., Box 39100, Indianapolis, IN 46239-9632, Tel: 317-897-7000; Empl.: 250; *Sls. Mgr.:* Jack Bradford; *Dist. Mgr.:* Dan McCauley ..... **C•1056**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs., Inc.	205-533-9108
AZ	Phoenix, Snyder Engrg.	602-279-2010
CA	Fullerton, Groh Assoc.	714-837-9871
CA	San Jose, Arnold Tech. Sls.	408-954-0400
CO	Broomfield, Summit West Mktg.	303-460-9600
CT	North Haven, Coakley, Boyd & Abbett	203-481-2828
FL	Deerfield Beach, J. Krutek & Assoc.	305-628-4837
FL	Maitland, J. Krutek	305-628-4837
GA	Norcross, Hughes Assocs., Inc.	404-622-1587
IL	Northbrook, Howard Benjamin	312-272-2900
IN	Noblesville, Century Elctrns.	317-849-2026
KS	Overland Pk., Thomas Dowell & Assocs.	913-648-7373
MD	Elicott City, Eastern Tech. Corp.	301-461-7720
MA	Needham Heights, Coakley, Boyd & Abbett	617-444-5470
MN	St. Paul, Northport Engrg.	612-457-8000
MS	Corinth, Hughes Assocs., Inc.	601-287-2915
MO	St. Louis, Thomas Dowell & Assocs.	314-849-4234
NJ	Mountainside, Henry G. Richter	201-233-4615
NY	Fayetteville, H.G. Richter	315-637-6713
NC	Raleigh, Hughes Assocs., Inc.	919-782-2065
OH	Cleveland, Electronic Comps., Inc.	216-331-5330
OH	Dayton, Electronic Comps., Inc.	513-866-3340
OK	Tulsa, Advance Tech. Sls.	918-664-0482
TN	Jonesboro, Hughes Assocs., Inc.	615-753-2719
TX	Austin, Advance Tech. Sls.	512-331-9979
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
WA	Olympia, Bergford & Assocs.	206-866-2001

Local Distributors

AZ	Tempe, Acacia/VWR Elctrns.	602-894-2874
CA	Irvine, Acacia/VWR Elctrns.	714-660-0834
CA	San Diego, Acacia/VWR Elctrns.	619-565-4365
CT	South Windsor, Car-Lac Elctrns.	203-282-0631
MA	Milford, Car-Lac Elctrns.	508-478-7797
MA	Newton, In-Stock Products Co.	617-964-6200
MO	Maryland Heights, French Gerleman Elec. Co.	314-569-3122
NJ	Atlantic Highlands, Freedom Elctrns., Inc.	201-872-2300

NY Bohemia, Car-Lac Elctrns. 516-567-4200
OH Cleveland, Car-Lac Elctrns. 216-881-0050

GENERAL DIGITAL CORP., 160 Chapel Rd, Box 1657, Manchester, CT 06040, Tel: 203-647-9700, FAX: 203-872-4681; Empl.: 50

GENERAL ELECTRIC CO., Accessory Equipment Plant, 1285 Boston Ave., Bridgeport, CT 06602, Tel: 203-382-2000, TELEX: 96-4209; Empl.: 700; *Sls. Mgr.:* H. C. Wallace

GENERAL ELEC. CO., Electromaterials Dept., 1350 South Second Street, Coshocton, OH 43812, Tel: 614-622-5310, TELEX: 810-255-2921; Empl.: 600; *Sls. Mgr.:* D.E. Allen

GENERAL ELECTRIC CO., Instrument Prods. Section, See Yokogawa Corp. of America

GE MICROELECTRONICS CENTER, GE Aerospace, P.O. Box 13049, Research Triangle Park, NC 27709, Tel: 919-549-3100, FAX: 919-549-3598; FSC No.: 1HL38; Empl.: 400; *Sls. Mgr.:* Donald B. Dickerman, Jr.

GENERAL ELECTRIC SOLID STATE DIV., G.E. Corporation, Route 202, Somerville, NJ 08876, Tel: 201-685-6530, FAX: 201-685-7008; FSC No.: 19089; *Sls. Mgr.:* Edward Parker; *Dist. Mgr.:* Thomas Piterra

GENERAL ELECTRIC CO., RELAY OPERATION, See Genicom Corp.

GENERAL FIBER OPTICS, INC., 98 Commerce Rd, Cedar Grove, NJ 07009, Tel: 201-239-3400, TELEX: 132741, FAX: 201-239-4258; *Sls. Mgr.:* Herb Berkowitz

GENERAL HARDWARE MFG., 80 White St., New York, NY 10013, Tel: 212-431-6100, FAX: 212-431-6499; *Sls. Mgr.:* Tom McGannon

GENERAL INDUSTRIES, Taylor & Olive St., Elyria, OH 44035, Tel: 216-323-3136, FAX: 216-323-4017; Empl.: 1000

GENERAL INSTRUMENT, Govt. Systems, 600 W. John St., C. S. 710, Hicksville, NY 11802-0709, Tel: 516-933-3000, TELEX: 311512, TWX: 510-221-1865, FAX: 516-933-3432; Empl.: 768; *Sls. Mgr.:* A. Heckler/C. Turner

GENERAL LASER, INC., 7950 E. Redfield Rd., Scottsdale, AZ 85260, Tel: 602-991-0674, FAX: 602-991-1462

GENERAL MAGNETICS, 211 Grove St., Bloomfield, NJ 07003, Tel: 201-743-2700; FSC No.: 99165; Empl.: 20

GENERAL MANUFACTURING, 724 Ruberta Ave., Glendale, CA 91201, Tel: 818-243-2069; FSC No.: 10454

GENERAL MIRCOCIRCUITS, 780 Boston Rd., Billerica, MA 01821, Tel: 508-663-9101, FAX: 508-663-9132; Empl.: 40; *Sls. Mgr.:* Michael Lioz

FAX: 516-226-8966

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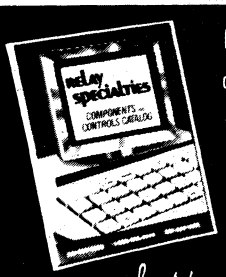

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Can Nepean, Ont., Genicom Corp. 613-726-0215

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OH Columbus, Electronics Mktg. Corp. 614-299-4161
OH Dayton, Elctrns Mktg. Corp. 513-278-5745
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NY	Syracuse, Northeastern Elctrns., Inc.	315-455-7561
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GORDON CO.:WATLOW, 5710 Kenosha St., Richmond, IL 60071, Tel: 815-678-2211, TELEX: 72-2427, FAX: 815-678-3961; Empl.: 300

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GORDOS, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, AR 72757, Tel: 501-636-5000, TWX: 910-720-7998 ..... **A•1741; B•1494-1506; D•1180-1181**

Local Sales Offices & Reps

CA	Costa Mesa, Jim Pancake	714-751-6760
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CA	San Diego, West Elctrn. Sls. Co.	619-233-0236
CA	Westminster, West Elctrn. Sls. Co.	213-493-5569
CO	Arvada, Gemini Elctrns.	303-428-5600
CT	Woodbury, Anacon Sls. Assocs.	203-266-0707
FL	Deerfield Bch., Florida Comps., Inc.	305-429-1758
FL	Tampa, Florida Comps., Inc.	813-960-7044
IL	Schaumberg, Martan, Inc.	312-303-5660
IN	Indianapolis, Hy-Tek Sls. Co.	317-887-2564
MD	Glen Burnie, Tri-Mark	301-761-6000
MA	Wilmington, Anacon Sls. Assocs.	617-270-3712
MI	Troy, Pyramid Integrated Control Sys.	313-362-5375
MO	Maryland Hgts., Ensco Rep, Inc.	314-423-3935
NJ	Budd Lake, Guido Assocs.	201-347-4643
NJ	Lawrenceville, DVS Co.	609-896-1112
NY	Pittsford, Noeth-Honsinger	716-586-9002
NC	Silver City, Crossroads Elctrn. Assocs.	919-742-2372
OH	Centerville (Dayton), Omega Sls., Inc.	513-434-5507
OH	Shaker Hgts., Omega Sls., Inc.	216-751-9600
OK	Tulsa, Advanced Tech. Sls.	918-664-0482
OR	Beaverton, Venture Elctrns., Inc.	503-626-7418
TX	Austin, Advanced Tech. Sls.	512-331-9979
TX	Dallas, Advanced Tech. Sls.	214-340-1300
TX	Houston, Advanced Tech. Sls.	613-440-3888
WA	Bellevue, Venture Elctrns., Inc.	206-454-4594
WI	Grafton, Martan, Inc.	414-337-6640
WI	Milwaukee, Bill Swanson	414-543-2727
EXP	AZ/Rogers, Gordos	501-636-5000

Local Distributors

AL	Auburn, Interstate Elctrl. Supp.	205-821-3341
AL	Birmingham, Sesco	205-988-8304
AL	Montgomery, Control Comps.	205-264-3325
AL	Tempe, Control Design	602-829-7981
AZ	Phoenix, Bell	602-966-7800
AZ	Phoenix, Future	602-272-7952
AZ	Tempe, Time Elctrns.	602-967-2000
AZ	Tucson, Elctrn. Supp.	602-790-1137
AZ	Tucson, Future	602-882-0808
CA	Anaheim, Control Design	213-821-1516
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Hayward, Kea Elctrns.	415-887-2900
CA	Irvine, Future	714-250-4141
CA	Irvine, Integrated Elctrns.	714-837-9960
CA	Los Angeles, Control Design	213-802-1371
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Riverside, Elctrn. Supp.	714-683-7300
CA	Sacramento, Integrated Elctrns.	916-424-5299
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CA	San Diego, Elctrn. Supp.	619-693-8222
CA	San Diego, Time Elctrns.	619-586-1331
CA	San Francisco, Control Design	408-996-9197
CA	San Jose, Future	408-434-1114
CA	San Jose, Integrated Elctrns.	408-435-1000
CA	Santa Ana, Ben-Dec	714-545-3968
CA	Santa Clara, Future	408-748-8550
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CO	Denver, Bell	303-424-1985
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Englewood, Time Elctrns.	303-799-8851
CO	Westminster, Future	303-650-0123
CT	Bethel, Future Elctrns.	203-743-9594
CT	Cheshire, Time Elctrns.	203-271-3200
FL	Altamonte Springs, Control Design	305-788-3220
FL	Clearwater, Future	813-578-2770
FL	Ft. Lauderdale, Control Design	305-782-1388
FL	Ft. Lauderdale, Hammond	305-973-7103
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
FL	Lakeland, AA Elec.	813-665-6911
FL	Miami, Sesco	305-832-0770
FL	Orlando, Future	305-767-8414
FL	Orlando, Hammond	305-849-6060
FL	Orlando, Time Elctrns.	305-841-6565
FL	St. Petersburg, Sesco	813-576-6991
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GA	Columbus, Interstate Elctrl. Supp.	404-324-1000
GA	Norcross, AA Elec.	404-449-8670
GA	Norcross, Future	404-441-7676
GA	Norcross, Time Elctrns.	404-448-4448
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IL	Addison, Pyramid Controls	312-543-0110
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IL	Chicago, Newark	312-784-5100
IL	Genoa, Control Design	815-784-6519
IL	Hoffman Estates, Integrated Elctrns.	312-843-2040
IL	Rockford, Pyramid Controls	815-968-8388
IL	Schaumburg, Future	312-882-1255
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IN	Indianapolis, Control Design	317-788-4559
IA	Cedar Rapids, Control Design	319-373-2923
KS	Wichita, L Comp	316-265-8501
LA	Baton Rouge, Sesco	504-928-4951
LA	New Orleans, Currier & Roser	504-734-1147
MD	Columbia, Future	301-995-1222
MD	Columbia, Jaco	301-995-6620
MD	Columbia, Time	301-964-3090
MA	Peabody, Time Elctrns.	617-532-6200
MA	Westboro, Future Elctrns.	617-366-2400
MA	Wilmington, North-Star Elctrns.	617-657-5155
MA	Woburn, Control Design	617-932-9404
MI	Ann Arbor, McNaughton-McKay Elec. Co.	313-995-9515
MO	Chesterfield, Advanced Ind. Sys., Inc.	314-532-2477
MI	Detroit, Future	313-261-5270
MI	Detroit, Newark Elctrns.	313-967-0600
MI	Kalamazoo, Pyramid Controls Inc.	616-327-3733
MI	Madsion Hgts., McNaughton-McKay Elec. Co.	313-399-7500
MI	Oak Pk., Newark Elctrns.	313-968-2950
MN	Bloomington, Time Elctrns.	612-944-9192
MN	Eden Prairie, Future	612-944-2200
MN	Minneapolis, Control Design	612-721-1628
MN	Minneapolis, Newark Elctrns.	612-331-6350
MO	Ellisville, AIS	314-391-0366
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MO	St. Louis, L Comp	314-291-6200
MO	St. Louis, Time Elctrns.	314-391-6444
NJ	E. Rutherford, AA Elec.	201-777-5477
NJ	Fair Lawn, Relay Specialties	201-337-1000
NJ	Fairfield, Future	201-227-4346
NJ	Mt. Laurel, Future	609-778-7600
NJ	Pennsauken, Resco	609-662-4000
NM	Albuquerque, Elctrn. Dvcs.	505-884-2950
NY	Bohemia, Key Comps.	516-567-7500
NY	Buffalo, Summitt	716-884-3450
NY	Hauppauge, Future	516-234-4000
NY	Hauppauge, Jaco	516-273-5500
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Liverpool, Future	315-451-2371
NY	Rochester, Future	716-272-1120
NY	Rochester, Simcona	716-328-3230
NY	Rochester, Summitt	716-334-8110
NY	Syracuse, Future	315-432-1355
NY	Syracuse, Time Elctrns.	315-432-1355
NC	Charlotte, Carolina Elec. Supp. Co.	704-527-6555
NC	Charlotte, Control Design	704-588-4410
NC	Charlotte, Future	704-529-5500
NC	Charlotte, Time Elctrns.	704-522-7600
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Sesco	919-467-7482
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
OH	Dublin, Time Elctrns.	614-761-1100
OH	Highland Hgts., Elctrns. Mktg. Corp.	216-442-3441
OH	Keetering, Elctrns. Mktg. Corp.	513-439-4711
OK	Tulsa, Sesco	918-622-3868
OR	Beaverton, Cascade Data Mktg.	503-641-9266
OR	Beaverton, Future	503-645-9454
OR	Beaverton, Integrated Elctrns.	503-641-1690
OR	Portland, Bell	503-241-4115
OR	Portland, Time Elctrns.	503-684-3780
PA	Bristol, Aim Elctrns.	215-785-3500
PA	King of Prussia, Time Elctrns.	215-337-0900
PA	Malvern, Control Design	215-296-0150
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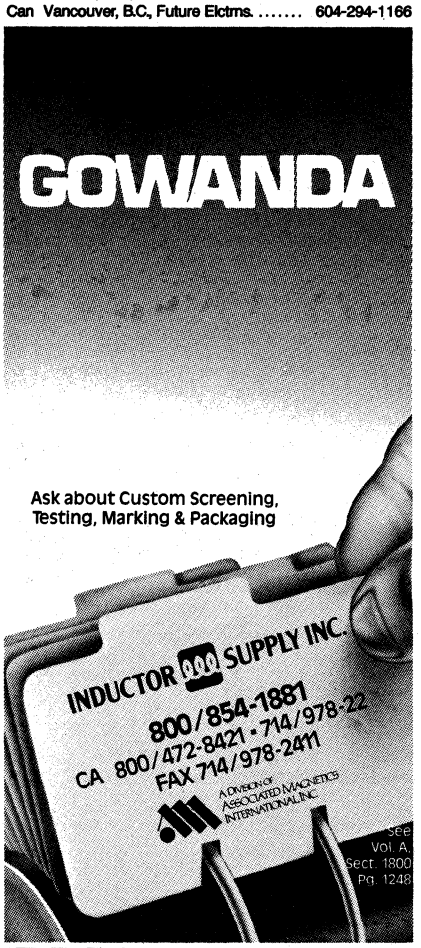

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GORMAN MACHINE CORP., 7 Burke Dr., Brockton, MA 02401, Tel: 508-588-2900, TWX: 710-345-0679, FAX: 508-588-9560; Empl.: 25; *Sls. Mgr.:* Kenneth P. Gorman

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CA Hayward, Pacific Mktg., Inc. 415-887-1620
CA Northridge, Myco Sls. 818-886-7101
CA San Diego, Hadden Assocs., Inc. 619-565-9444
CO Boulder, R.F. Mayo Assocs. 303-422-2155
FL Longwood, Sam Reps. 407-869-9565
IL Highland Park, Bransky Sls. 312-433-2375
IN Greenfield, France Entprs. 317-462-6098
MA Waltham, Powercard Corp. 617-890-6789
TX Irving, Kite Elctrn. Sls. 214-986-0321
VA Arlington, Gans & Pugh Assocs. 703-527-3262

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GOULD INC., Recording Systems Division, 3631 Perkins Avenue, Cleveland, OH 44114, Tel: 216-361-3315, TELEX: 196113GLD RS UT; FSC No.: 96795; Empl.: 550 ..... **D•1439**

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AZ Phoenix, Gould Inc., T&M Sls./Svc. ... 602-990-8212
CA Los Angeles, Gould Inc., T&M Sls./Svc. 213-404-1919
CA San Francisco, Gould Inc., T&M Sls./Svc. 408-864-7733
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DC Washington, Gould Inc., T&M Sls./Svc. 301-345-0050
FL Orlando, Gould Inc., T&M Sls./Svc. ... 305-830-0695
GA Atlanta, Gould Inc., T&M Sls./Svc. 404-279-1652
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MI Detroit, Gould Inc.,T&M Sls./Svc. 313-588-4020
MN Minneapolis, Gould Inc., T&M Sls./Svc. 612-544-5253
NJ New York Metro, Gould Inc., T&M Sls./Svc. 201-935-1717
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NC Greensboro, Gould Inc., T&M Sls./Svc. 919-275-1078
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OH Dayton, Gould Inc., T&M Sls./Svc. 513-433-9586
PA Pittsburgh, Gould Inc., T&M Sls./Svc. 412-838-7700
TX Dallas, Gould Inc., T&M Sls./Svc. Div. 214-991-8229
TX Houston, Gould Inc., T&M Sls./Svc. ... 713-680-1121
WA Seattle, Gould Inc., T&M Sls./Svc. 206-882-7525

GOULD INC., Semiconductor Division, 2300 Buckskin Rd., Pocatello, ID 83201, Tel: 208-233-4690, TWX: 910-977-5752; Empl.: 1500; *Dist. Mgr.:* Richard Brown

GOULD INC., Test & Measurement, 19050 Pruneridge Ave., Cupertino, CA 95014-0718, Tel: 800-Gould-10, FAX: 408-988-1647; *Sls. Mgr.:* Dan Cockcroft

GOULD SHAWMUT, 374 Merrimac St., Newburyport, MA 01950, Tel: 508-462-6662/3131, FAX: 508-465-6419; FSC No.: 71424; *Sls. Mgr.:* Malcolm Allison

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CA Fremont, William Parks Assocs. 415-770-9058
CA San Diego, Earle & Assocs. 619-278-5441
CA San Diego, Earle Assocs. 619-278-5441
CO Broomfield, Western Region Mktg. 303-469-9338
FL Longwood, NSL Assocs. 305-629-5226
GA Atlanta, L & D, Inc. 404-395-7079
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IA Cedar Rapids, Snider Sls. Co. 319-362-4410
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MN Chanhassen, G&F Distribution 612-934-2907
NY Hauppauge, Broadline Electric 516-231-4100

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GRADO LABORATORIES, 4614 Seventh Ave., Brooklyn, NY 11220, Tel: 718-435-5340

GRALEX INDUSTRIES, 155 Wildey St., Tarrytown, NY 10591, Tel: 914-631-2978, FAX: 914-631-0862; FSC No.: 11332; Empl.: 15 ..... **D•1397**

Local Sales Offices & Reps

CT Bridgeport, Gralex Inds., Inc. 203-334-7363
NY Tarrytown, Gralex Inds., Inc. 914-631-2978

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GA Atlanta, Metermaster 404-446-0166
IL Chicago, Metermaster 312-593-8650
MA Billerica, Electra Test, Inc. 617-667-8541
MA Boston, Calibron 617-894-6440
NJ S. Hackensack, Concord Elctrns. 201-488-0008, 1-800-222-1298
NY Great Neck, Instr. Mart Inc. 516-487-7430
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TX Dallas, Metermaster 214-271-5671

GRAND TRANSFORMERS, 1500 Marion St., Grand Haven, MI 49417, Tel: 616-842-5430; Empl.: 125; *Sls. Mgr.:* G. V. Retzlaff

GRANT HARDWARE CO., A Mobex Company, High Street, West Nyack, NY 10994, Tel: 914-358-4400, FAX: 914-358-1703; FSC No.: 83508; Empl.: 490; *Sls. Mgr.:* Tony DiSantis

GRAPHITE METALLIZING CORP., 1036 Nepperhan Ave., P.O. Box 110, Yonkers, NY 10702, Tel: 914-968-8400, TELEX: 13-1571, FAX: 914-968-8468; Empl.: 178; *Sls. Mgr.:* E. Walker ..... **B•1252**

Local Sales Offices & Reps

OR Beaverton, Graphite Metallizing 503-646-9964

GRASSLIN CONTROLS CORP.:GRASSLIN GMBH & CO., K.G., 45 Spear Rd., Ramsey, NJ 07446, Tel: 201-825-9696, FAX: 201-825-8694; Empl.: 5

GRAYHILL INC., 561 Hillgrove Ave., La Grange, IL 60525, Tel: 708-354-1040, TELEX: 6871375 GHLG UW, TWX: 910-683-1850, FAX: 708-354-2820; FSC No.: 5930; Empl.: 1000; *Sls. Mgr.:* Richard K. Neumann; *Dist. Mgr.:* Robert J. Ferrel ..... **B•1510-1511, 1743-1749, 1864-1865; C•1371**

Local Sales Offices & Reps

AL Huntsville, Rep, Inc. 205-881-9270
AZ Phoenix, Mercury Engrg. Sls. 602-265-0344
CA Anaheim, Impact Elctrns. 714-533-1351
CA Cupertino, West-Comp, Inc. 408-245-3100
CA San Diego, Earle Assocs. 619-278-5441
CO Denver, Lindberg Co. 303-758-9033
FL Winter Springs, Sunland Assocs. 407-365-9533
GA Tucker, Rep, Inc. 404-938-4358
IL Itasca, LTD Elctrns. 312-773-2900
IN Ft. Wayne, Menze Sls. 219-747-5616
IA Cedar Rapids, Lorenz Sls. 319-377-4666
KS Overland Pk., Spectrum Sls. 913-648-6811
MD Gaithersburg, Naudain Assocs. Southern 301-258-5040
MA Needham Hgts., Newscott Co. 617-444-1923
MI Royal Oak, Hilltronics Inc. 313-435-0920
MN S. St. Paul, Northport Engrg. 612-457-8000
MO Hazelwood, Spectrum Sls. 314-731-5151
NE Lincoln, Lorenz Sls., Inc. 402-475-4660
NJ Marlton, Naudain Assocs. 609-983-5300
NM Albuquerque, Lindberg Co. 505-881-1006
NY Great Neck, Coakley Boyd Abbett/Tylinski 516-466-9070
NY Ithaca, Bob Dean, Inc. 607-257-1111
NY Wappingers Falls, Bob Dean, Inc. 914-297-6406
NC Charlotte, R. W. Chapman & Co. 704-525-2421
NC Raleigh, R. W. Chapman 919-782-2624
OR Tigard, Eltech, Inc. 503-684-3458
PA Pittsburgh, Bear Mktg. 412-531-2002
SC Greenville, Robert W. Chapman & Co. 803-288-8821
TN Jefferson City, Rep, Inc. 615-475-9012
TX Austin, W. Pat Fralia Co. 512-835-7911
TX Euless, W. Pat Fralia Co. 817-267-3577
TX Houston, W. Pat Fralia Co. 713-772-1572
UT Salt Lake City, Lindberg Co. 801-277-2643
WA Bellevue, Eltech, Inc. 206-643-4330
WI Mequon, Badgerep 414-241-9200
Can Pickering, Ont., A. C. Simmonds & Sons Ltd. 416-839-8041

Local Distributors

AL Huntsville, Powell Elctrns. 205-539-2731
AZ Phoenix, Sterling Elctrns. 602-268-2121
AZ Tempe, D C Elctrns. 602-438-1234
AZ Tempe, Harper SID 602-967-1464
AR Little Rock, Carlton-Bates Co. 501-562-9100
CA Compton, Harper SID 213-979-5090
CA Garden Grove, Richey/Impact 714-895-0060
CA Gardena, Calif. Switch 213-770-2330
CA Los Angeles, Electric Switches 213-660-1310
CA Riverside, Electronic Supp. 714-683-7300
CA San Diego, Electronic Supply 619-693-8222
CA San Diego, Harper S.I.D. 619-578-2500
CA San Diego, Richey/Impact Elctrns. 619-271-4511
CA San Jose, Harper SID 408-943-9490
CA San Jose, Powell Elctrns. 408-943-9020
CA San Jose, Richey/Impact Elctrns. 408-432-7100
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Santa Monica, Master Distributors 213-452-1229
CO Denver, CSID, Inc. 303-292-9594
CO Denver, Newark Elctrns. 303-757-3351
CO Englewood, Shelley Ragon, Inc. 303-762-0670
CT Wallingford, Midan Elctrns. 203-265-2077
CT Wallingford, Sager 203-265-4600
FL Ft. Lauderdale, Hammond Elctrns. 407-973-7103
FL Ft. Lauderdale, Powell Elctrns. 305-484-8377
FL Orlando, Hammond Elctrns., Inc. 407-849-6060
FL Pompano Beach, Peerless Radio 305-973-4141
GA Norcross, Hammond Elctrns., Inc. 404-449-1996
GA Norcross, Pioneer/Georgia 404-448-1711
ID Couer D' Alene, A-1 Consolidated 208-765-3280
IL Bensenville, GBL Goold 312-860-7171
IL Chicago, Newark Elctrns. 312-784-5100
IL Chicago, Waldom Elctrns. 312-585-1212
IL Northbrook, Classic Comp. Supp. 312-272-9650
IL Palatine, Ohm Elctrn. 312-359-5500
IL Peoria, Klaus Radio 309-691-4840
IL Wood Dale, NEP Elctrns. 312-595-8500
IN Evansville, Hutch & Son 812-425-7201
IN Fort Wayne, Bell Inds./Graham Div. 219-423-3422
IN Indianapolis, Bell Ind./Graham Div. 317-875-8200
IN Indianapolis, Meunier Elctrn. Supp. 317-635-3511
IN Indianapolis, PEI/Genesis 317-879-0700
IA Cedar Rapids, Advent Elctrns. 319-363-0221
MD Baltimore, Rescoe/Baltimore 301-529-0500
MD Columbia, Powell Elctrns. 301-621-8080
MD Gaithersburg, Pioneer/Wash. 301-921-0660
MD Jessup, Treeko S/S, Inc. 301-792-0112
MD Kensington, Marine Air Supp. 301-949-9560
MA Hingham, Sager Elctrns. 617-749-6700
MA Norwood, Gerber Elctrns. 617-329-2400
MI Battle Creek, Great Lakes Elctrns. 616-963-6282
MI Livonia, Pioneer/STD Elctrns. 313-525-1800
MI Livonia, R.S. Elctrns. 313-525-1155
MI Oak Park, Newark/Detroit Elctrns. 313-967-0600
MI St. Clair Shores, Spemco 313-771-2700
MN Minneapolis, Newark Elec. 612-331-6350
MN Minneapolis, Sterling Elctrns. 612-831-2666
MN St. Paul, Gopher Elctrns. 612-483-3322
MO Kansas City, LComp, Inc. 816-221-2400
MO Maryland Hgts., LComp, Inc. 314-291-6200
MO St. Charles, Finnigan Elctrns., Inc. 314-946-6201
NE Lincoln, Scott Elctrns. 402-466-8221
NH Nashua, Brevan Elctrns. 603-889-7230
NJ East Hanover, State Elec. 201-887-2550
NJ Kenilworth, Federated Purch. 201-272-0505
NJ West Berlin, General Comps. 609-768-6767
NM Albuquerque, Walker Elctrn. Supp. 505-883-2992
NY Binghamton, Pioneer Elctrns. 607-722-9300
NY Bohemia, Car-Lac Elctrns. 516-567-4200
NY Buffalo, Summit Distrs. 716-887-2800
NY Hauppauge, Sager Elctrns. 516-348-1300
NY Hempstead, Electronic Equip. 516-538-5510
NY Lynbrook, Peerless Radio 516-593-2121
NY Rochester, Simcona Elctrns. 716-328-3230
NY Rome, Rome Elctrns. 315-337-5400
NC Cary, Powell Elec. 919-467-1212
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Sager/Svc. 919-850-9550
OH Cincinnati, URI Elctrns. 513-761-4030
OH Cleveland, Pioneer/Cleveland 216-587-3600
OH Columbus, Hughes-Peters 614-294-5351
OH Dayton, Pioneer/Dayton 513-236-9900
OH Dayton, Stotts-Friedman 513-298-5555
OH Willoughby, Gateway Megatech 216-953-0330
OK Oklahoma City, Electro Entprs. 405-427-6591
OK Tulsa, Norvell 918-254-8606
OR Beaverton, Component Resources 503-641-8488
OR Portland, Radar Elec. Co. 503-232-3404
PA Harrisburg, Cumberland Elctrns. 717-232-5999
PA Mars, Almo Elctrns., Inc. 412-931-5990
PA McKean, Advacom 814-476-7774
PA Philadelphia, Almo Elctrns. 215-698-4000
PA Philadelphia, Powell Elctrns. 215-365-1900
PA Pittsburgh, Pioneer/Pittsburgh 412-782-2300
PA W. Berlin, General Comps. 609-768-6767
RI Pawtucket, Major/Edwards Elctrns. 401-725-7400
SC Columbia, Dixie Elctrns. 803-779-5332
SC Greenville, EMSCO 803-233-4121
TN Memphis, Bluff City 901-345-9500
TX Austin, Norvell Elctrns. 512-837-5555
TX Dallas, Associated Aircraft 214-331-4381
TX Dallas, Harrison Equip. 214-239-2750
TX Dallas, Norvell Elctrns. 214-233-0020
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Garland, Newark Elctrns. 214-494-5911
TX Houston, Norvell Elctrns. 713-777-1666
TX Irving, Harper SID 214-621-0500
TX Stafford, Harrison Equip. 713-879-2600
UT Salt Lake City, Standard Supp. 801-486-3371
VA Richmond, Sterling Elctrns. 804-226-2190
WA Kent, Component Resources, Inc. 206-454-8666
WA Seattle, Radar Elect. Co., Inc. 206-282-2511
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI Milwaukee, Progressive Image 414-321-4722
WI New Berlin, Classic Comps. 414-786-5300

GREEN ENGINEERING, 78 Stone Place, Melrose, MA 02176, Tel: 617-665-8994, FAX: 617-665-8255; Empl.: 5

GREENLEE TEXTRON INC.:SUBSIDIARY OF TEXTRON INC., 4455 Boeing Drive, Rockford, IL 61109, Tel: 815-397-7070, TELEX: 433-0029GTCRKD; *Sls. Mgr.:* J. Angel, V.P.

GREENRAY INDS., INC., 840 W. Church Rd., Mechanicsburg, PA 17055, Tel: 717-766-0223, TWX: 510-650-4939, FAX: 717-790-9509; FSC No.: 16681; Empl.: 55

GREENWICH INSTRUMENTS USA, 3401 Monroe Rd., Charlotte, NC 28205, Tel: 704-376-7805, TELEX: 358905

GREIBACH INSTRUMENTS DIV., 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717, FAX: 914-699-9410; FSC No.: 32590; Empl.: 35

Local Sales Offices & Reps

IL Lincolnwood, Saffro & Assocs. 312-677-9722
MN Minneapolis, Hei-Lite Sls. 612-861-6051
WI Lake Mills, Saffro & Assocs. 1-800-327-0312

THE GRIEVE CORPORATION, 500 Hart Rd., Round Lake, IL 60073-9989, Tel: 312-546-8225, FAX: 312-546-9210; *Sls. Mgr.:* Frank Calabrese

GRIM CORP

FAX: 609-261-0921

GRIM CORPORATION, Box 968:Triangle Industrial Center, Medford, NJ 08055-0968, Tel: 609-267-7950, TWX: 510-683-9392; FSC No.: 21870; Empl.: 125; *Sls. Mgr.:* Al Henry ..... **D•1067-1070**

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GRM CORP., See Grim Corp.

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GSE, Core Inds., 23640 Research Dr., Farmington Hills, MI 48024, Tel: 313-476-7875, TELEX: 23-0738, FAX: 313-496-7249; Empl.: 105; *Sls. Mgr.:* Harold G. Munn

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GSI CORP., 1917 Greenspring Dr., Timonium, MD 21093, Tel: 301-252-1768, TELEX: 292319 GSIC UR; FSC No.: 60990; Empl.: 50 ..... **C•1860-1862**

Local Sales Offices & Reps

AZ	Tempe, Elctrn. Dev. & Sls.	602-438-1547
CA	El Toro, PAR Mktg.	714-768-6021
CA	San Jose, Norcal Repco	408-294-1999
CT	Madison, Omni-Rep	203-421-4561
IL	Crystal Lake, J. D. Noble & Assocs., Inc.	815-455-5084
MD	Poolesville, Westerly Assocs. Inc.	301-972-8176
MA	Burlington, Omni-Rep	617-245-4511
MN	Bloomington, Paul Ericson & Assocs.	612-831-5016
NJ	Ho-Ho-Kus, D. J. Fisher Co., Inc.	201-652-0090
NY	Camillus, Cichy & Cichy Sls.	315-488-3526
RI	Cumberland, Omni-Rep	401-333-2353
TX	Irving, Elctrn. Dev. & Sls.	214-570-5122

GTE CORP., Sylvania Emissive Prods./Process Heat, Portsmouth Ave., Exeter, NH 03833, Tel: 603-772-4331, TWX: 510-294-4471; Empl.: 200

GTE FIBEROPTIC PRODUCTS, 2401 Reach Rd, Williamsport, PA 17701, Tel: 717-326-6591, 1-800-FBR-OPTICS

GTE GOVERNMENT SYSTEMS CORP., P.O. Box 7188, Mountain View, CA 94039, Tel: 415-966-2000, TWX: 910-379-6948, FAX: 415-966-2303; Empl.: 3200; *Sls. Mgr.:* Evan S. Baker; *Dist. Mgr.:* Evan S. Baker

GTE MICROCIRCUITS, 2000 W. 14th. St., Tempe, AZ 85281, Tel: 602-968-4431, TWX: 910-951-1383; FSC No.: 16766; Empl.: 400; *Sls. Mgr.:* Jim Kelley

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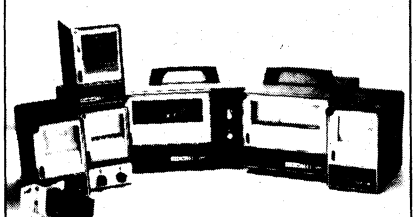

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GTE PRODUCTS GRP. (SYLVANIA), See Sylvania Miniature Lighting

GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116, Tel: 800-433-4837; Empl.: 1300

GTE SWITCHING & TELEPHONE PRODUCTS, 400 N. Wolf Rd., Northlake, IL 60164, Tel: 312-681-7100

GTE SYLVANIA LIGHTING, Sylvania Lighting Center, 100 Endicott St., Danvers, MA 01923, Tel: 617-777-1900

GTE SYLVANIA, INC., STANDISH, ME, See Sylvania Control Devices

GTI/CIRCUITS DIV., Box 217, Leesburg, IN 46538, Tel: 219-453-3261, TELEX: 023-2653, FAX: 219-453-3833; Empl.: 150; *Sls. Mgr.:* Hugh M. Walker

GTI/ELECTRONICS DIV., P.O. Box 2096, Hadley, PA 16130, Tel: 412-253-3161, FAX: 412-253-3853; Empl.: 180; *Sls. Mgr.:* Richard C. Kaufman

GUARDIAN ELEC. MFG. CO., 1550 W. Carroll Ave., Chicago, IL 60607, Tel: 815-337-0050, FAX: 815-337-0377; Empl.: 500; *Sls. Mgr.:* John Cotton; *Dist. Mgr.:* Mac Rowell

GUILDLINE INSTRUMENTS, 4403 Vineland Rd, Suite B-10, Orlando, FL 32811-7335, Tel: 407-423-8215, TELEX: 856443; Empl.: 85; *Sls. Mgr.:* Michael S. Shaw

GULTON GRAPHIC INSTRUMENTS DIV., A Mark IV Company, Gulton Ind'l. Pk., E. Greenwich, RI 02818, Tel: 401-884-6800, TWX: 710-387-1500; Empl.: 400

GULTON INDUSTRIES, INC., Servonic Div., 1644 Whittier Ave., Costa Mesa, CA 92627, Tel: 714-642-2400, 800-854-4066, TELEX: 183-532, TWX: 910-596-1352, FAX: 714-642-9490; FSC No.: 99564; Empl.: 320; *Sls. Mgr.:* Earl Pope

GUNTHER, W., GMBH, Vimsberger Strasse 51, D 8500 Nurnberg 82, West Germany, Tel: (0)911/65521 or 65520, TWX: 622351 Wigu d, FAX: (0)911/6552-239; Empl.: 340; *Sls. Mgr.:* Peter Busch

Refer to Spectron Inc., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788 for reps. & distrs.Refer to Gordos Corporation, Bloomfield, New Jersey for Representatives and Authorized Distributor information.

GW INSTRUMENTS, INC., 35 Medford St, Somerville, MA 02143, Tel: 617-625-4096

G W THREE INCORPORATED, 7623 Fullerton Rd., 2nd Floor, Springfield, VA 22153, Tel: 703-451-2043

HACKER INSTRUMENTS, Box 657, Fairfield, NJ 07007, Tel: 201-226-8450, FAX: 201-808-8281; Empl.: 15

HADES MANUFACTURING CORP., 151 Verdi St., Farmingdale, NY 11735, Tel: 516-249-4244, FAX: 516-420-8135; FSC No.: 51578; Empl.: 18; *Sls. Mgr.:* K. Norris

HADLEY, ROBERT M. CO., INC., 750 West 51st St, Los Angeles, CA 90037, Tel: 213-234-9091, FAX: 213-234-2779; FSC No.: 72964; Empl.: 135; *Sls. Mgr.:* Charles A. Hadley

HADRON, INC., 9990 Lee Hwy., Fairfax, VA 22030, Tel: 703-359-6100, TELEX: 248454 TELCM UR; *Sls. Mgr.:* D. Laiti

HAEFELY TEST SYSTEMS, E. Haefely & Co. LTD., 2616 Morse Lane, Woodbridge, VA 22192, Tel: 703-494-1900, TELEX: WU 90 1097, FAX: 703-494-4597; Empl.: 800; *Sls. Mgr.:* George A. Przybys

HAFSTROM TECHNICAL PRODUCTS, INC., P.O. Box 9829, San Diego, CA 92109, Tel: 619-274-8822; Empl.: 10; *Sls. Mgr.:* J. R. Hafstrom

THE HALL COMPANY, 420 East Water St., Urbana, OH 43078, Tel: 513-652-1376, FAX: 513-653-7447; Empl.: 75

HALLMARK METALS INC., 610 W. Foothill Blvd., Glendora, CA 91740, Tel: 213-335-1263; Empl.: 20; *Sls. Mgr.:* Robert Schoenick

HALLMARK NAMEPLATE, INC., 1855 New Highway, Farmingdale, NY 11735, Tel: 800-645-9502, FAX: 516-454-6528; *Sls. Mgr.:* Dan Fortuna

HALMA ENTERPRISES, Tettex Instruments, 1055 W. Germantown Pike, Fairview Village, PA 19409-0281, Tel: 215-539-6050

HALMAR ELECTRONICS, INC., 900 N. Hague Ave., Columbus, OH 43204, Tel: 614-275-0530, TWX: 810-482-1654, FAX: 614-274-2559; Empl.: 130

HAMAMATSU CORPORATION, PO Box 6910, 360 Foothill Rd., Bridgewater, NJ 08807, Tel: 201-231-0960, TELEX: 833403, FAX: 201-231-1218; Empl.: 150; *Sls. Mgr.:* George Marshall; *Dist. Mgr.:* George Marshall

HAMAMATSU PHOTONICS K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, Japan, Tel: 0534-52-2141, FAX: 0534-56-7889; Empl.: 1200; *Sls. Mgr.:* H. Hiruma

HAMEG, INC., 88-90 Harbor Rd., Port Washington, NY 11050, Tel: 516-883-3837, TELEX: 023-497-4606, FAX: 516-883-3894; *Sls. Mgr.:* Alex Orloff

Local Distributors

AL	Huntsville, B & C Instr.	205-883-6530
AZ	Phoenix, Jensen Tools Inc.	602-968-6241
CA	Anaheim, R & D Elctrns. Supp.	714-773-0240
CA	Canoga Park, Rag Elctrns., Inc.	818-998-6500
CA	El Segundo, Time Motion Tools	213-772-8170
CA	San Diego, Gateway Elctrns.	619-279-6802
CA	San Diego, Instr. Engrs.	619-268-8344
CA	Santa Ana, Action Elctrns.	714-547-5169
CA	Van Nuys, Testek	818-786-6890
CO	Denver, Gateway Elctrns.	303-458-5444
CT	Hamden, Kaufman Inst. Lab	203-776-7201
CT	Newtown, CT Calibration Lab	203-270-1263
FL	Hialeah, Kimball Elctrn. Lab Inc.	305-822-5792
FL	Miami, Walder Elctrn. Dist.	305-379-4794
FL	Tampa, Advanced Instrs.	813-876-4848
IL	Countryside, Pacific Indicator Co.	312-352-3500
IL	Joliet, Mainline Supp. Co. Inc.	815-436-3900
IL	Joliet, Primus Elctrns. Corp.	815-436-8945
MD	Hunt Valley, Tessco Inc.	301-785-5300
MD	Lanham, Sel-tronics Inc.	301-731-8080
MD	Silver Spring, Print	301-587-7824
MA	North Andover, Contact East	617-682-2000
MN	Minneapolis, Tonka Tech. Sls.	612-593-1770
MO	Kansas City, Indl. Svc. Labs	816-587-5400
MO	St. Louis, Gateway Elctrns.	314-427-6116
MO	St. Louis, Indl. Svc. Labs	314-423-3141
MO	St. Louis, Scherrer Instr. Inc.	314-644-5362
NJ	Clarksburg, Accutest Instr. Inc.	609-259-0460
NJ	Whippany, General Calibration	201-428-2880
NY	Bohemia, Exphil Calibration Labs	516-563-3520
NY	Great Neck, Instr. Mart	516-487-7430
OH	Moraine, MCM Elctrns.	513-434-0031
OR	Portland, Westeonn Elctrns.	503-283-0132
TX	Houston, Gateway Elctrns.	713-978-6575
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WA	Seattle, Eicher-Richards	206-523-7888
WI	Madison, Schrenk Sls.	608-255-7400

HAMILTON METALCRAFT, 848 N. Fair Oaks Ave., Pasadena, CA 91103, Tel: 818-795-4811, FAX: 818-795-9705; *Sls. Mgr.:* Mel Stahler

HAMILTON STANDARD CONTROLS/STANCOR, See Stancor/Hamilton Standard Controls

HAMILTON STANDARD DIV., United Technologies Corp., One Hamilton Road, Windsor Locks, CT 06096-1010, Tel: 203-654-6000, TELEX: 99-4439, FAX: 203-654-2620; *Sls. Mgr.:* Andrew H. Voorhis, VP Mktg.

HAMLIN

FAX: 414-648-5244

HAMLIN, Lake & Grove Sts., Lake Mills, WI 53551, Tel: 414-648-2361, TWX: 910-260-3740; Empl.: 1000; *Sls. Mgr.:* Ken Deans ..... **B•1513, 1751, 1957**

Local Sales Offices & Reps

AZ	Phoenix, Westrep	602-997-8899
CA	Anaheim, Westrep	213-404-3881
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Westrep	408-988-8833
CO	Boulder, R-G Entprs.	303-447-9211
CT	North Haven, Coakley, Boyd & Abbett, Inc.	800-225-8402
FL	Altamonte Springs, Semtronic Assocs.	305-831-8233
GA	Jonesboro, Wallace Elctrn. Sls.	404-471-6297
IL	Skokie, Indl. Rep.	312-967-8430
IN	Carmel, TMC	317-844-8462
IN	Fort Wayne, TMC	219-432-5553
IA	Cedar Rapids, Palatine Sls.	319-365-8071
KY	Louisville, TMC	502-499-7808
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Needham Heights, Coakley, Boyd & Abbett, Inc.	617-444-5470
MI	Farmington Hills, J. L. Montgomery Assocs.	313-489-0099
MN	Minneapolis, R-J, Inc.	612-866-3661
MO	Blue Springs, Palatine Sls.	816-229-4007
MO	Hazelwood, Palatine Sls.	314-839-0800
NH	Plaistow, Coakley, Boyd & Abbett, Inc.	800-225-8402
NJ	Marlton, Naudain Assoc.	609-983-5300
NY	Great Neck, Tylinski Assocs.	516-466-9070
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742
OH	Dayton, Bear Mktg.	513-299-5877
OH	Richfield, Bear Mktg.	216-659-3131
TX	Austin, Allied Comps.	512-331-4494
TX	Dallas, Allied Comps.	214-238-0408
TX	Hurst, Allied Comps.	817-589-0456
WA	Bellevue, Testco, Inc.	206-454-7422
WI	Milwaukee, Indl. Rep.	414-259-0965
Can		416-475-8500
Can	Mississauga, Ont., Hi-Tech Sls.	416-672-0284

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AZ	Tempe, Circuit Specialties	602-966-0764
CA	Buena Park, Cypress/RPS Elctrns.	213-744-0255
CA	Fullerton, Pyramid Elctrns.	714-773-0781
CA	Hawthorne, Electrosonic Comps.	213-988-4455
CA	San Jose, Cypress Elctrns. Inc.	408-945-8400
CA	Santa Clara, Patane Avionics	408-496-6151
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CO	Englewood, Ind. Elctrns.	303-694-9444
CT	Bethel, Heilind Elctrns.	203-797-8600
CT	Hartford, Hatry Elctrns.	203-527-1881
CT	New Haven, Hatry Elctrns.	203-787-5921
CT	Stratford, Hatry Elctrns.	203-375-5866
CT	Wallingford, Sager Elect. Supp.	203-265-4600
CT	Waterbury, Hatry Elctrns.	203-755-1181
FL	Lakeland, AA Elec.	813-665-6941
FL	Longwood, Intertec Inc.	305-834-7777
FL	Miami, Elctrn. Equip. Co.	305-871-3500
FL	Orlando, Hammond Elctrn.	305-849-6060
FL	Tampa, Leader Elctrns.	813-870-3315
GA	Atlanta, Specialty Distrbg. Co.	404-873-2521
GA	Norcross, AA Elec.	404-449-8670
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, Ohm Elctrns.	312-359-5500
IN	Carmel, Altex Elctrns.	317-848-1323
IN	Ft. Wayne, Graham Elctrns.	219-424-3422
IN	Indianapolis, Graham Elctrns.	317-634-8202
IA	Cedar Rapids, Iowa Radio Supp. Co.	319-393-4510
MD	Gaithersburg, Pioneer/Wash.	301-921-0660
MA	Burlington, Heilind Elctrns.	617-272-5610
MA	Hingham, Sager Elec. Supp.	617-749-6700
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MI	Oak Park, Newark Elctrns.	313-967-0600
MN	Fridley, Voyager Electronics	612-571-7766
MN	Minneapolis, Newark Elctrns.	612-331-6350
MO	St. Louis, Olive Indl. Elctrns.	314-426-4500
NH	Hudson, Heilind Elctrns.	603-883-9536
NJ	Berlin, General Comps., Inc.	609-768-6767
NJ	Oakland, Relay Spec.	201-337-1000
NJ	Pennsauken, Resco Elctrns.	609-662-4000
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Buffalo, Summit Distr.	716-844-3540
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rome, Rome Elctrns.	315-337-5400
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cincinnati, Graham Elctrns.	513-772-1661
OH	Solon, Repco	216-248-8900
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Radar Elec.	503-233-3691
PA	McKeesport, Barno Radio	412-751-5966
TX	Dallas, Harrison Equip. Co.	214-239-2750
TX	Farmers Branch, Heilind Elctrns.	214-351-2058
TX	Fort Worth, Allied Elctrns.	214-265-9341
TX	Houston, Harrison Equip.	713-879-2711
TX	Houston, Heilind Elctrns.	713-988-2711
WA	Kent, Interface Elctrns.	206-872-5800
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Spokane, Radar Elec. Co.	509-747-3053
WI	Cedarburg, AA Elec.	414-377-7500
WI	Mequon, Taylor Elec.	414-241-4321
Can	Burnaby, B. C., Rae Indl. Elctrns.	604-291-8866
Can	Burnaby, B. C., Semad Elctrns.	604-438-2515
Can	Dorval, Que., Semad Elctrns.	514-636-4614
Can	Downsview, Ont., Rae Indl. Elctrns.	416-736-1750
Can	Markham, Ont., Semad Elctrns.	416-475-3922
Can	Ottawa, Ont., Semad Elctrns.	613-729-6145
Can	Surrey, B. C., Memco Elctrn. Mkts.	604-590-1553

HAMLIN LCD, A Div. of Standish Inds., W7514 Hwy V, Lake Mills, WI 53551, Tel: 414-648-2315, FAX: 414-648-8696; Empl.: 250; *Sls. Mgr.:* Eastern:Brent Hering ..... **B•1081**

Local Sales Offices & Reps

AZ	Phoenix, Westrep	602-820-9932
CA	Anaheim, Westrep	213-404-3881
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Westrep	408-988-8833
CO	Boulder, R-G Entprs.	303-447-9211
CT	North Haven, Coakley, Boyd & Abbett, Inc.	800-225-8402
FL	Altamonte Springs, Semtronic Assocs.	407-831-8233
GA	Jonesboro, Wallace Elctrn. Sls.	404-471-6297
IL	Skokie, Indl. Rep.	312-967-8430
IN	Carmel, TMC	317-844-8462
IN	Ft. Wayne, TMC	219-432-5553
IA	Cedar Rapids, Palatine Sls.	319-365-8071
KY	Louisville, TMC	502-893-1377
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Needham Hgts., Coakley, Boyd & Abbett, Inc.	617-444-5470
MI	Farmington Hills, J.L. Montgomery Assocs.	313-489-0099
MN	Minneapolis, R-J, Inc.	612-866-3661
MO	Blue Springs, Palatine Sls.	816-229-4007
MO	Florissant, Palatine Sls.	314-839-0800
NH	Plaistow, Coakley, Boyd & Abbett, Inc.	800-225-8402
NJ	Marlton, Naudain Assoc.	609-983-5300
NY	Great Neck, Coakley, Boyd, Abbbett, Tylinski	516-466-9070
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742
OH	Centerville, Bear Mktg.	513-436-2061
OH	Richfield, Bear Mktg.	216-659-3131
TX	Austin, Allied Comps.	512-331-4494
TX	Dallas, Allied Comps.	214-238-0408
TX	Hurst, Allied Comps.	817-589-0456
WI	Milwaukee, Indl. Rep.	414-259-0965
Can	Mississauga, Ont., Hi-Tech Sls.	416-672-0284

Local Distributors

AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, Circuit Specialties	602-996-0764
CA	Buena Park, Cypress/RPS Elctrns.	213-744-0355
CA	Fullerton, Pyramid Elctrns.	714-773-0781
CA	Hawthorne, Electrosonic Comps.	213-970-0997
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CO	Englewood, Ind. Elctrns.	303-694-9444
CT	Bethel, Heilind Elctrns.	203-797-8600
CT	Hartford, Hatry Elctrns.	203-527-1881
CT	New Haven, Hatry Elctrns.	203-787-5921
CT	Stratford, Hatry Elctrns.	203-375-5866
CT	Wallingford, Sager Elect. Supp.	203-265-4600
CT	Waterbury, Hatry Elctrns.	203-755-1181
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Lakeland, AA Elec.	813-665-6941
FL	Longwood, Intertec Inc.	305-834-7777
FL	Miami, Elctrn. Equip. Co.	305-871-3500
FL	Orlando, Hammond Elctrn.	305-849-6060
GA	Doraville, Specialty Distrbg.	404-458-6341
GA	Norcross, AA Elec.	404-449-8670
GA	Norcross, Emsco	404-925-8366
GA	Norcross, Specialty Distrbg.	404-448-4004
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, Ohm Elctrns.	312-359-5500
IN	Carmel, Altex Elctrns.	317-848-1323
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-634-8202
IA	Cedar Rapids, Iowa Radio Supp. Co.	319-393-4510
MD	Gaithersburg, Pioneer/Wash.	301-921-0660
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Wilmington, Heilind Elctrns.	617-657-4870
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MI	Oak Park, Newark Elctrns.	313-967-0600
MN	Fridley, Voyager Elctrns.	612-571-7766
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Thief River Falls, Digikey	218-681-6674
MO	Maryland Hgts., Chelsea Inds.	314-997-7709
NJ	Berlin, General Comps., Inc.	609-768-6767
NJ	Oakland, Relay Spec.	201-337-1000
NJ	Pennsauken, Resco Elctrns.	609-662-4000
NM	Albuquerque, Bell Inds.	505-292-2700

NY Buffalo, Summit Distr. 716-887-2810
NY Lynbrook, Peerless Radio Corp. 516-593-2121
NY Rochester, Masline Elctrns. 716-546-5373
NY Rome, Rome Elctrns. 315-337-5400
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cincinnati, Graham Elctrns. 513-772-1661
OH Dayton, Bell Inds. 513-435-8660
OH Solon, Repco 216-248-8900
OH Twinsburg, Advacom 216-425-8477
OK Tulsa, Radio, Inc. 918-587-9123
OR Portland, Radar Elec. 503-233-3404
PA Export, Advacom 412-733-5400
PA McKean, Advacom 814-476-7774
PA McKeesport, Barno Radio 412-751-5966
PA Philadelphia, Resco Elctrns. 215-743-6702
SC Greenville, Emsco 803-233-4121
TX Dallas, Harrison Equip. Co. 214-239-2750
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Houston, Harrison Equip. 713-879-2711
TX Stafford, Southwest Elctrns. 713-240-4000
WA Kent, Interface Elctrns. 206-872-5800
WA Seattle, Radar Elec. Co. 206-282-2511
WA Spokane, Radar Elec. Co. 509-747-3053
WI Cedarburg, AA Elec. 414-377-7500
WI Mequon, Taylor Elec. 414-241-4321
Can Burnaby, B.C., Semad Elctrns. 604-438-2515
Can Calgary, Alberta, ITT Multicomponents 403-251-5888
Can Concord, Ont., ITT Multicomponents .. 414-736-1144
Can Downsview, Ont., Rae Indl. Elctrns. 416-736-1750
Can Edmonton, Alberta, ITT Multicomponents 403-451-4001
Can Halifax, Nova Scotia, ITT Multicomponents 902-465-2350
Can Markham, Ont., Semad Elctrns. 416-475-4158
Can Ottawa, Ont., Semad Elctrns. 613-727-9489
Can Point Clare, PQ, Semad 514-694-0860
Can Quebec, PQ, ITT Multicomponents 514-335-7697
Can Saskatoon, Saskatchewan, ITT Multicomponents 306-933-2888
Can Surrey, B.C., Memco Elctrn. Mkts. 604-590-1553
Can Toronto, Ont., ITT Multicomponents ... 416-736-1144
Can Vancouver, B.C., ITT MultiComponents 604-291-8866
Can Winnipeg, Manitoba, ITT MultiComponents 204-786-8401
WA Bellevue, Testco, Inc. 206-454-7422

HAMMOND MANUFACTURING CO., 1690 Walden Ave., Buffalo, NY 14225, Tel: 716-894-5710, FAX: 716-894-1156; Empl.: 1,450; *Sls. Mgr.:* Ray Shatzel ..... **C•1057; D•1791**

Local Sales Offices & Reps

AZ Scottsdale, Mahaffey & Assocs. 602-991-9790
CA San Carlos, Hickey Indl. Sls. 415-594-9978
CA Studio City, Bert Moore & Assocs. 213-877-5955
CO Northglenn, Challenge Sls. 303-450-2402
GA Atlanta, Millar Elctrns. 404-634-3350
IL Highland Park, Bransky Sls. 312-433-2375
IN Indianapolis, Wilson Tech. Sls. 317-872-2513
MD Woodbine, DJC Elctrn. Sls. 301-795-7020
MA N. Scituate, W. A. Hendrickson Co. 617-545-0652
MI Troy, Component Assocs. 313-643-8460
MN Golden Valley, Ambassador Inds. Mktg. 612-542-8437
MO St. Louis, Kathrinus, Kelly & Baumhauer 314-647-2400
NY Islip, ABS Technlgs., Inc. 516-277-7101
NY Victor, Net Sls. 716-924-1844
NC Raleigh, Millar Elctrns. 919-828-8840
OH Reynoldsburg, Benchmark Sls. & Mktg. 614-861-2070
PA Philadelphia, DJC Elctrn. Sls. 215-334-4533
TX Dallas, J. Y. Schoonmaker Co., Inc. 214-349-1650

Local Distributors

AL Birmingham, ACK, Inc. 205-322-0588
AZ Phoenix, Electronic Parts Co. 602-277-7281
AZ Tucson, Southwest Sls. 602-628-1613
AR Ft. Smith, Carlton Bates 501-646-8201
AR Little Rock, Carlton Bates 501-562-9100
AR Texarkana, Lavender Dist. Corp. 501-773-4631
CA Chatsworth, Poco Sls. 818-700-8727
CA Manhattan Beach, Prime Electro 213-379-3642
CA Milpitas, Zack Elctrns. 408-942-5432
CA Redwood City, H.D.B. 415-368-1388
CA San Diego, Western Radio Elec. 619-268-4400
CA San Jose, Con. Parts, Inc. 408-435-1200
CA San Jose, Quement Elctrns. 408-998-5900
CA San Rafael, Elctrns. Plus 415-457-0466
CA Santa Ana, ITT Multicomponents 714-727-4001
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CO Denver, Fistell Elctrns. 303-629-1312
CT Bridge Port, Park Distrbg. 203-366-7200
CT Danbury, Pilgrim Elec. 203-792-7274
CT Hartford, Hatry Elec. 203-527-1881
CT New London, Jan Elctrn. Supp. 203-442-4386
CT Norwalk, Cobra 203-847-6442
CT Stratford, Hatry Elec. 203-375-5866
CT Wallingford, Midstate Elec. 203-265-9900
DE Wilmington, Whisl. Elctrns. 302-652-3222
FL Orlando, EMSCO 407-849-6060
FL Tampa, EMSCO 813-253-2684
GA Atlanta, Ack, Inc. 404-351-6340
GA Norcross, Whitehead Elctrns. 404-923-6667
GA Norcross, Wholesale Inds. Elec. 404-447-8431
IL Chicago, Newark Elec. 312-784-5100
IL Joliet, Mainline Elec. 815-436-3900
IL Mt. Prospect, Magnuson Elctrns. 317-956-0700
IL Niles, Joseph Elec. 312-297-4200
IL Wheeling, Hawk Elec. 312-459-4030
IN Indianapolis, Advent Elec. 317-872-4910
IN Indianapolis, Mar Elec. 317-633-6699
IN Lafayette, C.W.Y. Elec. 317-448-1611
IA Cedar Rapids, Dee Elec. 319-365-7551
KY Louisville, Peerless Elctrns. 502-637-7674
LA New Orleans, W. B. Allen Supp. 504-525-8222
MD Gaithersburg, M. S. Elec. 301-921-0200
MA Haverhill, Spartan Elctrns. 508-373-1200
MA Lynn, Land Elec. Supp. 617-592-2220
MA Needham, Y.D.I. 617-449-1005
MA Wellesley Hills, Target Elctrns. Supp. .. 617-235-2545
MA Woburn, Abbott Elec. 617-935-2040
MI Farmington Hills, Advent Elctrns. 313-477-1650
MN Minneapolis, Bergquist 612-835-2322
MN Minneapolis, Tortec Corp. 612-866-3662
MO Kansas City, Electronic Supp. 816-931-0250
MO St. Louis, Van Sickle Radio 314-621-5000
NV Las Vegas, Kiesub Corp. 702-733-3888
NH Dover, American Radio Corp. 603-335-3118
NJ Edison, Brownell Elctrns. 201-287-2037
NJ Oakland, Relay Specialties 201-337-1000
NJ Raritan, Masters Elctrn. Supp. 201-725-3533
NM Albuquerque, Beta Tron Elctrns. 505-821-1122
NY Buffalo, Genesee Ind. Elec. 716-873-9661
NY Buffalo, Summit Dist. 716-887-2800
NY Commack, Spartan Elctrns. 516-499-9500
NY Hempstead, Davis Elctrns. 516-483-9200
NY Poughkeepsie, Chief Elctrns. 914-471-1300
NY Rochester, Goldcrest Elec. 716-546-8464
NY Rochester, Masline Elec. 716-546-5373
NY Rome, Rome Elec. 315-337-5400
NY Syracuse, Salina Elec. 315-422-2336
NY Troy, Trojan Elec. 518-272-4481
NC Greensboro, Hammond Elec. 919-275-6391
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cleveland, Roberts Elec. 216-238-1711
OH Columbus, Thompson Elec. Supp. 614-228-6191
OH Dayton, Stotts Friedman 513-298-5555
OK Oklahoma City, Radio, Inc. 405-528-2391
OK Tulsa, Radio, Inc. 918-587-9123
OR Toledo, International Co. 503-336-2221
PA Drexel Hill, Kass Elec. 215-449-2300
PA McKean, Advacom 814-476-7774
PA Wayne, Peak Elec. 215-293-9000
PA York, Rosen Elctrns. 717-843-3875
RI Pawtucket, Jabbour Elctrn. Supp. 401-728-4600
RI Pawtucket, Major Elec. Supp. 401-725-7400
SC Charleston, Wholsale Inds. Elctrns. 803-722-2634
SC Greenville, EMSCO 803-233-4121
TN Knoxville, Bondurant Bros. 615-573-9151
TX Austin, Galtronics 512-837-7470
TX Corpus Christi, Douglas Elec. 512-883-5103
TX Dallas, Off-the-Shelf Comps. 214-247-0052
TX Dallas, Wholesale Elec. 214-969-9400
TX Ft. Worth, Allied Elec. 817-336-5401
TX Houston, Electrotex 713-526-3456
TX Houston, The Altair Co. 713-462-3029
TX Midland, ESI Supp. 915-694-9657
TX San Antonio, Altex Elctrns. 512-828-0503
TX San Antonio, Sherman Elec. 512-224-1001
UT Salt Lake City, Standard Elec. Supp. .. 801-486-3371
VA Arlington, Arlington Elctrns. 703-524-2412
VA Norfolk, Norfolk Wire 804-499-1100
WA Bellevue, Integrated Elec. 206-455-2727
WI Mequon, Taylor Elec. 414-241-4321
WI Oshkosh, Elctrn. Inds. 414-235-8930
WI Racine, Badger Elctrn. Supp. 414-637-1256

HANCOCK ELECTRONICS CORP., 75 Terry Drive, Hingham, MA 02043, Tel: 617-740-4190, FAX: 617-740-4192; FSC No.: 66851; Empl.: 8; *Sls. Mgr.:* Robert H. Sturdy

HAND HELD PRODUCTS, INC., 8008 Corporate Center Dr., Charlotte, NC 28226, Tel: 704-541-1380, TWX: 810-621-0380 PROTECH, FAX: 704-541-1333; *Sls. Mgr.:* Scott Cardais; *Dist. Mgr.:* Scott Cardais

H & L INSTRUMENTS, 1440 Rollins Road, Burlingame, CA 94010, Tel: 415-342-7850, FAX: 415-347-1065; Empl.: 3; *Sls. Mgr.:* Jenifer H. Landman

HANDY & HARMAN ELCTRN. MATLS. CORP., 72 Elm St., Box 1031, N. Attleboro, MA 02761-1031, Tel: 508-695-1401, FAX: 508-695-7565; Empl.: 300; *Sls. Mgr.:* T. Longo

HANKSCRAFT MOTORS, Div. of Gerber Prods. Co., P.O. Box 120, Reedsburg, WI 53959, Tel: 608-524-4341, FAX: 608-524-6779; Empl.: 550

HANOVIA, Canrad, 100 Chestnut St., Newark, NJ 07105, Tel: 201-589-4300, TELEX: 13-8531, FAX: 201-589-4430; Empl.: 250; *Sls. Mgr.:* Tom Tarantino; *Dist. Mgr.:* Tom Tarantino

HANSCOM, H. F., CO., INC., 225 Chapman St., Providence, RI 02905, Tel: 401-941-1455, FAX: 401-781-8835; Empl.: 50; *Sls. Mgr.:* John E. Christiansen

HARBISON INDUSTRIAL PRODUCTS, 7205 Hibbs La., Levittown, PA 19057, Tel: 215-943-9000, FAX: 215-949-1518; Empl.: 40

HARDIGG INDS., INC., North Main St., South Deerfield, MA 01373, Tel: 413-665-2163, TELEX: 955431; FSC No.: 11214; *Sls. Mgr.:* Norman F. Roberts

HARDMAN INC., 600 Cortlandt St., Belleville, NJ 07109, Tel: 201-751-3000, TWX: 710-995-4940; Empl.: 105

HAROWE SERVO CONTROLS, INC.:A FASCO CO., 110 Westtown Rd. P.O. Box 547, West Chester, PA 19380, Tel: 215-692-2700, TELEX: 685-1176; FSC No.: 06989; Empl.: 300; *Sls. Mgr.:* Clayton A. Walters

HARREL, INC., 16 Fitch St., E. Norwalk, CT 06855, Tel: 203-866-2573; *Sls. Mgr.:* Richard Decew

HARRIS CORP., Computer Systems Div., 2101 W. Cypress Creek Rd., Ft. Lauderdale, FL 33309, Tel: 305-974-1700, TWX: 510-956-9473, FAX: 305-977-5580; FSC No.: 29436

HARRIS CORP., Dracon Div., 809 Calle Plano, Camarillo, CA 93010, Tel: 805-987-9511, TELEX: 182327; Empl.: 350; *Sls. Mgr.:* Tom Erdmann; *Dist. Mgr.:* Keith Boutillier

HARRIS MICROWAVE SEMICONDUCTOR, Harris Semiconductor, 1530 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-433-2222, TWX: 910-338-2247, FAX: 408-432-3268; *Sls. Mgr.:* Vic Kovacevic

HARRIS SEMICONDUCTOR, Box 883, Melbourne, FL 32902, Tel: 305-724-7400, TWX: 510-959-6259; FSC No.: 34371; Empl.: 2300; *Sls. Mgr.:* Dan McCranie; *Dist. Mgr.:* Charles H. Beaty

HARTLEY PRODUCTS, 1200 N. 23rd St., Ste. 105, Wilmington, NC 28405, Tel: 919-763-7422; *Sls. Mgr.:* R. Schmetterer

HARTMANN, 10097 Tyler Place, Ijamsville, MD 21754, Tel: 301-831-1055, FAX: 301-831-8072; Empl.: 2; *Sls. Mgr.:* Nancy Schwartz

HARTWELL CORP., 900 S. Richfield Rd., Placentia, CA 92670, Tel: 714-993-4200, TELEX: 683-485, TWX: 910-596-1294; FSC No.: 83014; Empl.: 425

HARWIL, 1548 17th St., Santa Monica, CA 90404, Tel: 213-829-2310, FAX: 213-829-2259; Empl.: 10

HASCO COMPONENTS, INC., 247-40 Jericho Tpke., Bellrose Village, NY 11001, Tel: 516-328-9292, TWX: 710-582-5750, FAX: 516-326-9125; Empl.: 30; *Sls. Mgr.:* Tab Hauser ..... **B•1514-1521, 1752**

Local Sales Offices & Reps

AZ Phoenix, Sanford Sls. 602-957-3570
CA Irvine, Groh Assocs. 714-837-9871
FL Hollywood, Advantage 305-962-2255
IL Chicago, Rendell Sls. 312-539-1820
MI Brighton, AP Assocs. 313-229-6550
MN Minneapolis, Holmgren Assocs. 612-786-7641
NJ Parlin, JMR 201-254-8484
NY Long Island, Hasco Comps. 516-328-9292
WA Seattle, Jensen Assocs. 206-874-2772
Can Toronto, Ont., CEA Assocs. 416-231-9717

Hathaway

FAX: 918-438-7629

HATHAWAY CORPORATION: MOTION CONTROL DIV., 10837 E. Marshall, Tulsa, OK 74116, Tel: 918-438-7800; Empl.: 80; *Sls. Mgr.:* David Richards ..... **B•1253**

Local Sales Offices & Reps

AL Huntsville, DHR Mktg., Inc. 205-722-0440
AZ Scottsdale, Bill Earl Assoc., Inc. 602-994-3813
CA El Toro, SDK & Assocs. Ltd. 714-855-9881
CA Santa Clara, Fahrner Miller Assoc., Inc. 408-727-9800
CO Englewood, Dynatech, Inc. 303-773-2830
CT Waterbury, Underwood Sls. Corp. 508-256-8191
FL Tampa, DHR Mktg., Inc. 407-740-7940
GA Duluth, DHR Mktg., Inc. 404-564-0529
IL Addison, Vikeland Sls., Inc. 312-832-8425
MA Lowell, Underwood Sls. Corp. 508-256-8191
MI Brighton, A.P. Assocs., Inc. 313-229-6550
MN St. Paul, Vikeland Sls., Inc. 612-645-4647
NY Sidney, Southern Tier Equip. 607-563-8978
NC Raleigh, DHR Mktg., Inc. 919-829-1970
OH Cincinnati, Stegman Blaine Mktg. 513-729-1969
OR Portland, General Elctrns. 503-297-8500
PA Philadelphia, Homersmith, Inc. 215-543-2434
SC Greenville, DHR Mktg., Inc. 803-235-3594
TN Nashville, DHR Mktg., Inc. 615-331-2745
TX Dallas, R.F. Kimball Co., Inc. 214-231-3447
VA Richmond, DHR Mktg., Inc. 304-359-8803
WI Waukesha, Vikeland Sls., Inc. 414-782-1133

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HEI CORPORATION, 350 E. Randy Road, Carol Stream, IL 60188, Tel: 312-665-5500, FAX: 312-665-5769; Empl.: 20

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HICKOK ELECTRIC INSTRUMENT, 10514 DuPont Ave., Cleveland, OH 44108, Tel: 216-541-8060; Empl.: 450; *Sls. Mgr.:* Norm Holliday; *Dist. Mgr.:* Jeff Snider

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HI-G COMPANY, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, Tel: 203-522-8600, TELEX: 643394, TWX: 710-425-1379, FAX: 203-524-8540; FSC No.: 02289; Empl.: 550; *Sls. Mgr.:* J. Parsons ..... **B•1522-1538**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-533-9281
AZ	Phoenix, Westrep	602-997-8899
CA	Anaheim, Westrep	213-404-3881
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Westrep	408-988-8833
CO	Englewood, Omega	303-762-1921
CT	Bloomfield, Friedman Sls.	203-243-3122
FL	Orlando, Comp. Des. Mkt.	407-352-5480
GA	Norcross, 20th Century Mkt.	404-446-1999
IL	Highland Park, Bransky Sls.	312-433-2375
IN	Fort Wayne, TX Sls.	219-489-4447
IA	Cedar Rapids, Pattison Sls.	319-395-9866
KS	Olathe, Advanced Tech. Sls.	913-782-8702
MD	Monkton, Imagitron Sls. Co.	301-374-5600
MA	Needham, Friedman Sls.	617-459-7399
MI	Ft. Wayne, TX Sls.	219-489-4447
MN	St. Paul, Repco	612-642-2828
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NJ	West Caldwell, Grimm-Siegel Assoc.	201-575-9300
NY	E. Rochester, Tri-Tech Elctms.	716-385-6500
NC	Gary, 20th Century Mkt.	919-481-3370
OH	Miamisburg, Elctms. Comps., Inc.	513-866-3340
OR	Lake Oswego, RTS	503-244-4123
TN	Knoxville, 20th Century Mkt.	615-966-2099
TX	Euless, Fralia Co.	817-354-1144
WA	Vashon, RTS	206-285-1363
WI	Cedarburg, Bransky Sls.	414-377-6837
Can	Downsview, Ont., Designtronics	416-747-1171

Local Distributors

AL	Huntsville, Hallmark Elctms.	205-837-8700
AZ	Phoenix, Hallmark Elctms.	602-437-1200
AR	Little Rock, Electro Entprs.	501-562-6936
CA	Buena Pk., Cypress Elctms.	213-744-0355
CA	Canoga Park, Hall-Mark Elctms.	818-716-7300
CA	Citrus Hgts., Hall-Mark Elctms.	916-722-8600
CA	Irvine, Integrated Elctms.	714-660-1055
CA	San Diego, Hallmark Elctms.	714-268-1201
CA	San Jose, Cypress Elctms.	408-945-8400
CA	San Jose, Hall-Mark Elctms.	408-946-0900
CA	Santa Ana, Norstan Elctms.	714-250-4903
CA	Torrance, Hall-Mark Elctms.	213-217-8400
CA	Tustin, Hallmark Elctms.	714-359-0330
CO	Denver, Integrated Elctms.	303-292-6121
CO	Englewood, Hallmark Elctms.	303-790-1662
CT	Wallingford, Hallmark Elctms.	203-269-0100
FL	Clearwater, Hallmark Elctms.	305-530-4543
FL	Orlando, Hallmark Elctms.	305-855-4020
FL	Ovideo, Aztech	407-365-2241
FL	Pompano, Hallmark Elctms.	305-971-9280
GA	Norcross, Hallmark Elctms.	404-447-8000
IL	Wood Dale, Hallmark Elctms.	312-860-3800
IN	Indianapolis, Hallmark Elctms.	317-876-7165
KS	Lenexa, Hallmark Elctms.	913-888-4747
KS	Wichita, Lee Prods.	316-264-2172
MD	Columbia, Aztech	301-995-6859
MD	Columbia, Hallmark Elctms.	301-988-9800
MD	Columbia, Vantage Comps.	301-720-5100
MA	Billerica, Hallmark Elctms.	617-667-4129
MA	Woburn, A.C.I. Elctms.	617-935-7230
MN	Eden Prairie, Hallmark Elctms.	612-941-2600
MO	Maryland Heights, Hallmark Elctms.	314-291-5350
NJ	Clifton, Vantage Comps.	201-777-4100
NJ	Fairfield, Hallmark Elctms.	201-575-4415
NJ	Mt. Laurel, Hallmark Elctms.	609-235-1900
NJ	Oakland, Relay Specialties	201-337-1000
NY	Commack, Vantage Comps.	516-543-2000
NY	Hauppauge, Jaco Elctms.	516-273-5500
NY	Hauppauge, Sherburn Elctms.	516-231-4300
NY	Ron Kon Koma, Hallmark Elctms.	516-737-0600
NC	Raleigh, Hallmark Elctms.	919-872-0902
OH	Solon, Hallmark Elctms.	216-349-4632
OH	Worthington, Hallmark Elctms.	614-888-3313
OK	Oklahoma City, Electro Entprs.	405-427-6591
OK	Tulsa, Hallmark Elctms.	918-665-3200
OR	Beaverton, Integrated Elctms.	503-641-1690
TX	Austin, Hallmark Elctms.	512-258-8848
TX	Dallas, Hallmark Elctms.	214-553-4300
TX	Houston, Hallmark Elctms.	713-781-6100
TX	Irving, Aztech	214-401-4118
UT	West Valley City, Hall-Mark Elctms.	801-972-1008
WA	Bellevue, Integrated Elctms.	206-455-2727
Can	Pointe Claire, Future	514-694-7710

HIGH ENERGY, Inductotherm Industries, Lower Valley Rd., Parkesburg, PA 19365, Tel: 215-593-2800, TELEX: 759888, FAX: 215-593-2985; Empl.: 65

HIGHLAND TECHNOLOGY, INC., 320 Judah Street, San Francisco, CA 94122, Tel: 415-753-5814; Empl.: 8; *Sls. Mgr.:* Hugh Callahan

HIGH REL BURN-IN, Riverside Assoc. Inc., 1710 Ringwood Ave., San Jose, CA 95131, Tel: 408-437-0300, FAX: 408-437-1418; FSC No.: 4Y548; Empl.: 30; *Sls. Mgr.:* Beth Pagano

HIGH TECHNOLOGY SENSORS, INC., 262 E. Hornbeam Dr., Longwood, FL 32779, Tel: 407-423-1755; Empl.: 7; *Sls. Mgr.:* R. M. Mindock

FAX: 914-968-0347

HIGH VOLTAGE TECHNOLOGY INC., 71 Alexander St., Yonkers, NY 10701, Tel: 914-423-6636; Empl.: 7; *Sls. Mgr.:* Pete Gonzalez ..... **D•1802-1804**

Local Sales Offices & Reps

CA	Irvine, CMI Corp.	714-552-3271
NM	Albuquerque, IMEC	505-883-9010
NY	Patchogue, Optimum Sls. Co.	516-758-0644
EXP	Tokyo, Japan, EWIG Engrg.	03-464-1978

HILEVEL TECHNOLOGY, 31 Technology Drive, Irvine, CA 92718, Tel: 714-727-2100, TELEX: 655316, FAX: 714-727-2101; Empl.: 82; *Sls. Mgr.:* Dan Riordan

HILTON INDUSTRIES, INC., Subsidiary of Core Industries, 1177 Cattlemen Road, Sarasota, FL 34232, Tel: 813-371-2600, TWX: 810-864-4363, FAX: 813-371-7750; Empl.: 137; *Sls. Mgr.:* F. Moloney; *Dist. Mgr.:* F. Moloney

FAX: 914-279-2467

HIPOTRONICS INC., P.O. Drawer A, Brewster, NY 10509, Tel: 914-279-8091; FSC No.: 25284; Empl.: 200; *Sls. Mgr.:* Robert Schlesinger ..... **A•2304-2306; D•1280-1283, 1806-1807, 2203-2205**

Local Sales Offices & Reps

AL	Birmingham, Spader & Assocs.	205-979-5551
AZ	Litchfield Pk., S.W. Elctrl. Sls.	602-935-7292
CA	San Diego, RDX Corp.	619-581-0077
CA	San Dimas, RDX Corp.	714-599-0985
CA	Sunnyvale, RDX Corp.	408-734-4500
CO	Parker, Equal Elec. Inc.	303-841-8982
CT	Branford, Abbott Allison Co.	203-481-0405
FL	Daytona Bch. Shores, W. Rihm Assocs.	904-761-7130
GA	Decatur, Spader & Assocs.	404-296-3041
HI	Honolulu, B. F. Wittenberg	808-696-5538
IL	Hawthorne Woods, Ryan & Assocs.	312-438-2905
MO	St. Louis, Fitzgerald Sls. Co.	314-862-1660
MN	Edina, Ainslie Co.	612-920-2996
NJ	Union, Friedman Assocs., Inc.	201-964-6200
NM	Albuquerque, Brytec Sls. Inc.	505-884-1123
NY	Le Roy, Hasgo Power Equip.	716-768-8500
OH	Vermilion, Robert S. Howley	216-967-8787
PA	Downingtown, Kenn Ebert-Hipotronics	215-269-5898
UT	Salt Lake City, Riter Engrg. Co.	801-973-9063
WA	Redmond, Gore Elec. Co.	206-883-4505
PR	Santurce, Mario R. Franceschini Inc.	809-725-7080
Can	Burnaby, B.C., C. D. Nova	604-430-5612
Can	Halifax, B.C., D. C. Keddy Ltd.	902-453-1711
Can	Quebec, J46 1L9, Tremcour Elctm.,Inc.	514-522-7757
Can	Weston, Ont., U-Tek Svcs. & Supp.	416-747-1879

HI-Q CRYSTALS, Hybrids International Ltd., 311 N. Lindenwood Dr., Olathe, KS 66062, Tel: 913-764-4544, TWX: 910-743-0029, FAX: 913-764-6400; Empl.: 20; *Sls. Mgr.:* Abdul Ghafoor ..... **A•1411**

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HIRAM JONES ELECTRONICS, 11607 Vanowen St, No. Hollywood, CA 91605, Tel: 213-875-0213; FSC No.: 04867; Empl.: 8 ..... **C•1372-1375**

Local Distributors

TX Houston, Lenert Co. 713-225-1465

HIROSE ELECTRIC U.S.A., INC. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), 2685-C Park Center Drive, Simi Valley, CA 93065, Tel: 805-522-7958, FAX: 805-522-3217; Empl.: 25 (USA), 720 (Japan); *Sls. Mgr.:* Jim Erickson ..... **C•1378-1380**

RICHARD HIRSCHMANN OF AMERICA INC., Industrial Row, P.O. Box 229, Riverdale, NJ 07457, Tel: 201-835-5002, FAX: 201-835-8354; *Sls. Mgr.:* C. Patten

HISONIC, INC., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, Tel: 913-782-0012, TELEX: 4-2562, ESYLNK: 62829955, FAX: 913-782-0562; FSC No.: 11402; Empl.: 185; *Sls. Mgr.:* W. S. Bonebright ..... **A•2307**

Local Sales Offices & Reps

AL Huntsville, MacKay, Smith & Assocs. .. 205-539-8000
AZ Scottsdale, Arcom Sls., Inc. 602-947-5745
FL Ft. Lauderdale, MacKay, Smith & Assocs. 305-467-3888
FL Orlando, MacKay, Smith & Assocs. ... 407-277-1513
FL St. Petersburg, MacKay, Smith & Assocs. 813-530-1873
GA Atlanta, MacKay, Smith & Assocs. 404-496-9913
KS Shawnee Mission, Florence & Meyer 913-722-5210
MO St. Louis, Florence & Meyer 913-722-5210
NC Charlotte, MacKay, Smith & Assocs. .. 704-372-1188
NC Raleigh, MacKay, Smith & Assocs. 919-847-2277
TX Austin, Aid Elctrns. 512-836-6724
TX Irving, AID Elctrns. 214-259-4761

HITACHI AMERICA, LTD., 2210 O'Toole Ave., San Jose, CA 95131, Tel: 408-435-8300, TELEX: 17-1581, TWX: 910-338-2103; *Dist. Mgr.:* Daryl Lundquist

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Local Sales Offices & Reps

AL Huntsville, Technlg. Mktg. Assoc. 205-883-7893
AZ Mesa, System Sls. of Arizona 602-464-9989
CA San Jose, Quadrep 408-432-3300
CO Parker, Parker Webster 303-841-4888
CT Wallingford, Technlg. Sls., Inc. 203-269-8853
FL Orlando, Technlg. Mktg. Assoc. 407-857-3760
GA Atlanta, Technlg. Mktg. Assoc. 404-446-3565
IL Chicago, M. Gottleib Assoc., Inc. 312-775-1151
IN Indianapolis, Elctrn. Sls. & Engrg. 317-849-4260
IA Cedar Rapids, Barnes Wes-Tech 319-393-9790
KS Overland Park, West & Assocs. 913-345-1248
MD Columbia, Robert Elctrn. Sls. 301-995-1900
MA Waltham, Technlg. Sls. Inc. 617-890-5700
MI Plymouth, Jay Mktg. 313-459-1200
MN Bloomington, Hitachi Ltd. 612-896-3444
NJ Teaneck, Strategic Sls., Inc. 201-833-0099
NM Albuquerque, System Sls. of AZ 505-889-2901
NY Fairport, Technlg. Sls., Inc. 716-223-7500
NC Charlotte, Robert Elctrn. Sls. 704-563-1223
NC Raleigh, Robert Elctrn. Sls. 919-878-4465
OH Dayton, Thompson & Assocs. 513-435-7733
OK Tulsa, West & Assocs. 918-665-3465
OR Portland, Crown Elctrns. 503-620-8320
PA Willow Grove, Technlg. Sls., Inc. 215-784-0170
TX Richardson, West & Assocs. 214-680-2800
UT Murray, Parker Webster 801-266-9939
WA Bellevue, Crown Elctrns. 206-643-8100
WI Brookfield, Sumer, Inc. 414-784-6641
Can Mississuaga, Ont., Longman Sls. 416-670-8100

Local Distributors

AL Huntsville, Marshall 205-881-9235
AZ Phoenix, Marshall 602-496-0290
AZ Phoenix, Sterling 602-268-2121
CA Angora Hills, Western Micro 818-707-0377
CA Chatsworth, Marshall 818-407-4100
CA Irvine, ITT 714-727-4001
CA Irvine, Marshall 714-458-5301
CA Irvine, Western Micro 714-637-0200
CA Sacramento, IEC 916-424-5297
CA San Diego, Marshall 619-578-9600
CA San Jose, IEC 408-435-1000
CA San Jose, ITT 408-453-1404
CA San Jose, Marshall 408-942-4600
CA Saratoga, Western Micro 408-725-1660
CO Denver, IEC 303-292-6121
CO Denver, Marshall 303-451-8383
CO Englewood, Sterling 303-792-3939
CT Milford, Milgray 203-878-5538
CT Wallingford, Cronin 203-265-3134
CT Wallingford, Marshall 203-265-3822
FL Deerfield Beach, Vantage 305-429-1001
FL Ft. Lauderdale, Marshall 305-977-4880
FL Ft. Lauderdale, Reptron 305-735-1112
FL Orlando, Marshall 407-767-8585
FL Orlando, Milgray 407-647-5747
FL Tampa, Reptron 813-855-4656
GA Atlanta, Marshall 404-923-5750
GA Atlanta, Milgray 404-446-9777
GA Norcross, Reptron 404-446-1300
IL Arlington Hgts., Milgray 312-253-1212
IL Chicago, Marshall 312-490-0155
IL Hoffman Estates, IEC 312-843-2040
IL Schaumburg, Reptron 312-882-1700
IN Indianapolis, Marshall 317-297-0483
KS Kansas City, Marshall 913-492-3121
KS Kansas City, Milgray 913-236-8800
KS Kansas City, Sterling 913-492-5406
MD Baltimore, Resco 301-529-0500
MD Columbia, Milgray 301-995-6169
MD Columbia, Vantage 301-720-5100
MD Silver Springs, Marshall 301-622-1118
MA Boston, Western Micro 508-273-2800
MA Needham, Cronin 617-449-5000
MA New England, Milgray 508-657-5900
MA Wilmington, Marshall 508-658-0810
MI Livonia, Marshall 313-525-5850
MI Livonia, Reptron 313-525-2700
MN Minneapolis, Marshall 612-559-2211
MN Minneapolis, Sterling 612-831-2666
MN Minnetonka, Reptron 612-938-0000
MO St. Louis, Marshall 314-291-4650
NJ Clifton, Vantage 201-777-4100
NJ Mt. Laurel, Marshall 609-234-9100
NJ N. New Jersey, Marshall 201-882-0320
NJ Parsippany, Milgray 201-335-1766
NJ S. Plainfield, Sterling 201-769-7000
NM Albuquerque, Sterling 505-884-1900
NY Binghamton, Marshall 607-798-1611
NY Farmingdale, Milgray 516-420-9800
NY Long Island, Marshall 516-273-2424
NY Rochester, Marshall 716-235-7620
NY Rochester, Milgray 716-235-0830
NY Smithtown, Vantage 516-543-2000
NC Raleigh, Marshall 919-878-9882
OH Dayton, Marshall 513-898-4480
OH Solon, Marshall 216-248-1788
OH Worthington, Reptron 614-436-6675
OK Tulsa, Sterling 918-663-2410
OR Beaverton, IEC 503-641-1690
OR Beaverton, Western Micro 503-629-2087
OR Portland, Marshall 503-644-5050
TX Austin, Marshall 512-837-1991
TX Austin, Sterling 512-836-1341
TX Dallas, Marshall 214-233-5200
TX Dallas, Sterling 214-243-1600
TX Houston, Marshall 713-895-9200
TX Houston, Sterling 713-627-9800
UT No. Salt Lake City, IEC 801-298-1869
UT Salt Lake City, Marshall 801-485-1551
UT Salt Lake City, Milgray 801-272-4999
VA Richmond, Sterling 804-226-2190
VA Washington/ Baltimore, Sterling 703-742-8400
WA Bellevue, IEC 303-292-5537
WA Redmond, Western Micro 206-881-6737
WA Seattle, Marshall 206-747-9100
WI Milwaukee, Marsh 414-475-6000
WI Waukesha, Marshall 414-797-8400
Can Alberta, ITT 403-451-4001
Can Alberta, ITT 403-251-5888
Can British Columbia, ITT 604-192-8866
Can British Columbia, Space Elctrns. 604-294-1167
Can Manitoba, ITT 204-786-8401
Can New Brunswick, ITT 506-857-8011
Can Ontario, ITT 416-736-1148
Can Ontario, ITT 613-226-7406
Can Ontario, Space Elctrns. 416-638-4771
Can Ontario, Space Elctrns. 613-820-8313
Can Prince Edward Island, ITT 902-465-2350
Can Quebec, ITT 514-335-7697
Can Quebec, Space Elctrns. 514-697-8676
Can Saskatchewan, ITT 306-933-2888

HITACHI AMERICA, LTD., 220 White Plains Rd., Tarrytown, NY 10591, Tel: 914-631-0600, TELEX: 234553, FAX: 914-631-0672; *Sls. Mgr.:* William Porter; *Dist. Mgr.:* John McDonnell

HITACHI DENSHI AMERICA LTD., Test & Meas. Div., 175 Crossways Pkwy. W., Woodbury, NY 11797, Tel: 516-921-7200, TWX: 510-221-1899; Empl.: 110

HI-TECH COMPONENTS, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022, Tel: 212-605-2607, TWX: 710-581-6762; Empl.: 10; *Sls. Mgr.:* Bill Adikes; *Dist. Mgr.:* Tom Hayashi

HI-TECH, INC., 3600 16th St., Zion, IL 60099, Tel: 312-746-2447, FAX: 312-746-4945; Empl.: 35; *Sls. Mgr.:* Sue Lawson ..... **C•1659**

Local Sales Offices & Reps

AL Birmingham, Wade Prods. 205-822-5546
CA Woodland Hills, Glenn M. Stevenson Co. 213-348-5506
IL Chicago, Jerry Golten co. 312-792-1991
MI Sheridan, MacDougall and Assocs. ... 517-291-3334
NY Huntington, Andrews & Andrews 516-692-8686
OH Seven Hills, Nenadal Entprs. 216-524-4293
TN Chattanooga, Wade Prods. Co. 615-266-2262

HITEMP TECHNOLOGIES, INC., 118 Charcot Ave., San Jose, CA 95131-1101, Tel: 408-922-0740, FAX: 408-922-0534; Empl.: 10; *Sls. Mgr.:* JoAnn Ricci

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Local Sales Offices & Reps

AL Birmingham, Robertson Sls. 205-823-4187
AZ Scottsdale, Electro Mktg. 602-991-0110,

CO	Denver, Calvert Controls	303-428-4852
CT	Guilford, Motion Controls Assocs.	203-457-1874,
CT	Ridgefield, Manning & Assocs., Inc.	203-438-5027
ID	Boise, Calvert Controls	208-343-3964
IL	Addison, Hedge Assocs., Inc.	312-543-0888
LA	Metairie, RAPCO Assocs., Inc.	504-887-9500,
MA	Uxbridge, Motion Controls Assocs.	617-278-6886
NY	Syracuse, Lachut Elctrl. Sls.	315-458-6486,
NC	Charlotte, Servicon Sls. Corp.	704-525-4800,
OH	Broadview Hgts., MC, Inc.	216-526-6511,
OR	Eugene, Calvert Controls	503-683-2018
OR	Portland, Calvert Controls	503-236-1358
PA	Fort Washington, Hostvedt-Pavoni, Inc.	215-643-5757
PA	Pittsburgh, Greye Glass Assocs.	412-366-6664
UT	Salt Lake City, Calvert Controls	801-531-8129
WA	Seattle, Calvert Controls	206-251-6135
WA	Spokane, Calvert Controls	509-244-3601
WA	Tacoma, Calvert Controls, Inc.	206-383-1130
WA	Tri-Cities, Calvert Controls	509-545-4506
WV	Sissonville, Interstate Ind. Sls. Corp.	304-988-3687
WI	Brookfield, Kirchmayer-Seidel	414-781-5469
	Local Distributors	
NY	Jamaica, Queens Indl. Elec. Corp.	718-526-7198
RI	Providence, WALCO Elec. Co.	401-467-6500,

HMW ENTERPRISES, INC., 604 Salem Road, Etters, PA 17319, Tel: 717-938-4691, TWX: 510-650-3536, FAX: 717-938-4095; FSC No.: 06A150; Empl.: 40; *Sls. Mgr.:* Gerhard Schmutz

HOBSON BROS., 4940 W. Lawrence Ave., Chicago, IL 60630-3884, Tel: 312-283-3600, FAX: 312-283-3606; Empl.: 75; *Sls. Mgr.:* Betty Maager

HODGE MANUFACTURING CO., INC., 55 Fisk Ave., Springfield, MA 01107, Tel: 413-781-6800, FAX: 413-733-6573; *Sls. Mgr.:* Edwin L. Kossoy

HOFFMAN, P. R., CO., MATERIALS PROCESSING DIV., Spreckels Industries Inc., 321 Cherry St, Carlisle, PA 17013, Tel: 717-243-2011, TWX: 510-650-2285, FAX: 717-243-1672; Empl.: 125; *Sls. Mgr.:* Lee Kingsborough

HOFFMAN ENGINEERING, 900 Ehlen Dr., Anoka, MN 55303, Tel: 612-421-2240, TELEX: 29-0499, TWX: 910-578-2211, FAX: 612-421-1556; *Sls. Mgr.:* Larry Muehlbauer

HOFFMAN ENGINEERING CORP., 20 Acosta St, Stamford, CT 06902, Tel: 203-325-8933, FAX: 203-327-4812; FSC No.: 06097; Empl.: 49; *Sls. Mgr.:* Jack DeSoye

HOKE INCORPORATED, 1 Tenakill Pk., Cresskill, NJ 07626, Tel: 201-568-9100, TELEX: 135428, FAX: 1-201-568-5913; *Sls. Mgr.:* Mark Christensen; *Dist. Mgr.:* Len Messina

HOLADAY INDUSTRIES, INC., 14825 Martin Drive, Eden Prairie, MN 55344, Tel: 612-934-4920, TELEX: 290922, FAX: 612-934-3604; Empl.: 29; *Sls. Mgr.:* Burton Gran

HOLD-HEET PRODUCTS CORP., 5011 N. Ravenswood Ave., Chicago, IL 60640, Tel: 312-728-4454, 312-728-4455; Empl.: 15; *Sls. Mgr.:* Dan Mundt; *Dist. Mgr.:* Dan Mundt ..... **B•1539**

HOLIDAY-HAMMOND CORP., 220 S. 2nd Street, Waco, TX 76701, Tel: 817-756-7401; Empl.: 30; *Sls. Mgr.:* Pat Holiday

HOLLEX, INC., See Cabletest Products Co.

HOLLINGSEAD INTERNATIONAL, 13701 Excelsior Drive, Santa Fe Springs, CA 90670, Tel: 213-921-3438, TELEX: 691-462, FAX: 213-921-6313; *Sls. Mgr.:* Doug Wagner

HOLLIS AUTOMATION, Esterline Corporation, 15 Charron Ave., Nashua, NH 03061, Tel: 603-889-1121, TELEX: 710-2281881; Empl.: 150; *Sls. Mgr.:* John L. Chugg; *Dist. Mgr.:* Jerry Vermette

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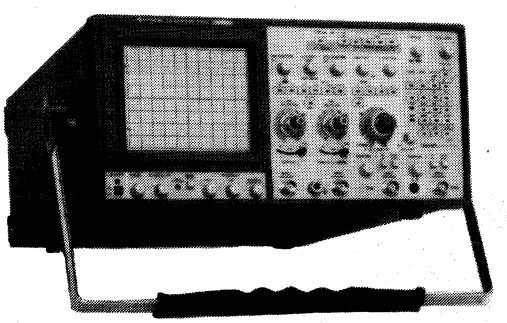

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OH	Cleveland, Matthew Haley Co.	216-892-1820
OH	Perrysburg, Matthew Haley Co.	419-874-0488
OK	Tulsa, Don Plummer Sls. Co.	918-835-0979
OR	Portland, SPS Elctrns.	503-297-6919
PA	Cuddy, Brown-Yates Elec.Equip. Co.	412-221-4200
PA	Philadelphia, Fite-Walker, Inc.	215-233-2100
SC	Taylors, Heritage Sls. Assocs.	803-292-1723
TN	Knoxville, Tubbs Agy.	615-577-0689
TN	Memphis, Electro-tech	901-372-4550
TX	Dallas, SW Mktg. Assocs.	214-341-8631
TX	Houston, SW Mktg. Assocs.	713-537-8166
UT	Salt Lake City, T.M.M.I.	801-487-7676
VA	Alexandria, T.D.I.	703-971-8982
VA	Richmond, Dunnington & Assocs.	804-282-8383
WA	Redmond, SPS Elctrns.	206-323-4140
WI	Appleton, Bu-Nell Engrg.	414-733-4242
WI	Waukesha, Bu-Nell Engrg.	414-784-0994

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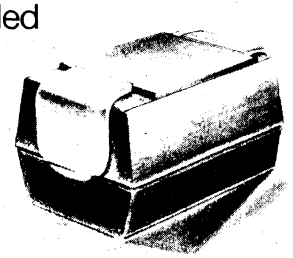

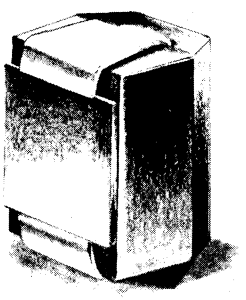

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FAX 714/491-2292

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IEC ELECTRONICS, 105 Norton St., Newark, NY 14513, Tel: 315-331-7742, TWX: 910240, ESYLNK: 6290-2827, FAX: 315-331-3547; Empl.: 850; *Sls. Mgr.:* Frank Montabana; *Dist. Mgr.:* Frank Montabana

FAX: 818-901-9046

IEE (INDUSTRIAL ELECTRONIC ENGINEERS), 7740 Lemona Ave., Van Nuys, CA 91405, Tel: 818-787-0311, TELEX: 6831955IEE INT; Empl.: 425; *Sls. Mgr.:* R. Nisar ..... **B•1087**

Local Sales Offices & Reps

AL Huntsville, DHR Mktg., Inc. 205-722-0440
AL Huntsville, TMA Technlg. Mktg. Assocs. 205-883-7893
AZ Phoenix, Howe & Howe Sls., Inc. 602-264-7971
CA Brea, Masco Elctrns., Inc. 714-529-0866
CA Campbell, LCO Tech. Sls. 408-378-9900
CA Los Angeles, Masco Elctrns., Inc. 714-529-0866
CA Vista, Masco Elctrns., Inc. 619-758-5562
CO Lakewood, Cristee-Meade Co. 303-232-0287
CA San Jose, Class One Elctrns. 408-297-8666
CT North Haven, Kitchen & Kutchin, Inc. .. 203-239-0212
FL Largo, TMA Technlg. Mktg. Assocs. 813-541-1591
FL Melbourne, TMA Tech. Mktg. Assocs. 407-676-3776
FL Orlando, TMA Tech. Mktg. Assocs. 407-857-3760
FL Pompano Beach, TMA Tech. Mktg. Assocs. 305-977-9006
GA Duluth, DHR Mktg., Inc. 404-564-0529
GA Norcross, TMA Tech. Mktg. Assocs. 404-446-3565
IL Arlington Hgts., Phoenix Elctrn. Sls. 312-394-4422
IL Highland Park, Bransky Sls. 312-433-2375
IN Indianapolis, Wilson Tech. Sls. 317-872-2513
KS Lenexa, Midtec 913-541-0505
MD Hunt Valley, Marktron, Inc. 301-628-1111
MD Rockville, Marktron, Inc. 301-251-8990
MA Burlington, Kitchen & Kutchin, Inc. 617-229-2660
MI Southfield, L. H. Dickelman Co. 313-353-8210
MN Burnsville, 2M Sales, Inc. 612-890-7774
NY N. Syracuse, Advanced Comps. Corp., Inc. 315-699-2671
MO St. Louis, Midtec 314-275-8666
NC Raleigh, DHR Mktg., Inc. 919-829-1979
OH Richfield, Geotronix, Inc. 216-659-6100
OH Trotwood, Geotronix, Inc. 513-854-5939
OR Beaverton, Olson Tech. Sls. Corp. 503-643-9488
PA Allison Pk., Geotronix, Inc. 412-487-1770
PA Norristown, RJI 215-631-1414
SC Greenville, DHR Mktg., Inc. 803-235-3594
TX Dallas, MGR Elctrns., Inc. 214-238-5246, 713-759-0187
VA Springfield, Pantech 703-451-5700
WA Bellevue, Olson Tech. Sls. Corp. 206-883-7792
WI Cedarburg, Bransky Sls. 414-377-6837

Local Distributors

AL Birmingham, American Elctrns. 205-942-4656
AL Huntsville, Component Distr. 205-883-7501
AZ Phoenix, Tri-Tek, Inc. 602-371-0860

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CA Gardena, California Switch & Signal Co. 213-538-9830
CA Industry, Ital Elctrn. Sls., Inc. 818-968-8515, 714-990-0922
CA Lakeside, Mouser Elctrn. Corp. 619-449-2222
CA San Diego, Richey/Western Elctrns. .. 619-271-4511
CA San Jose, Richey/Western Elctrns. ... 408-727-7411
CA Santa Monica, Master Distrs. 213-452-1229
CA Sunnyvale, Penstock 408-727-1200
CA Sunnyvale, Target Elctrns. Inc. 408-734-5611
CO Denver, Integrated Elctrns. 303-292-6121
CT East Haven, J. V. Elctrns. 203-469-2321
CT Wallingford, Cronin Elctrns. 203-265-3134
FL Altamonte Springs, Pioneer Technlgs. Grp., Inc. 407-834-9090,800-432-6094
FL Miami, Elctrn. Equip. Co., Inc. 305-871-3500, 800-432-1235
IL Bensenville, Voyager Elctrns. Corp. ... 312-860-1300
IL Chicago, Bell Inds. 312-640-1910
IL Chicago, Newark Elctrns. 312-784-5100
IL Elgin, Allied Elctrns. 312-697-8200
IL Elmhurst, Semiconductor Specialists, Inc. 312-279-1005
IL Northbrook, Classic Comps. 312-272-9650
IN Carmel, Altex Elctrns., Inc. 317-848-1323, 800-692-6039
MD Gaithersburg, Pioneer Technlgs. Grp., Inc. 301-921-0660
MD Jessup, Treeko Elctrns., Inc. 301-792-0112
MA Billerica, Mayer Co., Inc. 508-667-6900
MA Needham, Cronin Elctrns., Inc. 617-449-5000
MI Grand Rapids, S-F Elctrn. Supp. Inc. .. 616-459-0216
MI Southfield, Michigan Lectrols Corp. 313-353-1350, 800-445-5714
MN Minneapolis, Stark Elctrns. 612-332-1325
MO Maryland Hgts., Chelsea Inds. 314-997-7709
NJ Randolph, Mouser Elctrn. Corp. 201-328-3322
NM Albuquerque, Betatron Elctrns. 505-821-1122
NM Albuquerque, Intl. Elctrns. 505-291-9951
NY Farmingdale, Pride Elctrns. 516-293-4020
NY Farmingdale, S.A.I. 516-293-2710
NY Mamaroneck, Logicomp Elctrns. 914-698-9332
NY Rochester, Masline Elctrns. 716-546-5373
NC Greensboro, Hammond Elec. 919-275-6391
NC Raleigh, So. Eastern. Elctrns. 919-828-2311
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cleveland, Alpha Distr. Corp. 216-659-7100
OH Dayton, The Stotts-Friedman Co. 513-298-5555
OK Oklahoma City, Electro Entrs., Inc. 405-427-6591
PA Philadelphia, Herbach & Rademan, Inc. 215-426-1700
PA Philadelphia, PEI/Genesis Elctrns. 215-673-0400
SC Greenville, EMSCO 803-233-4121
SC Taylors, Cantrell Whls. 803-268-1194
TN Knoxville, MAC-1 615-966-4143
TX Austin, Southwest Elctrns. 512-837-8971
TX Austin, The Altair Co. 512-837-4490
TX Farmers Branch, Force Elctrns. Inc. of Texas 214-247-9955
TX Fort Worth, Allied Elctrns. 817-336-5401
TX Houston, Force Elctrns. Inc. of Texas 713-561-8644
TX Houston, The Altair Co. 713-462-3029
TX Mansfield, Mouser Elctrn. Corp. 817-483-4422
TX Richardson, Southwest Elctrns. 214-234-3050
TX Richardson, The Altair Co. 214-231-5166
TX Stafford, Southwest Elctrns. 713-240-4000
WI Milwaukee, Marsh Elctrns. 414-475-6000

IEI-ISKARA ELECTRONICS INC., INC, See Iskara Electronics, Inc.

IERC, 135 W. Magnolia Blvd., Burbank, CA 91502, Tel: 213-849-2481, TWX: 910-498-2206, ESYLNK: 62951515, FAX: 818-848-8872; FSC No.: 98978; Empl.: 97; *Sls. Mgr.:* Dan Ketchum; *Dist. Mgr.:* Ken McPherson .... **C•1661-1663**

Local Sales Offices & Reps

AL Huntsville, Murcota Corp. 205-539-8476
AZ Scottsdale, BSE Inc. 602-483-0373
CA Fremont, Vic/Tal Sls. 415-651-6420
CA San Diego, Coastal Elctrn. Sls. 619-459-4148
CA Santa Clara, Ross Mktg. Assocs. 408-988-8111
CA Sherman Oaks, Wes-K Assoc., Inc. 818-990-1302
CO Denver, Elcom, Inc. 303-337-2300
FL Boca Raton, Sls. Specialties 305-395-5371
FL Plant City, Sls. Specialists 813-754-1329
FL Temple Terrace, Sls. Specialists 813-988-0561
IL Mt. Prospect, Magnuson & Assocs. 312-956-0700
IN Indianapolis, Magnuson & Assocs. 317-247-5108
KS Leawood, Thunderbird Tech. Sls. & Svcs., Inc. 913-642-7220
KS Wichita, Thunderbird Tech. Sls. 316-684-3941
MA Lexington, Hathaway Elctrns., Inc. 617-861-7010
MN Minneapolis, Magnuson Assocs. 612-521-1235
MO Maryland Heights, Thunderbird Tech. Sls. & Svcs., Inc. 314-567-6488
NJ Wayne, G. T. Assocs., Inc. 201-694-6040
NM Albuquerque, Rep New Tech 505-293-2582
NY Rochester, Ossman Comp. Sls. Corp. 716-424-4460
NY Syracuse, Ossman Comp. Sls. Corp. .. 315-437-7052
NC Winston-Salem, Murcota Corp. 919-722-9445
OH Cleveland, Norm Case & Assocs. 216-333-0400
OR Portland, Frank Jackson & Assocs. ... 503-645-8511
PA Philadelphia, Kenneth B. Erdman Co. 215-224-1833
TX Carrollton, Connec-Tek 214-245-1266
TX Houston, Barry Sls., Inc. 713-784-5860
TX Richardson, Barry Sls., Inc. 214-234-0255
UT Salt Lake City, Elcom, Inc. 801-485-7415
WA Redmond, Frank Jackson Assocs. 206-881-7277
WI Milwaukee, Magnuson Assocs. 414-933-8344
Can Burlington, Ont., White Radio Ltd. 416-632-6894
Can Montreal, Que., White Radio Ltd. 514-481-0158

Local Distributors

AZ Phoenix, Arizona Comps. Co. 602-269-5655
CA Anaheim, DECO Electronics, Inc. 714-630-8252
CA Canoga Pk., Tim-Co Comp. Sls. 818-992-5040
CA Chatsworth, Jacon Fasteners & Elctrns. 818-700-2901
CA Chatsworth, Mil-Comm Distrs. 213-998-3111
CA City of Industry, Ital Elctrns. 818-968-8515
CA San Diego, Deco Elctrns. 619-693-1595
CA San Diego, Timco Sls. 619-236-1161
CA San Jose, Rose Elctrns. 408-263-9700
CA Sautee, Mouser Elctrns. 619-449-2222
CA Sunnyvale, Power Supply Components 408-737-1333
CO Englewood, Indelco 303-694-9444
CT Bridgeport, Park Distrs., Inc. 203-366-7200
FL Clearwater, Lynch Gentry Assocs. 813-433-2697
FL Winter Park, Distributor Sls. 407-647-8164
IL Mt.Prospect, Magnuson & Assocs. 312-956-0700
MD Towson, Jones-Maryland Elctrns. 301-823-5721
MA Billerica, A. W. Mayer Co., Inc. 617-229-2255
NJ Randolph, Mouser Elctrns. 201-328-3322
NY Bohemia, Car-Lac Elctrn. Indl. Sls. 516-567-4200
NY E. Syracuse, Modutex Corp. 315-437-7052
NY West Hempstead, March Elctrns. 516-485-4700
OH Englewood, Argent Inds., Inc. 513-836-8633
OR Portland, United Radio Supp. 503-233-5341
PA McKeesport, Barno Radio 412-751-5966
RI Providence, William Dandreta & Co. .. 401-861-2800
TX El Paso, ERA 915-855-3600
TX Houston, Lenert Co. 713-225-1465
TX Mansfield, Mouser Elctrns. 817-483-4422
WA Seattle, Rose Elctrns. 206-721-4997
WA Seattle, United Radio Supp. 800-547-4557
WA Spokane, Rose Elctrns. 509-624-8867

FAX: 516-334-5988

IET LABS, INC., 534 Main St., Westbury, NY 11590, Tel: 516-334-5959; FSC No.: 62015; *Sls. Mgr.:* Sam Sheena ..... **D•1286-1293**

IFR SYS. INC., 10200 W. York St., Wichita, KS 67215, Tel: 316-522-4981, TWX: 910-741-6952, FAX: 316-524-2623; Empl.: 700; *Sls. Mgr.:* T. Dideum

DDC ILC DATA DEVICE CORPORATION

FAX: 516-567-7358

ILC DATA DEVICE CORP., 105 Wilbur Pl, Bohemia, NY 11716, Tel: 516-567-5600, TWX: 310-685-2203; FSC No.: 19645; Empl.: 910; *Sls. Mgr.:* J. P. Sheahan; *Dist. Mgr.:* Marshall Lacoff ..... **D•1182-1183**

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg. 205-830-0498
AZ Scottsdale, Fred Board Assocs. 602-994-9388
AZ Tuscon, Fred Board Assocs. 602-299-1508
CA Fallbrook, Gary Chilcote & Assocs. ... 619-728-7678
CA Garden Grove, ILC Data Dvcs. Corp. .. 714-895-9777
CA Santa Clara, ILC Data Dvcs. Corp. 408-244-0831
CA Woodland Hills, ILC Data Dvcs. Corp. 818-992-1772

CO Englewood, Quorum 3 Sls. Grp. 303-799-8100
CT Canton Center, Dynamic Sls. of New Eng. 203-693-6567
FL Clearwater Beach, Perrott Assocs. 813-443-5214
FL Orlando, Perrott Assocs. 407-298-7748
FL W. Palm Beach, Perrott Assocs. 407-790-5722
GA Norcross, Montgomery Mktg., Inc. 404-447-6124
IL Des Plaines, Elctm. Mktg. 312-298-2330
IN Carmel, Giesting & Assocs. 317-844-5222
KS Lenexa, Dytec/South 913-888-0215
KS Wichita, Dytec South, Inc. 316-945-7090
MD Frederick, ILC Data Dvc. Corp. 301-898-3121
MA Burlington, Dynamic Sls. of New Eng. 617-272-5676
MI Coloma, Giesting & Assocs. 616-468-4200
MI Comstock Pk., Giesting & Assocs. 616-784-9437
MI Livonia, Giesting & Assocs. 313-478-8106
MN Eden Prairie, Comprehensive Tech. ... 612-941-7181
MO Maryland Hgts., Dytec/South 314-739-0665
NJ Totowa, ILC Data Dvcs. Corp. 201-785-1734
NM Albuquerque, Nelco Electronix 505-293-1399
NY E. Rochester, Tri Tech Elctrns. 716-385-6500
NY Endwell, Tri Tech Elctrns. 607-754-1094
NY Fayetteville, Tri Tech Elctrns. 315-446-2881
NY Fayetteville, Tri-Tech Elctrns, Inc. 315-446-2881
NY Fishkill, Tri Tech Elctrns. 914-897-5611
NC Cary, Montgomery Mktg., Inc. 919-467-6319
NC Raleigh, Montgomery Mktg; Inc. 919-851-0010
OH Cincinnati, Giesting & Assocs. 513-385-1105
OH Cleveland, Giesting & Assocs. 216-261-9705
OH Dayton, Lionel Fedotin 513-275-9345
OK Tulsa, Bonser-Philhower Sls. 918-744-9964
OR Portland, Venture Elctrns. 503-624-0617
PA E. Lancaster, Electro Rep 717-299-5877
PA Pittsburgh, Giesting & Assocs. 412-963-0727
TX Austin, Bonser-Philhower Sls. 512-346-9186
TX Houston, Bonser-Philhower Sls. 713-782-4144
TX Richardson, Bonser-Philhower Sls. 214-234-8438
UT Salt Lake City, Quorum 3 Sls. Grp. 801-943-9227
VT Burlington, Dynamic Sls. of New Eng. 802-863-6665
VA Vienna, ILC Data Dvcs. Corp. 703-893-7989
WA Bellevue, Venture Elctrns. 206-454-4594
WI Waukesha, Electron Mktg. 414-547-1505
Can Montreal, Repco Engrg. 514-694-1877
Can Ontario, Repco Engrg. Co., LTD 416-670-1459

ILC TECHNOLOGY, INC., 399 Java Dr., Sunnyvale, CA 94089, Tel: 408-745-7900, TWX: 910-339-9389; *Sls. Mgr.:* Lynn Reiter

ILLINOIS CAPACITOR, INC.

FAX: 312-673-2850

ILLINOIS CAPACITOR, INC., 3757 W. Touhy Ave., Lincolnwood, IL 60645, Tel: 312-675-1760, TELEX: 72-4361; Empl.: 64; *Sls. Mgr.:* C. Kurland .... **A•1080-1081**

Local Sales Offices & Reps

AL Huntsville, Electramark 205-830-4400
AR Little Rock, Doby Assocs., Inc. 501-221-0326
CA San Jose, Arnold Tech. Sls., Inc. 408-954-0400
CA Woodland Hills, Illinois Capacitor, Inc. 800-323-3652
CO Denver, Lindberg Co. 303-758-9033
CT Bristol, Technlg. Prods. Grp. 203-585-1643
FL Clearwater, H.H.P. Assocs., Inc. 813-797-4447
FL Pompano Bch., HHP & Assocs. 305-971-5750
FL Winter Pk., H.H.P. Assocs., Inc. 407-740-0320
GA Norcross, Electramark 404-446-7915
IL Lincolnwood, Illinois Capacitor, Inc. ... 312-675-1760
IN Greenwood, Valentine & Assocs. 317-888-2260
IN South Bend, Valentine & Assocs. 219-288-7070
IA Marion, AEM, Inc. 319-377-1129
KS Lenexa, AEM Inc. 913-888-0022
MA Brookline, Technology Prods. Grp. 617-731-0858
MI Farmington Hills, Tritech Sls. Inc. 313-553-3370
MI Kalamazoo, Tritech Sls. Inc. 616-382-5570
MN Golden Valley, Highland Elctm. Sls. Co. 612-545-2123
MS Jackson, Doby Assocs. 601-981-1138
MO Bridgeton, AEM, Inc. 314-298-9900
MO Hazelwood, AEM, Inc. 314-731-2240
MO Hazelwood, Jim Moore & Assocs. 314-731-2240
MO Kansas City, AEM, Inc. 816-758-0262
NJ Englewood Cliffs, Masin-Esco, Inc. 201-569-8868
NM Albuquerque, Lindberg Co. 505-881-1006
NY Clinton, Advanced Comps. Corp. 315-853-6438
NY Endicott, Advanced Comps. Corp. 607-785-3191
NY Hauppauge, Masin-Esco, Inc. 516-273-3500
NY N. Syracuse, Advanced Comps. Corp. 315-699-2671
NY Rochester, Advanced Comps. 716-544-7017
NY Scottsville, Advanced Comps. Corp. ... 716-889-1429
PA Narberth, J. Bresson Assocs. 215-664-6460
TX Austin, A-I-D Elctrns. 512-450-1938
TX Irving, A-I-D Elctrns. 214-790-4761
UT Salt Lake City, Lindberg Co. 801-277-2643
VA Forest, Bresson Assocs. 800-523-5512
WI Milwaukee, Erdman Sls. Co. 414-281-1330

Local Distributors

AL Huntsville, Hammond Elctrns. 205-830-4764
AZ Phoenix, Arizona Comps. Co. 602-269-5655
AR Ft. Smith, Carlton Bates 501-646-8201
AR Little Rock, Carlton Bates 501-562-8100
AR Pine Buff, Carlton Bates 501-535-1354
AR Springdale, Carlton Bates Co. 501-756-5012
CA Anaheim, A to Z Elctrns. 714-632-1620
CA Canoga Park, Myco Elctrn. Supp. 818-340-2025
CA Huntington Bch., Capacitor Specialtists Intl. 714-843-1815
CA Milpitas, California Capacitor 408-262-6000
CA Milpitas, Projections Unltd. 408-942-1717
CA San Diego, Neumann Elctrns. 619-695-3005
CA San Diego, Projections Unltd. 619-453-7900
CA Tustin, Projections Unltd. 714-544-2700
CO Colorado Springs, Kimball Elctrns. 719-528-7066
CO Englewood, Indelco 303-694-9444
CO Englewood, NEP Elctrns. 303-799-9898
CT Wallingford, Midstate Elctrns. 203-265-9900
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Melbourne, G.R.S./Rome Elctrns. 407-242-8151
FL Orlando, Hammond Elctrns. 407-841-1010
GA Norcross, Hammond Elctrns. 404-449-1996
ID Boise, Kimball Elctrns. 208-342-3559
ID Pocatello, Kimball Elctrns. 208-232-2201
IL Northbrook, Classic Comps. 312-272-9650
IL Wood Dale, NEP Elctrns. 312-595-8500
IN Carmel, ALD 317-848-1323
KS Wichita, RSC Elctrns. 316-267-5213
LA Shraveport, Carlton Bates 318-636-9975
MD Beltsville, Resco/Washington 301-937-9100
MD Columbia, G.R.S. Elctrns. Co. Inc. 301-995-6744
MA Hopkinton, ADD Elctrns. Corp. 617-435-5010
MA Woburn, Lorcor 617-935-5024
MI Grand Rapids, Calder Elctrns. 616-698-7400
MN Eitzen, Capacitor Assocs. 507-495-3306
MN Fridley, Voyager Elctrns. 612-571-7766
MN Minneapolis, Bergquist Co. 612-835-2322
MO Kansas City, Walters Indl. Supp. 816-531-7015
MO Springfield, Carlton Bates 417-862-1699
MO St. Charles, Finnigan Elctrns. 314-946-6201
NJ Camden, G.R.S. Elctrns. Co., Inc. 609-964-8560
NJ Clifton, J-Mar Elctrns. 201-772-6400
NJ Roselle, Lectron Ind. 201-245-5859
NY Buffalo, Summit Distrbg. 716-887-2829
NY Elmsford, Ancar Elctrns. 914-592-7100
NY Hauppauge, Broadline Elctrns. 516-231-4100
NY Johnson City, Help Elctrns. 607-729-3528
NC Greensboro, Hammond Elctrns. 919-275-6391
OH Akron, AESCO Elctrns. 216-762-8818
OH Centersville, ALD 513-436-0067
OH Cincinnati, Hughes-Peters, Inc. 513-351-2000
OH Cincinnati, URI 513-761-4030
OH Columbus, AESCO Elctrns. 614-882-6762
OH Columbus, Hughes-Peters, Inc. 614-294-5351
OK Oklahoma City, Carlton Bates 405-681-4446
OK Tulsa, Altair Elctrns. 918-252-5781
OK Tulsa, Carlton Bates 918-250-1626
PA Exton, VSH Elctrns. 215-363-2250
PA Reading, G.R.S. Elctrns. Co., Inc. 215-375-4477
TN Memphis, Carlton Bates 901-365-3539
TN Nashville, Carlton Bates 615-244-3582
TN Richardson, RSC Elctrns. 214-644-3444
TX Austin, Altair Elctrns. 512-837-4970
TX Houston, Altair Elctrns. 713-462-3029
TX Richardson, Altair Elctrns. 214-231-5166
TX Texarcana, Carlton Bates 214-792-6923
UT Salt Lake City, Kimball Elctrns. 801-328-2075
WA Bothell, Projections Unltd. 206-485-2147
WI Milwaukee, Badger Capacitor Sls. 414-281-1330
WI New Berlin, Classic Comps. Supp. Co. 414-786-5300
WI New Berlin, NEP Elctrns. 414-785-9100

Illinois Lock

FAX: 312-537-1881

ILLINOIS LOCK CO., The Eastern Co., 301 W. Hintz Rd., Wheeling, IL 60090, Tel: 312-537-1800, TWX: 910-651-0221; Empl.: 120 ..... **B•1756-1757**

ILP MFG. INC., 250 Wildcat Rd., Downsview, Ont., CAN M3J 2N5, Tel: 416-667-9914, FAX: 416-667-8928; Empl.: 25; *Sls. Mgr.:* Howard Gladstone ..... **A•2310-2311; D•1012**

Local Sales Offices & Reps

AZ Scottsdale, Mayfield Mktg., Inc. 602-998-3142
CA Burbank, Darco-De Angelo, Rothman & Co. 818-504-2425
FL Deerfield Beach, Jack Krutech & Assocs., Inc. 305-427-4202
GA Tucker, Stephen & Assocs., Inc. 404-493-4666
IL Park Ridge, Bob Burns & Assocs. 312-823-9260
MA Hingham, Shain Assocs., Inc. 617-740-2334
NH Nashua, Shain Assocs., Inc. 603-881-4881
NC Raleigh, Eastern Elctrns. 919-876-7591
OH Dayton, J.C. Hofstetter Co. 513-296-1010
OR McMinnville, Electro-Design 503-472-0481
TX Lewisville, Jim Hughes Co. 214-221-1536
WA Redmond, Electro Design 206-868-7400

IMAGE GRAPHICS, INC., 917 Bridgeport Ave., Shelton, CT 06484, Tel: 203-926-0100, FAX: 203-926-9705; FSC No.: 5M867; Empl.: 100; *Sls. Mgr.:* Putnam Morgan

IMAGING & SENSING TECHNOLOGY CORP., Westinghouse Circle, Horseheads, NY 14845, Tel: 607-796-3372, TWX: 510-252-1588, FAX: 607-796-3279; Empl.: 360

FAX: 602-790-2808

I.M.C., (International Microtronics Corp.), 3930 E. Tennessee St., Tuscon, AZ 85714, Tel: 602-748-7900, 1-800-433-3767 ..... **D•1398-1401**

Local Sales Offices & Reps

IL KTEK 312-635-9612
LA RE Owens, Inc. 504-888-5813

Local Distributors

CA Tech-Ser, Inc. 415-496-1004
CA Tech-Ser, Inc. 213-370-7200
DE Electra-Tech 301-877-0344
IL Data Elctrns. 800-621-8288
IL Data Elctrns. 312-283-0300
IL Pacific Inds. 312-352-3500
IN Data Elctrns. 317-359-5388
IA Data Elctrns. 800-521-8278
MA Calibron Instrs. 617-894-8440
MN Data Elctrns. 612-559-1434
NJ Electra-Tech 215-245-7455
NY Masline Elctrns.,Inc. 716-546-5373
OR H.I.S. 503-643-5648
TX Seaton Corp. 214-980-9860
TX Textrol, Inc. 214-484-9961
VA Meter Metrics 804-275-1431
WI Data Elctrns. 800-621-8276

IMC MAGNETICS CORP., Arizona Div., 1900 E. Fifth St., Tempe, AZ 85281, Tel: 602-968-4441, TWX: 910-951-0001, FAX: 602-968-5026; *Sls. Mgr.:* Joseph Gute

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IMC MAGNETICS CORP., Exec. Off., 100 Jericho Quadrangle, Ste. 221, Jericho, NY 11753, Tel: 516-938-0800, TWX: 510-221-2126; Empl.: 1,300; *Sls. Mgr.:* R. Kintner

IMC MAGNETICS CORP., Eastern Div., 570 Main St., Westbury, NY 11590, Tel: 516-334-7070, TWX: 510-222-4469, FAX: 516-334-7723

IMC MAGNETICS CORP., Florida Division, 14025 N.W. 60th Ave., Miami Lakes, FL 33014, Tel: 305-822-2558, FAX: 305-825-3850

IMC MAGNETICS CORP., IMC/Hansen, Box 23, Princeton, IN 47670-0023, Tel: 812-385-3415, FAX: 812-386-6387; *Sls. Mgr.:* George A. Gilbert

IMC MAGNETICS CORP., Thermal Products Group., 100 Jericho Quad., Ste. 221, Jericho, NY 11753, Tel: 516-938-0800, TWX: 510-221-2126, FAX: 516-938-0752; *Sls. Mgr.:* R. Lavochkin

IM/D CORP., 540 Commercial St, Manchester, NH 03101, Tel: 603-669-5224, FAX: 603-669-3826; Empl.: 12; *Sls. Mgr.:* Frank N. Haigh

IMEC CORP., 3065 Beyer Blvd., San Diego, CA 92154, Tel: 619-690-2622; Empl.: 1400; *Sls. Mgr.:* R. L. Hill

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IMPERIAL ASTRONICS, Meridian Intl. Corp., 19151 Parthenia St. J, Northridge, CA 91324, Tel: 818-886-7672; Empl.: 38; *Sls. Mgr.:* Laurie Lee, GM ..... **A•1951**

Local Sales Offices & Reps

CA American Canyon, Jacobson & Assocs. 707-552-4412

I.M.S. EQUIPMENT, INC., See Worldnet Marketing, Inc.

IMTRONICS INDUSTRIES, 11930 31st Ct. N., St. Petersburg, FL 33716, Tel: 813-572-9010, TELEX: 566027 IMTRON CWTR UD, FAX: 813-572-9012; Empl.: 10; *Sls. Mgr.:* Steven B. Cohen

INCONIX CORP, See Hancock Electronics Corp.

ELINA

FAX: 408-433-9330

INDEK CORPORATION, 2360 Qume Dr., No. A, San Jose, CA 95131, Tel: 408-432-1199, TELEX: 176476ELINA; Empl.: 7; *Sls. Mgr.:* Charles Granata; *Dist. Mgr.:* Anke Vanoverbeek ..... **C•1664-1668**

Local Sales Offices & Reps

AZ	Phoenix, CPS Assocs., Inc.	602-246-1097
CA	San Diego, K-Tronics	619-549-7155
CA	San Jose, Veer Mktg.	408-432-1818
CA	Tustin, C & N and Assocs., Inc.	714-730-9137
CA	Valencia, C & N Assocs. Inc.	805-254-5844
CO	Denver, AKI Entprs.	303-388-4488
GA	Norcross, Mountain Electro Mktg.	404-448-5594
ID	Boise, N.R. Schultz Co.	208-377-9686
IN	Granger, Gregory Sls. Co.	219-272-9626
MA	Topsfield, Liberty Electro Mktg.	508-887-6655
MI	Brighton, A.P. Assocs.	313-229-6550
MO	Florissant, Deltron Co., Inc.	314-839-0033
NJ	Cherry Hill, Vantage Sls. Co.	609-424-6777
NY	Glen Cove, Dyno-Rep	516-676-1598
OH	Columbus, Tom Mulligan Co.	614-457-2242
OH	Dayton, Tom Mulligan Co.	513-254-0202
OK	Tulsa, Comptech	918-622-7744
OR	Beaverton, N.R. Schultz Co.	503-643-1644

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TX	Houston, Comptech	713-492-0005
TX	Irving, Comptech	214-751-1181
VA	Front Royal, Eltron Sls. Inc.	703-635-7201
WA	Bellevue, N.R. Schultz Co.	206-454-0300
WA	Redmond	
Can	Brampton, Ont., Designtronics	416-793-5155

Local Distributors

AZ	Tempe, Harper S.I.D.	602-967-1464
CA	Compton, Harper SID	213-979-5090
CA	Fremont, Terminal Sls. Corp.	415-656-7722
CA	San Diego, Harper SID	619-578-2500
CA	San Jose, Compass Comps.	408-432-7575
CA	San Jose, Harper SID	408-943-9490
GA	Norcoss, Applied Power	404-263-0421
IL	Palatine, OHM Electronics	312-359-5500
MA	Westborough, In-Stock Prod.	508-870-5750
MO	St. Louis, Beckwith Elec.	314-343-6463
NJ	West Berlin, GCI Corp.	609-768-6767
OK	Oklahoma City, Radio Supp. Inc.	405-232-6127
TX	Irving, Harper SID	214-621-0500
WA	Redmond, Priebe Elctrns.	206-881-2363

INDEPENDENT CABLE, INC., 43 Broad St., Hudson, MA 01749, Tel: 617-562-9913; Empl.: 120; *Sls. Mgr.:* Gary W. Nace

Distributor

FAX: 714-978-2411

INDUCTOR SUPPLY, 1849 W. Sequoia Ave., Orange, CA 92668-1017, Tel: 714-978-2277, 800-854-1881, 800-472-8421; Empl.: 32; *Sls. Mgr.:* Neal McDonald, Ruben Ramirez ..... **A•1252**
696, 707, 720, 729, 791, 813

Industrial Computer Designs

FAX: 818-889-1490

INDUSTRIAL COMPUTER DESIGNS, INC., 31264 La Baya Drive, Westlake Village, CA 91362, Tel: 818-889-3179; Empl.: 20; *Sls. Mgr.:* Laura L. Webb, Sls. Mgr./Sr. VP ..... **D•1185**

INDUSTRIAL CONTROL CO., 3100 Pineda Ave., Rockledge, FL 32955, Tel: 407-259-7105; Empl.: 15; *Sls. Mgr.:* I. Nobilio

INDUSTRIAL DEVICES CORPORATION, 35 Pamaron Way, Novato, CA 94949-6284, Tel: 415-883-3535, FAX: 415-883-2094; Empl.: 25

INDUSTRIAL DEVICES, INC., 260 Railroad Ave., Hackensack, NJ 07601, Tel: 201-489-8989, FAX: 201-489-6911; FSC No.: 91802; Empl.: 275; *Sls. Mgr.:* Michael Diceglie ..... **B•1158-1162**

Local Sales Offices & Reps

AL	Huntsville, South Design & Mktg.	205-880-3623
AZ	Phoenix, More Sls., Inc.	602-788-9181
AZ	Tempe, WestRep	602-820-9932
CA	Los Angeles, Universal Comps.	213-641-4255
CA	Santa Clara, WestRep	408-988-8833
CO	Englewood, Harthun Assocs., Inc.	303-792-5050
FL	Casselberry, Dyne-A-Mark Corp.	305-831-2822
FL	Clearwater, Dyne-A-Mark	813-441-4702
FL	Ft. Lauderdale, Dyne-A-Mark Corp.	305-771-0114
IL	Chicago, Rendell Sls. Co. (RSC)	312-539-1820
IN	Indianapolis, Elctrn. Mktg. Consits.	317-253-1668
MD	Columbia, PSA, Inc.	215-245-0513
MA	Westborough, Anchor Engrg.	617-870-0573
MI	E. Detroit, Fred Harris & Assocs.	313-776-5430
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594
MO	Blue Springs, KKB, Inc.	816-229-0001
MO	St. Louis, KKB, Inc.	314-647-2000
NY	Glen Cove, Dyno-Rep	516-676-1598
NY	Rochester, Apex Assocs.	716-254-6050
NC	Raleigh, Spears & Assocs.	919-790-7606
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Hillsboro, Temco Northwest	503-649-8375
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
PA	Trevose, PSA, Inc.	215-245-0513
SC	Greenville, Spears & Assocs.	803-877-9088
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Houston, R. F. Kimball Co.	713-890-8810
TX	Richardson, R. F. Kimball Co.	214-231-3447
WA	Bothell, Temco Northwest	206-821-5434

Local Distributors

AZ	Phoenix, Dalis Elctrn. Supp.	602-275-2885
CA	Fremont, Allied Elctrns.	415-487-5250
CA	Gardena, Calif. Switch & Signal	213-770-2330
CA	Los Angeles, Elec. Switches	213-664-1141
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	S. San Francisco, Steven Engrg.	415-588-9200
CA	Sacramento, Zack Elctrns.	916-446-3131
CA	San Diego, Shanks & Wright	619-239-0176
CA	San Diego, Sigma Elctrns.	714-565-2000
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Jose, Rose Elctrn. Distrbg. Co.	408-943-0255
CA	Santa Ana, Sunray Lighting, Inc.	714-556-3630
CA	Tustin, Allied Elctrns.	714-669-4190
CO	Arvada, Denver Beta	303-431-7161
CO	Denver, Allied Elctrns.	303-790-1662
CO	Denver, Con. Parts	303-623-5313
CT	Bridgeport, Park Distrs.	203-366-7200
CT	Wallingford, Sager Electrical Supp.	203-265-4600
FL	Pompano Bch., Allied Elctrns.	305-978-3008
FL	Tampa, Specialty Distrbg. Co.	813-870-3315
FL	W. Palm Beach, Nurmi Elctrn.	305-686-8553
GA	Atlanta, Wholesale Indl. Elec.	800-282-1857
GA	Norcross, Whitehead Elctrns.	404-923-6667
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Rockford, Mid-West Associated	815-962-8036
IL	Villa Park, Melvin Elctrns.	312-279-5015
IL	Wheeling, Hawk Elctrns.	800-843-4295
IL	Wood Dale, Electro-Kinetics	312-595-6700
IN	East Chicago, ACRO Elctrns.	312-375-1269
IN	Evansville, Hutch & Son	812-425-7201
IN	Fort Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-634-8202
IN	South Bend, Genesis Elctrns.	219-287-2911
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KY	Bowling Green, Crescent Elctrns.	502-842-2444
LA	Lafayette, Ralph's	318-234-4507
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	N. Wilbraham, Indl. Comps.	413-596-3854
MA	Norwood, Gerber Elctrns.	617-329-2400
MA	Worcester, Coghlin Elect.	617-756-8311
MI	Flint, Shand Elctrns.	313-743-8940
MI	Livonia, Shand Elctrns.	517-799-2527
MI	Saginaw, Shand Elctrns.	313-591-3980
MN	Minneapolis, Bergquist Co.	612-835-2322
MN	Minneapolis, Elctrn. Center	612-371-5200
MN	Minneapolis, Stark Elctrns.	612-332-1325
MO	Kansas City, Chelsea Inds.	816-842-8556
MO	Maryland Hgts., Chelsea Inds.	314-997-7709
MO	St. Louis, Van Sickle Radio-Elec.	314-621-5000
NE	Lincoln, Scott Elctrn. Supp.	402-466-8221
NJ	Hanover, State Elctrns. Parts	201-887-2550
NJ	Oakland, Relay Spec.	201-337-1000
NY	Albany, E. E. Taylor Co.	518-438-7811
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Hauppauge, Sager Elctrl. Supply Co.	516-348-1300
NY	Hempstead, Elctrn. Equip.	800-645-1605
NY	Mt. Vernon, Q.A.R. Indl. Elctrn. Sls.	914-699-2224
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Raleigh, Sager	919-850-9550
NC	Raleigh, Southeastern Radio Supp.	919-828-2311
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Columbus, Hughes Peters	614-294-5351
OH	Dayton, Stotts-Friedman Co.	513-298-5555
OK	Tulsa, PEI Genesis	918-622-8520
OR	Beaverton, Murphy Elctrns.	503-642-2001
OR	Portland, United Radio Supp.	503-233-7151
PA	Erie, REM Elctrns.	814-453-5626
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Philadelphia, PEI/Genesis	215-673-0400
TN	Memphis, Bluff City Elctrns.	901-345-9500
TN	Nashville, Randolph & Rice	615-255-5601
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
TX	San Antonio, Sherman Elctrns. Supp.	512-224-1004
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Glen Allen, Hermitage Distrs.	804-798-3830
WA	Redmond, Murphy Elctrns.	206-881-1234
WA	Seattle, Allied Elctrns.	206-547-2827
WA	Spokane, Radar Elec.	509-747-3053
WI	Milwaukee, Marsh Elctrns.	414-475-6000

FAX: 703-731-0847

INDUSTRIAL DRIVES, A Kollmorgen Div., 201 Rock Rd., Radford, VA 24141, Tel: 703-639-2495, TWX: 710-875-3743; FSC No.: 11384; Empl.: 343; *Sls. Mgr.:* Jim Webb/ Robert White Jr./ Robert Foster ... **B•1258-1259**

Local Sales Offices & Reps

CA	Laguna Hills, Industrial Drives	714-581-3626
CA	Milpitas, Maxim Elctrns. Sls.	408-946-6001
CA	Signal Hill, Thorson Co. of So. Calif.	213-595-0361
CO	Longmont, Piper Sls. Co.	303-443-5337
CT	Madison, Tedicko, Inc.	203-644-4330
GA	Atlanta, Industrial Apparatus Co.	404-875-8086
IL	Arlington Hgts., Industrial Drives	312-981-1433
IN	Indianapolis, J.N. Fauver Co.	317-872-3060
MA	Topsfield, Whitehead Assocs.	508-887-8050
MI	Madison Hgts., J.N. Fauver Co.	313-585-5252
MN	New Brighton, The Mackubin Grp.	612-636-5533
MO	St. Louis, Cadon Tech. Co.	314-645-8670
NJ	Paramus, Brundage Assocs.	201-967-7024
NY	E. Rochester, A&D Devices	716-385-2778
NC	Matthews, Industrial Drives	716-821-9875
OH	Chargin Falls, The Kilroy Corp.	216-543-3370
OR	Beaverton, Thorson Co. N.W.	503-644-5900
PA	Media, Homersmith, Inc.	215-543-2434
TX	Dallas, Kruvand Assocs.,Inc.	214-437-3355
UT	Salt Lake City, Piper Sls.	801-466-9336
VA	Radford, The Hatfield Co.	703-639-5471
WA	Bellevue, Thorson Co. N.W.	206-455-9180

INDUSTRIAL ELECTRONIC HARDWARE CORP., (IEH Corp.), 109 Prince St., New York, NY 10012, Tel: 212-677-1881, TWX: 710-581-4338, FAX: 212-674-1048; FSC No.: 97913; Empl.: 250; *Sls. Mgr.:* Louis Roberts; *Dist. Mgr.:* Louis Roberts

INDUSTRIAL ELECTRONICS CORP., 24175 Gibson Drive, Warren, MI 48089, Tel: 313-759-4450, FAX: 313-759-1589; Empl.: 30; *Sls. Mgr.:* Allen A. Russell

INDUSTRIAL INDEXING SYSTEMS, INC., 626 Fishers Run, Victor, NY 14564, Tel: 716-924-9181, FAX: 716-924-2169; Empl.: 30; *Sls. Mgr.:* Raymond F. Coller

Local Sales Offices & Reps

NY	East Rochester, A & D Dvcs.	716-385-2778
PA	Media, Homersmith, Inc.	215-543-2434

Local Distributors

MI	Grand Rapids, Ackerman Elec.	616-459-8327
WI	Oneida, MCL Inds., Inc.	414-434-1500

INDUSTRIAL MIDWEC CAPACITOR CORP., 4902 Tollview Dr., Rolling Meadows, IL 60008, Tel: 312-577-0120, TWX: 910-687-3375, FAX: 312-398-0318; Empl.: 100; *Sls. Mgr.:* T.B. Noone

Powertron

FAX: 516-883-7155

INDUSTRIAL TEST EQUIPMENT, 21 Yennicock Ave., Port Washington, NY 11050, Tel: 516-883-1700; FSC No.: 99074; *Sls. Mgr.:* Jay Monroe ... **D•1013, 1295, 2208-2212**

INDUSTRIAL TIMER CO., 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705, Tel: 203-753-2487, TWX: 643852, FAX: 203-756-8724; Empl.: 50; *Sls. Mgr.:* F. G. Coobutt

INERTIAL MOTORS, 280 N. Broad St., Doylestown, PA 18901, Tel: 215-345-1010, TELEX: 83-1633; Empl.: 17; *Sls. Mgr.:* Joanne Dorr

INFICON LEYBOLD-HERAEUS, INC., See Leybold Inficon, Inc.

INFINETICS INC., Friskem Div., 201 Vandever Ave., Wilmington, DE 19802, Tel: 302-658-2471, TWX: 510-666-2332; *Sls. Mgr.:* M. Schwartz

INFODEX

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FAX: 203-879-4944(x230)

INFODEX, INC., 10 Venus Dr., Wolcott, CT 06716, Tel: 203-879-4944; FSC No.: 09087; Empl.: 48; *Sls. Mgr.:* E. H. Ulm ... **B•1010-1011, 1088**

INFO-LITE CORP., See Dio-Rey and Crosspoint

INFORMATION CONTROL CORP., 9610 Bellanca Ave., Los Angeles, CA 90045, Tel: 213-641-8520, TWX: 910-328-7234, FAX: 203-368-3747; Empl.: 50

INFORMATION TRANSFER INDL. INC., Box 357, Holcomb, NY 14469, Tel: 716-657-7074, FAX: 716-657-7432; FSC No.: 55137; Empl.: 70; *Sls. Mgr.:* John Dillman ... **D•1186-1188, 1296-1297**

Local Sales Offices & Reps

AZ	Scottsdale, Luscombe Engrg.	602-949-9333
CA	Montrose, Luscombe Engrg.	818-249-9000
CA	San Diego, Luscombe Engrg.	619-292-4337
CO	Littleton, Pond Assocs., Inc.	303-798-2904
CT	Marion, Polytek Assocs.	203-634-4499
FL	Port Charlotte, John E. Wiseman Co.	813-625-5740
IL	Schaumburg, Kenneth W. Meyers Co.	312-882-4808
IN	Indianapolis, Kenneth W. Meyers Co.	317-783-1030
IA	Cedar Rapids, Kenneth W. Meyers Co.	319-363-8987
MA	Ashland, Polytek Assocs.	617-881-4741
MN	Minneapolis, Kenneth W. Meyers Co.	612-920-7080
NJ	Oxford, Malin Assocs.	201-689-7398
OR	Portland, Tasco J.D.	503-292-1910
PA	Melrose Park, Robert Meyers Assocs.	215-224-1663
TX	Houston, Sci. Sls. Co.	713-460-9170
TX	Richardson, Sci. Sls. Co.	214-231-6541
WA	Bellevue, Tasco	206-453-1414
WI	Brookfield, Kenneth W. Meyers Co.	414-784-3790

INFRARED INDUSTRIES, INC., 12151 Research Parkway, Orlando, FL 32826, Tel: 407-282-7700, FAX: 407-273-9046; Empl.: 50; *Sls. Mgr.:* Lisa Cioffi

INJECTORALL ELECTRONICS (WOMAN OWNED), 110 Keyland Court, Bohemia, NY 11716, Tel: 516-563-3388, FAX: 516-563-3389 ... **C•1125**

Local Sales Offices & Reps

AL	Birmingham, John F. Russell Co.	205-822-2196

Local Distributors

AL	Birmingham, ACK Radio Supp.	205-322-0588
AZ	Tucson, Electronic City	602-622-1173
CA	San Luis Obispo, Midstate Elctrns. Supp.	805-543-2770
CA	San Rafael, Elctrns. Plus	415-457-0466
CA	Sunnyvale, Halted Specialties	408-732-1573
FL	Jacksonville, Mitchell Elctrns.	904-356-8426
GA	Atlanta, Delta	404-458-4690
IL	Lombard, Tron Elctrns.	312-691-8900
IN	Evansville, Tri-State Supp. Co.	812-423-4257
IA	Cedar Rapids, Iowa Radio Supp. Co.	800-332-5296
KY	Louisville, P.I. Burkes	502-589-3960
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MA	Needham, Y.D.I.	617-449-1005
MI	Canton, The Elctrn. Connection	313-595-6655
NY	Endicott, Rogan Elctrns.	607-754-3590
NY	Lindenhurst, RNJ Elctrns.	516-226-2700
NY	Long Island City, Typeco	718-706-6666
NY	Richmond Hill, Anchor	212-846-2420
NC	Charlotte, Slayton Elctrns.	704-375-6600
OK	Oklahoma City, Radio Supp., Inc.	405-332-6127
OR	Beaverton, Norvac	503-644-1025
PA	Philadelphia, H & R Elctrns.	215-426-1700
SC	Charleston, Wholesale Indl. Elctrns.	803-722-2634
TX	Fort Worth, Sweico	817-335-6521
VA	Roanoke, H. C. Baker	703-344-9209

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FL	Tampa, Hutto Hawkins Assocs.	813-251-2970
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IA	Cedar Rapids, IOWA Tech. Sls.	319-393-8644
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OH	Lakewood, G & H Sls. Co.	216-226-6800
OK	Broken Arrow, Erickson Sls. Inc.	918-455-4276
PA	Rydal, Espy Sls. Co.	215-576-0780
TX	Austin, Erickson Sls. Inc.	512-244-3068
TX	Dallas, Erickson Sls. Inc.	214-739-5833
TX	Houston, Erickson Sls. Inc.	713-266-1604
TX	Indianapolis, Mohrfield Mktg.	317-546-6969
PR	Hato Rey, Casanova Indl. Sls. Corp.	809-753-8674

Local Distributors

CA	Canoga Park, Myco Vickers	213-340-2025
CA	Redwood City, Hi-Cor	415-365-5087
CT	Bridgeport, Park Distr.	203-366-7200
CT	East Haven, JV Elctrns.	203-469-2321
FL	Ft. Lauderdale, Bros. Elctrns.	305-561-6700
FL	Ft. Lauderdale, National Resistor Co.	305-772-4500
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MA	Chelmsford, T.L.C. Comps.	508-250-9666
MN	Eden Prarie, Cassidy Elctrns.	612-944-0100
MN	Minneapolis, Cassidy Elctrns.	612-835-7746
MN	New Brighton, Chris Elctrns.	612-631-2647
NJ	Bellmaur, Mid-Atlantic Elctrns.	609-931-5303
NJ	Clifton, Vantage Comps.	201-667-1840
NJ	Rockaway, Tonar Inds.	201-586-9000
NY	Commack, Vantage Comps. Corp.	516-543-2000
PA	Philadelphia, Mur'Tronics	215-632-4330
TN	Hixson, Techni-Tronics	615-842-0514
TX	Ft. Worth, C & W Supp. Co.	817-831-0395
WA	Seattle, Vesco	206-575-3607

INTERNATIONAL CONFIGURATIONS, INC., P. O. Box 3374, Enfield, CT 06082, Tel: 203-749-6380, TELEX: 643 067, FAX: 203-244-1681; FSC No.: 62484; Empl.: 4; *Sls. Mgr.:* Mr. L. Baldwin

INTERNATIONAL CONTROLS & MEASUREMENTS CORP., P.O. Box 2819, Syracuse, NY 13220, Tel: 315-699-5266; FSC No.: 52516; Empl.: 50; *Sls. Mgr.:* Don Plath; *Dist. Mgr.:* Don Plath

INTERNATIONAL CONVERTER CORP., 770-101 Wooten Road, Colorado Springs, CO 80915, Tel: 719-570-6900, FAX: 719-570-6180; Empl.: 7 (U.S.), 1100 (Offshore); *Sls. Mgr.:* Deanna Thompson

INTERNATIONAL CRYSTAL MFG., 701 W. Sheridan, P.O. Box 26330, Oklahoma City, OK 73126, Tel: 405-236-3741, TELEX: 747-147, FAX: 405-235-1904; Empl.: 165; *Sls. Mgr.:* Paul E. Denwalt

INTERNATIONAL DATA TECHNOLOGY, INC., 7440 N.W. 13th St., Ft. Lauderdale, FL 33313, Tel: 305-587-6823, TWX: 910-997-4751 (DIGITAL); Empl.: 15

INTERNATIONAL DIGITAL ELECTRONICS, 160 W. Santa Clara St., Ste. 800, San Jose, CA 95113, Tel: 408-283-1010 (ext 107), FAX: 408-283-0344; Empl.: 2; *Sls. Mgr.:* Masanori Kotani

INTERNATIONAL DIODE, 229 Cleveland Ave., Harrison, NJ 07029, Tel: 201-482-6518; Empl.: 9; *Sls. Mgr.:* Lee Toong

INTERNATIONAL ELECTRO MAGNETICS, INC., 350 N. Eric Dr., Palatine, IL 60067, Tel: 312-358-4622, TELEX: 4932869 IEM UI; Empl.: 6; *Sls. Mgr.:* T. Pretto ..... **D•1032**

Local Distributors

NY	Morris, Boynton Studio	607-263-5695
NY	New York, United Research Labs.	212-751-4660

INTERNATIONAL INSTRUMENTATION, INC., 2282 Townsgate Rd., Westlake Vlg., CA 91361, Tel: 805-495-7673, FAX: 805-379-0701; Empl.: 32; *Dist. Mgr.:* Dan Kimberling

INTERNATIONAL INSTRUMENTS

FAX: 203-481-8937

INTERNATIONAL INSTRUMENTS:APRIME TECHNOLOGY COMPANY, Twin Lakes Rd, P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092; Empl.: 150; *Dist. Mgr.:* Keith MacDowall ..... **D•1402-1403**

Local Sales Offices & Reps

KS	Olathe, Tech. Sls. Assoc.	913-829-2800
MD	Joppa, Electra-Tech	301-877-0344
MO	Ferguson, Tech. Sls. Assocs.	314-725-5361
NJ	Berkley Heights, NBS Assocs.	201-464-8500
NY	Rochester, H. C. Johnson Agys.	716-586-0777
OH	Westlake, Advanced Tech. Assocs.	216-835-5050
PA	Glenshaw, H. C. Johnson Agys.	412-487-1246
PA	Malvern, Stitzer Assocs.	215-644-5500
VA	Dumfries, Electra-Tech	703-670-6962

Local Distributors

CA	Los Angeles, E.I.L. Instrs., Inc.	213-685-7020
CA	Los Angeles, Metermaster	213-685-4340
CA	Palo Alto, Metermaster	415-960-8500
CA	San Diego, Metermaster	619-560-4844
CA	Santa Clara, Dynametron	408-727-6531
CA	Sunnyvale, E.I.L. Instrs.	408-245-4230
CO	Denver, E.I.L. Instrs., Inc.	303-534-4160
CO	Denver, Metermaster Instr. Corp.	303-722-5766
CT	Middletown, E.I.L. Instrs., Inc.	203-346-6646
FL	Palm Bay, E.I.L. Instrs., Inc.	305-725-8300
GA	Kennesaw, Metermaster	404-425-8902
IL	Bridgeview, E.I.L. Instrs., Inc.	312-430-2292
IL	Glendale Heights, Metermaster	312-250-0606
IN	Indianapolis, E.I.L. Instrs., Inc.	317-545-1373
KY	Louisville, E.I.L. Instrs., Inc.	502-454-3420
LA	New Orleans, Industrial Instr. Works	504-733-8355
MD	Gaithersburg, Pioneer Instrs. Div.	301-948-2242
MD	Sparks, E.I.L. Instrs.	301-771-4800
MA	Burlington, E.I.L. Instrs.	617-272-9450
MA	Southridge, CMI-Metermaster	617-765-0027
MI	Ferndale, Ram Meter Inc.	313-398-6767
MN	Minneapolis, Process Meas. Co.	612-544-4035
NJ	Pensauken, E.I.L. Instrs., Inc.	609-488-0474
NY	Clarence, E.I.L. Instrs.	716-634-8500
NY	Clarence, Trott Elctrns., Inc.	716-634-8800
NY	Hauppauge, E.I.L. Instrs., Inc.	516-231-6333
NY	Long Island City, Metermod Instr. Corp.	718-726-4850
NY	Pittsford, E.I.L. Instrs.	716-586-8251
NC	Charlotte, E.I.L. Instrs.	704-376-2237
OH	Cleveland, Metermaster	216-651-4100
OH	Cleveland, Pioneer/Instrmn. Div.	216-587-3600
OH	Dayton, E.I.L. Instrs., Inc.	513-435-2134
OH	Willoughby, E.I.L. Instrs.	216-953-0222
OR	Beaverton, Eicher-Richards	503-641-3300
PA	Philadelphia, Sunshine Scientific	215-673-5600
PA	Pittsburgh, CAM/RPC Instrmn.	412-963-1885
PA	Pittsburgh, E.I.L. Instrs.	412-823-2255
TX	Dallas, E.I.L. Instrs., Inc.	214-931-1236
TX	Garland, Metermaster	214-271-5671
TX	Houston, E.I.L. Instrs., Inc.	713-271-3100
TX	Houston, Meters & Instr. Corp.	713-644-1631
VA	Norfolk, E.I.L. Instrs., Inc.	804-855-9553
VA	Springfield, E.I.L. Instrs., Inc.	703-569-2611
WA	Redmond, E.I.L. Instrs., Inc.	206-882-3222
WA	Seattle, Eicher Richards	206-527-8275
Can	Alberta, Calgary, E.I.L. Instrs.-Multi Source	403-271-2001
Can	Deseronto, Ont., E.I.L. Instrs.	613-396-3383
Can	Longueuil, Que., E.I.L. Instrs.	514-651-4844
Can	Mississauga, Toronto, E.I.L. Instrs.	416-624-6660
Can	Toronto, Ont., Versatile Measuring Instrs.	416-238-8161
AZ	Tempe, Metermaster	602-437-1425

INTERNATIONAL LIGHT, 17 Graf Rd., Newburyport, MA 01950-4092, Tel: 508-465-5923, TELEX: 94-7135, FAX: 508-462-0759; Empl.: 19; *Sls. Mgr.:* Jack Kelley; *Dist. Mgr.:* Jack Kelley

INTERNATIONAL MACHINE & TOOL CORP., 115 Maple St., Warwick, RI 02888, Tel: 401-467-6905, TWX: 510-100-4251, FAX: 401-467-5885; Empl.: 35; *Sls. Mgr.:* Peter S. Piscopio

IMS

FAX: 401-683-5571

INTERNATIONAL MANUFACTURING SERVICES, 50 Schoolhouse La., Portsmouth, RI 02871-2418, Tel: 401-683-9700; FSC No.: 4S177; Empl.: 25; *Sls. Mgr.:* Jay Benson ..... **A•1953**

Local Sales Offices & Reps

MA	Attleboro, Antex-Overseas Sls.	617-222-5221
NJ	Flanders, K & R Engr. Sls.	800-452-9767

INTERNATIONAL MICROELECTRONIC PRODS., 2830 North First Street, San Jose, CA 95134, Tel: 408-432-9100, TELEX: 499-1041, TWX: 910-338-2274; Empl.: 380; *Sls. Mgr.:* Robert Krofner

INTERNATIONAL MIRCOELECTRONICS, P.O. Box 170415, Arlington, TX 76003, Tel: 817-561-2244, FAX: 817-483-8157; *Sls. Mgr.:* Wayne Fleming

INTERNATIONAL MICROSYSTEMS, 461 Valley Way, Milpitas, CA 95035, Tel: 800-237-4734; Empl.: 10; *Sls. Mgr.:* Peter Schade

INTERNATIONAL POLARIZER, INC., 320 Elm Street, Marlborough, MA 01752, Tel: 508-481-7495, TELEX: 601 6454, FAX: 508-481-0222; Empl.: 7; *Sls. Mgr.:* Donald Rickert

INTERNATIONAL POWER
DC POWER SUPPLIES

FAX: 805-388-2686

INTERNATIONAL POWER D.C., Power Supplies Inc., 355 N. Lantana, Ste. 710, Camarillo, CA 93010, Tel: 805-987-7900, TWX: 510-600-6944, ESYLNK: 62911592; Empl.: 25; *Sls. Mgr.:* Craig Johnson; *Dist. Mgr.:* Ron Ostlund ..... **D•1812-1814**

Local Sales Offices & Reps

AZ	Phoenix, S.W. Tech. Sls.	602-893-1209
CA	El Cajon, Atronix	619-444-1501
CA	Oceanside, Atronix	619-438-2537
CA	San Jose, Nelson Elctrn. Sls.	408-293-2600
CA	Woodland Hills, Atronix	818-703-7212
CT	Bethel, Livera Polk Assocs.	203-748-4639
FL	Land O Lakes, A.J. Power Source	813-996-2583
IL	Wheeling, Ed Joyner & Co.	312-520-1200
IN	Indianapolis, JFCO, Inc.	317-576-9363
MD	Randallstown, Beacon North, Inc.	703-478-2480
MI	Grand Rapids, JFCO, Inc.	616-245-4621
MI	Lake Orion, JFCO, Inc.	313-693-2053
MN	Richfield, Clay Rep Co.	612-861-2191
NH	Londonderry, Bennetron	603-432-9092
NJ	Madison, Livera-Polk Assocs.	201-377-3220
NY	Glen Head, Livera-Polk Assocs.	516-759-9300
OH	Cleveland, JFCO, Inc.	216-398-6300
OH	Vandalia, JFCO, Inc.	513-890-8322
OR	Hillsboro, Turn-A-Round Sls.	503-640-4641
PA	Pittsburgh, JFCO, Inc.	412-823-5400
TX	Austin, Barry Sls., Inc.	512-837-3616
TX	Houston, Barry Sls., Inc.	713-784-5860
TX	Richardson, Barry Sls., Inc.	214-234-0255
UT	Ogden, Taylor Mktg.	801-546-9570
VA	Sterling, Beacon North, Inc.	703-478-2480
WI	Milwaukee, Ed Joyner & Co.	414-481-0547
Can	St. Laurent, Que., Componetics, Ltd.	514-334-1464
Can	Surrey, B.C., Enerlec Sls., Ltd.	604-888-1667

Local Distributors

CA	Canoga Pk., Sandy's Elctrn. Supp.	818-346-8353
CA	N. Hollywood, Sandy's Elctrn. Supp.	818-765-8585, 818-983-2550
CA	Thousand Oaks, Pace Elctrns.	818-889-1209, 805-497-7515
IL	Champaign, Klaus Radio	217-356-1896
IL	Mt. Prospect, Feed Control	312-253-3898
IL	Villa Pk., Melvin Elctrns.	312-279-5015
IN	Carmel, Altex Elctrns.	317-848-1323
IN	Evansville, Evansville Supp. Co.	812-424-7541
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MD	Glen Burnie, Baytronics	301-766-0081, 301-953-7050
MA	Norwood, Emtel Elctrns.	617-769-9500
MN	Maplewood, Edison Controls	612-770-5122
NH	Londonderry, Orion Inds., Inc.	603-437-4446
NY	Glen Head, Livera Polk Assocs.	516-759-9300
NC	Raleigh, Sager/Svc. Plus Elctrns.	919-850-9550
OH	Highland Heights, Major Electronix	216-461-2100
PA	McKean, Advacom, Inc.	814-476-7774
TX	Richardson, All-Power	214-234-0255
VA	Sterling, ICE Comps., Inc.	703-478-2677
WI	Cedarburg, A-A Elec.	414-377-7500
Can	St. Laurent, Que., Componetics, Ltd.	514-334-1460
Can	Surrey, B.C., Enerlec Sls.	604-888-1667

INTERNATIONAL POWER DEVICES INC., 155 N. Beacon St., Brighton, MA 02135, Tel: 617-782-3331, ESYLNK: 989-752, FAX: 617-782-7416; Empl.: 96; *Sls. Mgr.:* Aileen Liu, G/M ..... **D•1815-1816, 1818-1822**

Local Sales Offices & Reps

AL	Huntsville, Macro Mktg.	205-883-9630
AZ	Mesa, Elec-Com Assocs.	602-844-0566
CA	Del Mar, Power Partners	619-481-0422
CA	Los Angeles, Power Partners	213-215-0800
CA	San Diego, Power Partners	800-468-5400
CA	San Ramon, Tech. Consits.	415-830-0829
CO	Littleton, MRC	303-794-4644
FL	Land O'Lakes, A.J.'s Power Source	813-996-2583
GA	Norcross, Macro Mktg.	404-662-5580,404-441-1081
IL	Skokie, Electro-Tech Mktg. Assocs., Inc.	312-676-3151
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
KS	Merriam, Lorenz Sls.	316-721-0500
MA	Brighton, IPD	617-782-3331
MA	Waltham, Newport Tech. Sls.	617-890-7255
MI	Ann Arbor, Augnat Assocs.	313-668-3134
MN	Bloomington, Smiley/Scott Inc.	612-888-5551
MO	St. Louis, Rush & West Assocs., Inc.	314-965-3322
NE	Lincoln, Lorenz Sls.	402-475-4660
NH	Londonderry, Bennetron	603-432-9092
NJ	Haddonfield, Sunday O'Brien	609-429-4013
NY	Buffalo, Ed Westgren Assocs.	716-632-0011
NY	Rochester, Ed Westgren Assocs.	716-426-3598
NC	Raleigh, Micro Sls., Inc.	919-881-0007
OH	Akron, Augnat Assocs.	216-273-1211
OH	Dayton, Augnat Assocs.	513-298-1507
OH	Kettering, Electro-Com	513-299-0864
OR	Portland, Power Sources Unltd.	503-292-0820
OR	Portland, Power Sources, Unltd.	503-292-0820
TX	Dallas, Seaton Corp.	214-980-9860
TX	Houston, Seaton Corp.	713-731-2649
VA	Richmond, Glasscock Assocs.	804-740-0063
WA	Redmond, Elctrns. N.W. Inc.	206-883-1959
WI	Brookfield, Electro-Tech Mktg., Inc.	414-785-9554

Local Distributors

GA	Norcross, Applied Power, Inc.	404-263-0421, 1-800-445-8415
MI	Brighton, Applied Power, Inc.	313-227-3604, 1-800-624-5496
NH	Londonderry, Orion Inds.	603-437-3260

INTERNATIONAL POWER MACHINES, 2975 Miller Park North, Garland, TX 75042, Tel: 800-527-1208, TELEX: 794078 IPM POWER, FAX: 214-494-2690; *Sls. Mgr.:* Wayne Harper

International Power Sources, Inc.

FAX: 508-879-8669

INTERNATIONAL POWER SOURCES, INC., 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-881-7434, TWX: 510-881-7434 ..... **D•1824-1826**

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc.	205-837-7105
AZ	Scottsdale, Power Up Elctrns.	602-955-1105
CA	Laguna Hills, Electro Venture South	714-581-9244
CA	Los Altos Hills, H B Mktg.	415-941-4080
FL	Tampa, Over & Over, Inc.	813-626-9100
GA	Norcross, Over & Over, Inc.	404-449-6205
IL	Arlington Hgts., Phoenix Elctrn. Sls.	312-394-4422
IA	Des Moines, The Beams Co.	515-255-1148
KS	Shawnee Mission, The Beams Co.	913-631-0300
MA	Franklin, OEM Mktg. & Sls.	508-528-4983
MA	Hunt Valley, Eagle Sls. Corp.	301-666-3930
MN	Edina, Engineering Prods. Assoc., Inc.	612-835-9022
MO	St. Louis, The Beams Co.	314-434-8448
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NY	Jericho, J-Square Mktg.	516-935-3200
NC	Charlotte, Over & Over, Inc.	704-542-9110
OH	Cincinnati, KCH Co.	513-931-1686
PA	Montgomeryville, Eastern Sci. Mktg.	215-368-4570
TX	Richardson, Jim D. Gray & Assocs.	214-699-9976
UT	Ogden, Taylor Mktg.	801-545-9570

Local Distributors

CA	Redwood City, HdB Elctrns.	415-368-1388
GA	Norcross, Applied Power, Inc.	404-263-0421
MI	Brighton, Applied Power, Inc.	313-229-6550
NH	Londonderry, Orion Inds., Inc.	603-437-4446
TX	Stafford, Southwest Elctrns.	713-240-4000

International IOR Rectifier

FAX: 213-772-9028

INTERNATIONAL RECTIFIER CORP., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245, Tel: 213-772-2000, TELEX: 472-0403, TWX: 910-348-6291; Empl.: 1900; *Sls. Mgr.:* Don Prescott; *Dist. Mgr.:* Shawn Fogarty ..... **B•1543**

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg., Inc. 205-830-0498
AZ Phoenix, Sun State Tech. Sls. 602-220-0595
CA Chatsworth, First Rep 818-718-6155
CA Mtn. View, Brooks Tech. Grp. 415-960-3880
CA San Diego, Harvey King, Inc. 619-587-9300
CA Tarzana, Power Comp. Sls. 818-881-9111
CO Wheat Ridge, Waugaman Assocs., Inc. 303-423-1020
CT Fairfield, N.R.G. Ltd., Inc. 203-384-1112
FL Boca Raton, Lawrence Assocs., Inc. 305-368-7373
GA Norcross, Montgomery Mktg., Inc. 404-447-6124
IL Hoffman Estates, Micro-Tex, Inc. 312-382-3001
IL Palatine, International Rectifier 312-397-0002
KY Carmel, Tech. Mktg. Corp. 317-844-8462
IA Cedar Rapids, Hitec Cen., Inc. 319-396-3228
KY Louisville, Technlg. Mktg. Corp. 502-893-1377
MD Columbia, L. D. Lowery, Inc. 301-381-0225
MA Burlington, AD/Nova Sls., Inc. 617-270-9600
MI Farmington Hills, Luebbe Sls. 313-489-8828
MN Edina, Mel Foster Tech. Sls. 612-941-9790
MO Florissant, Hitec Control, Inc. 314-831-9377
NJ Pallisades Park, International Rectifier 201-943-4554
NJ W. Caldwell, Tech. Mktg. Grp. 201-226-3300
NM Albuquerque, Reptronix Ltd. 505-292-1718
NY E. Syracuse, Nycom, Inc. 315-437-8343
NY Melville, Tech. Mktg. Grp. 516-351-8833
NY Poughkeepsie, Intl. Rectifier 914-471-5300
NC Cary, Montgomery Mktg., Inc. 919-467-6319
NC Greensboro, Intl. Rectifier 412-837-9155
NC Raleigh, Montgomery Mktg., Inc. 919-851-0010
OH Cincinnati, Luebbe Sls. Co. 513-530-0600
OH Cleveland, Luebbe Sls. Co. 216-333-0425
OH Columbus, Luebbe Sls. Co. 614-431-0474
OH Dayton, Luebbe Sls. Co. 513-294-0426
OH Northfield, Intl. Rectifier 216-467-0852
OK Tulsa, BP Sls. 918-744-9964
OR Portland, N.W. Mktg. Assocs. 503-620-0441
PA Broomal, L. D. Lowery, Inc. 215-356-5300
PA Greensburg, Intl. Rectifier 412-837-9155
PA Pittsburgh, Luebbe Sls. Co. 412-364-0490
TX Austin, BP Sls. 512-346-9186
TX Houston, BP Sls. 713-782-4144
TX Richardson, BP Sls. 214-234-8438
UT Salt Lake City, R-Squared Mktg. 801-595-0631
WA Bellevue, N.W. Mktg. Assocs. 206-455-5846
WI Elm Grove, International Rectifier 414-784-2480
WI Waukesha, Micro-Tex, Inc. 414-542-5352

IRC
A Member of the Crystalate Group

FAX: 704-264-8865

INTERNATIONAL RESISTIVE COMPANY, P.O. Box 1860, Boone, NC 28607, Tel: 704-264-8861, TELEX: 46-9902; Empl.: 1700; *Sls. Mgr.:* Larry J. Johnston; *Dist. Mgr.:* Hugh Bolen ..... **A•1746-1747, 1954-1961, 2110-2111; B•1015-1017, 1897**

Local Sales Offices & Reps

AL Huntsville, R. O. Whitesell & Assocs. .. 205-883-5110
AZ Scottsdale, SW Sls. Inc. 602-991-1937
CA Montrose, Luscombe Engrg. Co. 818-249-9000
CA Sacramento, ETS 916-962-3030
CA San Jose, ETS 408-433-9366
CO Westminster, Straube Assocs. 303-426-0890
CT North Haven, Coakley, Boyd & Abbett, Inc. 203-239-6217
FL Tampa, APM Assocs. 813-886-2457
GA Norcross, S. Atlantic Comp. Sls. 404-447-6154
IL Itasca, Circuit Sls. Inc. 312-833-2242
IN Ft. Wayne, R. O. Whitesell & Assocs. .. 219-432-5591
IN Indianapolis, R. O. Whitesell & Assocs. 317-359-9283
IA Cedar Rapids, C. H. Horn & Assocs. .. 319-393-8703
KS Lenexa, Midtec Assocs. 913-541-0505
KY Pewee Valley, R. O. Whitesell & Assocs. 502-241-1441
MD Columbia, L. D. Lowery Inc. 301-381-0225
MA Needham Hgts., Coakey, Boyd, & Abbett 617-444-5470
MI Grand Blanc, R. O. Whitesell & Assocs. 313-695-0770
MI Grand Rapids, R. O. Whitesell & Assocs. 616-942-5420
MI Southfield, R. O. Whitesell & Assocs. .. 313-559-5454
MI St. Joseph, R. O. Whitesell & Assocs. 616-983-7337
MN Minneapolis, Tecteam Sls., Inc. 612-854-6616
MO St. Louis, Jack Macke Co. 314-432-2830
NJ Hackensack, Coakley, Boyd Abbett, Tylinski, Inc. 201-440-4114
NY Rochester, Electra Sls. 716-427-7860
NY Syracuse, Electra Sls. 315-463-1248
NC Raleigh, S. Atlantic Comp. Sls. 919-859-9970
OH Cincinnati, R. O. Whitesell & Assocs .. 513-521-2290
OH Cleveland, R. O. Whitesell & Assocs. .. 216-447-9020
OH Columbus, R. O. Whitesell & Assocs. 614-888-9396
OH Dayton, R. O. Whitesell & Assocs. 513-298-9546
OK Tulsa, Ion Assocs. 918-481-2199
PA Broomall, L. D. Lowery Inc. 215-356-5300
PA Pittsburgh, R. O. Whitesell & Assocs. 412-963-6161
TN Knoxville, R. O. Whitesell & Assocs. ... 615-694-9476
TN Nashville, R. O. Whitesell & Assocs. ... 615-352-4760
TX Austin, Ion Assocs. 512-331-7251
TX El Paso, S. W. Sales 915-594-8259
TX Grand Prairie, Ion Assocs. 214-647-8225
TX Houston, Ion Assocs. 713-537-7717
UT Salt Lake City, Straube Assocs. 801-263-2640
VA Earlysville, L. D. Lowery Inc. 804-973-6672
OR Lake Oswego, RTS 503-244-4123
WA Vashon, RTS 206-285-1363
WI Brookfield, Circuit Sls., Inc. 414-784-7773
Can Montreal, Que., Tech-Rep 514-337-6046

Local Distributors

CA Campton, Harper S.I.D. 213-979-5090
CA Gardena, Bell Inds. 213-515-1800
CA Sunnyvale, Bell Inds. 408-734-8570
CA Sunnyvlae, Harper S.I.D. 408-988-6041
FL Tampa, Impala Elctrns. 813-885-4747
IL Schaumburg, Arrow Elctrns. 312-397-3440
IN Indianapolis, Graham Elctrns. 317-634-8202
IA Cedar Rapids, Deeco 319-365-7551
MA Woburn, Jaco Elctrns. 617-933-7760
MN Edina, Arrow Elctrns. 612-830-1800
NJ Hanover, State Elctrns. 201-887-2550
NJ Marlton, Arrow Elctrns. 609-596-8000
NY Hauppauge, Jaco Elctrns. 516-273-5500
NC Raleigh, Arrow Elctrns. 919-876-3132
NC Raleigh, Resco/Raleigh 919-781-5700
OH Columbus, Electronic Mktg. 614-299-4161
PA Philadelphia, Philadelphia Elctrns. 215-568-7400
TX El Paso, Intl. Elctrns. 915-778-9761
TX Richardson, Jaco Elctrns. 214-235-9575
WA Bellevue, Priebe Elctrns. 206-821-4695

INTERNATIONAL RESOURCE SVCS., 7792 N.W. 72nd Ave., Miami, FL 33166, Tel: 305-884-2924, TELEX: 529076 SUN MIA UD, FAX: 305-884-3771; Empl.: 5; *Sls. Mgr.:* Richard L. Winn

FAX: 402-694-6180

INTERNATIONAL SENSOR SYSTEMS, INC., Aurora Industrial Pk., Box 345, Aurora, NE 68818, Tel: 402-694-6111; Empl.: 45; *Sls. Mgr.:* Wayne Roblee ..... **A•1748-1749**

Local Sales Offices & Reps

CA Milpitas, Custom Technlg. Sls. 408-263-3660
CA Mission Viejo, EAB Assocs. Inc 714-859-7701
MD Baldwin, Quarterback Sls. Inc. 301-764-9400
MO Jefferson City, Williams Assocs. Co. .. 314-893-2459
NE Omaha, IONEB 402-895-4431
NY Liverpool, Syronics, Inc. 315-451-0968
OH Cincinnati, Applied Data Mgt. 513-579-8108
PA Southampton, Campbell Assocs. 215-322-6630
TN McMinnville, B & D Mktg. 615-473-7155
TX El Paso, Nokomis of El Paso, Inc. 915-778-2801
TX Lewisville, Elctrn. Prod. Reps. 214-436-4772

INTERNATIONAL TELECOMMUNICATIONS COMPONENTS, INC., 94 B East Jefryn Blvd., Deer Park, NY 11729, Tel: 516-243-1444, FAX: 516-595-9160; FSC No.: 0E6J8; Empl.: 15; *Sls. Mgr.:* Rick Walter

INTERNATIONAL TRANSDUCER CORP., Channel Technologies, Inc., 869 Ward Dr., Santa Barbara, CA 93111, Tel: 805-683-2575, TELEX: 658 495; FSC No.: ID 532; Empl.: 65; *Sls. Mgr.:* Christine M. Bashforth

INTERNATIONAL WIRE PRODUCTS CO., 500 W. Main St., Wyckoff, NJ 07481, Tel: 201-891-5800, TELEX: 642580; Empl.: 700; *Sls. Mgr.:* C. D. Abbott

INTEROPTICS

FAX: 415-340-1670

INTEROPTICS, Purdy Group, 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-7727, TELEX: 677-1439 (PURDY UW); Empl.: 35 ..... **B•1214**

Local Sales Offices & Reps

AZ Phoenix, C.T. Carlberg & Assocs. 602-468-0750
CA Anaheim, Exsell Sls. Assocs. 714-978-5740
CA Burlingame, William J. Purdy Co. 415-347-7701
CA Poway, Exsell Sls. Assocs. 714-978-5740
CA San Jose, Exsell Sls. Assocs. 800-873-1873
FL Boca Raton, Beacon Elctrns. 407-997-5740
FL Clearwater, Beacon Elctrns 813-796-2378
FL Longwood, Beacon Elctrns. 407-332-1940
MN Bloomington, Heil's Termatech Elctrn. Mktg. 612-854-2001
NH Nashua, Bell Controls, Inc. 603-882-6984
NJ Passaic, Lightcomm Sls. Assocs. 201-778-6540
NM Albuquerque, C.T.Carlberg & Assocs. . 505-836-1448
NY New York, Lightcomm Sls. Assocs. ... 212-807-8924
NY Utica, Fiber Instrs. Sls. 315-735-1691
NC Fayetteville, Zim-Tek 919-488-4101
OK Tulsa, Beacon Elctrns. 918-622-1494
OR Beaverton, Pacific Mktg. Specialists ... 503-641-9373
TX Austin, Beacon Elctrns. 512-345-3543
TX Dallas, Beacon Elctrns. 214-437-1505
VA Richmond, EME IV, Inc. 804-360-5-49
VA Williamsburg, EME IV, Inc. 804-253-0171
WA Redmond, Pacific Mktg. Specialists ... 206-882-3144

Local Distributors

CA Anaheim, Fibertron 714-634-3449
Can Burnaby, BC, C.D. Nova, Ltd. 604-430-5612

interpoint

INTERPOINT CORPORATION, 10301 Willows Roads, P.O. Box 97005, Redmond, WA 98073-9705, Tel: 206-882-3100, FAX: 206-882-1990; FSC No.: 50821; Empl.: 300; *Sls. Mgr.:* D. T. Baughman ..... **A•1750-1751; D•1828-1835**

Local Sales Offices & Reps

AL Huntsville, Novus Grp. 205-534-0044
AZ Tempe, Gassner & Clark 602-968-9037
CA Costa Mesa, Interpoint 714-432-6472
TX Irving, Kite Elctrn. Sls. 214-674-1330
CA San Diego, Martronix 619-728-0384
CO Parker, Tech. Mktg. Assocs. 303-841-3435
FL Deerfield Bch., Krutek & Assocs. 305-427-4202
GA Lilburn, Novus Grp. 404-381-1015
IA Des Moines, Beams Co. 515-255-1148
KS Shawnee Mission, Beams Co. 913-631-0300
MD Owings Mills, Neal Deoul Assocs. 301-363-4311
MA Wakefield, Howard C. Jappe Co. 617-245-9359
MN Minneapolis, Interpoint 612-921-8443
MO St. Louis, Beams Co. 314-934-8448
MO St. Louis, Beams Co. 314-569-1060
NJ Flanders, K & R Engrg. Sls. 201-584-5235
NY N. Syracuse, Advanced Comps. Corp. . 315-699-2671
NC Raleigh, Novus Grp. 919-872-3966
OH Cleveland, Arthur H. Baier Co. 216-461-6161
PA Newtown, Yax Assocs. 215-860-2540
TX Irving, Kite Electrn. Sls. 416-674-1330
Can Ontario/Scarborough, Bestec Elctrns., Ltd. 416-674-1330

INTERSIL, 2450 Walsh Ave., Santa Clara, CA 95051, Tel: 408-996-5000, TWX: 910-338-0583; FSC No.: 32293; Empl.: 4102; *Dist. Mgr.:* Bruce Mattern

INTERSTATE ELECTRONICS CORP., Box 3117, 1001 E. Ball Rd., Anaheim, CA 92803, Tel: 714-758-0500, TELEX: 655443, TWX: 910-591-1197; FSC No.: 6625, 5985; Empl.: 1500; *Sls. Mgr.:* Darryl Watanabe; *Dist. Mgr.:* R. Sorenson

INTERSTATE WIRE CO., INC., 10820 Sanden Dr., Dallas, TX 75238, Tel: 214-553-1311, TWX: 910-860-5084, FAX: 214-348-7106; *Sls. Mgr.:* Chris B. Brandon

INTERSWITCH, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-8217, TELEX: 677-1439, FAX: 415-340-1670; FSC No.: (Purdy UW); Empl.: 30; *Sls. Mgr.:* Clarence Bruce ..... **B•1867**

Local Sales Offices & Reps

CA Burlingame, Interswitch 415-347-8217
AZ Phoenix, C.T. Carlberg & Assoc. 602-468-0750
CA Anaheim, Impact 714-533-1351

CA	Burlingame, William J. Purdy Co.	415-347-7701
CO	Denver, William J. Purdy Co.	303-790-2211
CT	Meriden, Advanced Comp. Sls.	203-238-6891
IL	Ambler, W.R.Hartmaier Assocs.	215-643-6691
IL	Elmhurst, F.F./Hill-Gray	312-832-4101
IN	Indianapolis, John Sukup Inc.	317-253-5501
MD	Lisbon, S. K. MacDonald	301-982-1088
MA	Framingham, Gallagher Assocs., Inc.	508-626-2346
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MA	Farmingham, Gallagher	617-626-2346
NM	Albuquerque, C.T. Carlberg & Assocs.	505-836-1448
NM	Albuquerque, William J. Purdy Co.	505-266-7959
NY	Fairport, Net Sls., Inc.	716-223-1030
NY	Rochester, Net Sls.	716-223-1030
OH	Cleveland, Marlow	216-991-6500
OH	Dayton, Marlow	513-274-9666
OR	Beaverton, Pacific Mktg.	503-641-9373
PA	Philadelphia, S. K. MacDonald, Inc.	215-545-1205
TX	Dallas, Elcom Mktg.	214-241-2166
TX	Houston, Elcom Mktg.	713-350-8064
TX	Irving, EDC	214-257-0322
WA	Redmond, Pacific Mktg.	206-882-3144
Can	Oakville, Ont., Haltronics, Ltd.	416-844-2121

Local Distributors

AL	Huntsville, Powell Elctrns.	205-539-2731
AZ	Tempe, Anjon Entprs.	602-894-1332
AZ	Tempe, Waltronic Sls.	602-967-1020
CA	Burbank, Merit Comp. Supp.	818-842-8162
CA	Canoga Pk., Panel Parts Co.	818-884-8898
CA	Costa Mesa, Powell	714-754-1717
CA	Fremont, Allied Elctrns.	415-770-0590
CA	San Jose, Powell	408-943-9020
CA	Santa Clara, Waltronic Sls.	408-727-1200
CA	Sunnyvale, Penstock	408-730-0300
CO	Denver, Integrated Elctrns.	303-292-5537
FL	Ft. Lauderdale, Powell	305-484-8377
GA	Norcross, Allied Elctrns.	404-446-8595
IL	Chicago, Federal Screw Prods.	312-478-5744
IL	Elgin, Allied Elctrns.	312-697-8200
MD	Columbia, Powell	301-621-8080
MD	Columbia, Powell Elctrns., Inc.	301-621-8080
MA	Lynn, Land Elctrn. Co.	617-592-2220
MA	Westborough, Powell Elctrns.	617-366-6100
MA	Wilmington, Allied Elctrns.	617-942-0150
MN	Minneapolis, Bergquist	612-835-2322
NJ	Englewood, Powell Elctrns.	201-894-0800
NJ	Mt. Laurel, Allied Elctrns.	609-234-7769
NM	Albuquerque, Walker Elctrn. Supp.	505-883-2992
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Mt. Vernon, QAR Indl. Elctrns.	914-699-2224
NY	Rochester, Allied Elctrns.	716-244-9440
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Raleigh, Allied Elctrns.	919-876-5845
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
PA	Philadelphia, Powell	215-365-1900
PA	Philadelphia, Resco Elctrns.	215-659-4575
PA	Pittsburgh, Allied Elctrns.	412-367-4124
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Irving, Powell	214-550-0547
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
WA	Seattle, Allied Elctrns.	206-547-2827
WI	Mequon, Taylor Elec. Co.	414-241-4321
Can	Don Mills, Ont., Saynor Varah	416-445-0723
Can	Oakville, Ont., Paltronics, Ltd.	416-844-2121
Can	Willowdale, Ont., Electrosonic	416-494-1666

INTER-TECHNICAL GROUP INC., WIMA Div., 2269 Saw Mill River Rd., Ste. 400, Elmsford, NY 10523, Tel: 914-591-8822, TWX: 710-564-0802, FAX: 914-591-7336; Empl.: 17; *Sls. Mgr.:* Gary M. Fey; *Dist. Mgr.:* Andrew E. Dvorscak ..... **A•1083**

Local Sales Offices & Reps

AL	Huntsville, J. R. Assocs.	205-830-2130
CA	Campbell, Shur Sls.	408-374-5577
CO	Arvada, ArrowHead/CSI Sls. Corp.	303-423-5556
FL	Altamonte Springs, 'C' Assocs., Inc.	305-831-1717
GA	Conyers, J.R. Assocs.	404-760-1815
IL	Westchester, W. G. Brouilette & Assocs.	312-345-6500
MA	Newton, Normell Assocs.	617-969-5478
MN	Minneapolis, Holmgren Assocs.	612-786-7641
NJ	Upper Montclair, McCarron Entprs., Inc.	201-783-3112
NY	Rochester, BKT Assocs., Inc.	716-461-9880
NY	Smithtown, T & K Sls.	516-724-3456
OR	Beaverton, Harry Levinson Co.	503-690-1312
PA	Ambler, W M Assocs.	215-643-4119
TN	Chattanooga, J. R. Assocs.	615-977-0711
TX	Houston, Barry Sls., Inc.	713-784-5860
TX	Richardson, Barry Sls, Inc.	214-234-0255
UT	West Valley, Butterworth Mktg.	801-972-5566
VA	Richmond, Glasscock Assocs.	804-740-0063
WA	Seattle, Harry Levinson Co.	206-382-1300

Local Distributors

CA	San Jose, Shelly-Ragon, Inc.	408-432-0600
CA	Sunnyvale, Capsco Sls., Inc.	408-734-3020
GA	Norcross, Spectrum Elctrns., Inc.	404-448-1516
IL	Rosemont, Advent Elctrns., Inc.	312-297-6200
IN	Indianapolis, Advent Elctrns., Inc.	317-872-4910
IA	Cedar Rapids, Advent Elctrns., Inc.	319-363-0221
MA	Ashland, March Elctrns.	508-881-6715
MN	New Brighton, Chris Elctrns. Distr.	612-631-2647
NY	Bohemia, March Elctrns.	516-563-6000
OH	Englewood, Argent Inds., Inc.	513-836-8633
PA	Exton, VSH Elctrns.	215-363-2250
PA	North Versailles, CMD Elctrns., Inc.	412-678-6020
TX	McKinney, Prime Distrbg. Co.	214-231-0170
WA	Seattle, Kam Elctrns. Div.	206-382-1300

INTRA-COMPUTER, 101 W. 31st St., New York, NY 10001, Tel: 212-947-5533, FAX: 212-947-5984; Empl.: 9; *Sls. Mgr.:* Art Yaglian

Intronics

FAX: 617-527-3310

INTRONICS, INC., 57 Chapel St., Newton, MA 02158, Tel: 617-964-4000, TELEX: 200095, TWX: 710-335-6835; Empl.: 75 ..... **B•1018; D•1836-1837**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
AZ	Scottsdale, Arcom Sls., Inc.	602-947-5745
CA	Los Alamitos, Power Specialists	213-594-9418
CA	Mountain View, Marcon Sls., Inc.	415-964-8046
CO	Englewood, Component Sls., Inc.	303-779-8060
IL	Arlington Hgts., Coombs Assocs.	312-439-9810
IA	Cedar Rapids, Technical Elctrns.	319-366-5443
MA	Lowell, Underwood Sls. Corp.	617-256-8191
MA	Lowell, Underwood Sls. Corp.	508-256-8191
MN	Wayzata, Cardinal Sls. Co.	612-475-0042
NJ	Livingston, Avemark Tech. Mktg.	201-992-5331
NY	Utica, Fiber Instr. Sls.	315-735-1691
NY	Utica, Fiber Instrs. Sls.	315-735-1691
OH	Dayton, Del Steffen & Assocs.	513-293-3145
PA	New Hope, Intek, Inc.	215-862-5601
VA	Reston, Stinson Assocs.	703-478-2252
Can	Lachine, Que., Electro Design	514-636-4838
Can	Surry, BC, Enerlec Sls., Ltd.	604-888-1667

ION PHYSICS CO., 323 Andover St., Wilmington, MA 01887, Tel: 508-658-6030, TWX: 510-600-6134, FAX: 508-658-9455

IPAC GRP., 3047 Indl. Blvd., Bethel Pk., PA 15102, Tel: 412-831-9200, TWX: 510-697-3935, FAX: 412-831-9580; Empl.: 50; *Sls. Mgr.:* D. T. Cusack

ISKRA ELECTRONICS, INC., 155 Dupont St., Plainview, NY 11803, Tel: 516-349-0222, TELEX: 221527, FAX: 516-349-7642; *Sls. Mgr.:* Debbie Gremito

Local Sales Offices & Reps

CA	Arcadia, VanGott & Assoc.	818-445-9728
CA	Saratoga, F & F Assoc.	408-446-2349
IL	Elmhurst, Utronix Sls.	312-834-1100
IN	Ft. Wayne, Naunas Sls. Co.	219-432-4792
LA	Hammond, Design Mktg. of LA, Inc.	504-542-1115
MN	Minneapolis, R.K. Sls. Assocs. Inc.	612-571-1001
NJ	Glasboro, R. P. Luce & Co.	609-881-2877,
NY	Canastota, DR Huller Assoc.	315-697-9817
NY	New Hyde Pk., R. P. Luce & Co.	516-437-4550
NC	New Bern, R A Sls.	919-244-2672
OH	Mentor, Sales Plus	216-255-6917,
SC	Easley, R A Sls.	803-859-1859
TX	Rowlett, Champion Sls. Co.	214-475-8813

Local Distributors

NJ	Westwood, Seacor	201-666-5600
NY	Ronkonkoma, Baldwin Comps.	516-588-5700

ISL

FAX: 516-937-3840

ISL PRODUCTS INT'L, LTD., 235 P Robbins Lane, Syosset, NY 11791-6093, Tel: 516-937-3475, TELEX: 503242; Empl.: 10; *Sls. Mgr.:* Ken Kawaller ..... **A•1085, 2312; C•1386, 1864; D•2240**

Local Sales Offices & Reps

IL	Chicago, Golbeck Milota Assoc.	312-705-0602
IN	Indianapolis, C.C. Electro Sales	317-255-1508
MN	St. Paul, Countryman Assoc.	612-645-9151

ISOLATION PRODUCTS, INC., 157 San Lazaro Ave., Sunnyvale, CA 94086, Tel: 408-730-4672; Empl.: 5

ISOREG CORP., 410 Great Rd., P.O. Box 486, Littleton, MA 01460, Tel: 617-486-9483, FAX: 617-486-3539; Empl.: 75; *Sls. Mgr.:* Paul Foss; *Dist. Mgr.:* Paul Foss

ISOTEMP RESEARCH, INC.

FAX: 804-977-1849

ISOTEMP RESEARCH, INC., 1750 Broadway St., P.O. Box 3389, Charlottesville, VA 22901, Tel: 804-295-3101; FSC No.: 031785; Empl.: 58 ..... **A•1412-1413**

Local Sales Offices & Reps

CA	Fremont, Wm. Parks & Assocs.	415-796-0875
CA	San Diego, Qualtronics	619-695-0118
IL	Woodridge, Trend-Tronics	312-985-0626
NC	Raleigh, Godwin Assocs.	919-847-3006

ISOTRONICS, INC., Industrial Park, New Bedford, MA 02745, Tel: 508-998-2000, TWX: 710-344-1961; *Sls. Mgr.:* Jeffrey Lang

ITEK ENCODER, 27 Christina St., Newton, MA 02161-1953, Tel: 617-969-7300, TWX: 710-335-6783, FAX: 617-964-3705; Empl.: 100 ..... **B•1960-1961**

Local Sales Offices & Reps

CA	Long Bch., Itek Encoder	213-598-8575
CA	Montrose, Luscombe Engrg.	818-249-9000
FL	Orlando, K. S. Chaney	407-293-5656
IL	Des Plaines, Marsland Assocs.	312-298-2620
MI	Grand Rapids, Midwest & Meridian Corp.	616-698-7391
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Midwest & Meridian Corp.	314-878-4441
NJ	Metuchen, Itek Encoder	201-548-1500
TX	Garland, Carey, McMahill & Assocs., Inc.	214-681-1414
WI	New Berlin, Marsland Assocs., Inc.	414-786-6611

ITHACO, INC., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437, Tel: 607-272-7640, TWX: 510-255-9307, FAX: 607-272-4550; Empl.: 120; *Sls. Mgr.:* E. W. Seymour

ITL CIRCUITS, 90 Don Park Road, Markham, Ontario, Canada L3R 1C4, Tel: 416-475-6658, 416-492-9307, FAX: 416-475-5097; FSC No.: FSCM 38747; Empl.: 90; *Sls. Mgr.:* Derk Wissink

ITT CANNON:MILITARY/AEROSPACE DIV., 666 E. Dyer Road, Santa Ana, CA 92705-5684, Tel: 714-557-4700, TELEX: 75-3917, TWX: 910-997-0523; FSC No.: 71468;Multiple; Empl.: 2000; *Sls. Mgr.:* Richard Torson; *Dist. Mgr.:* Richard Torson

ITT Components

A Division of ITT Corporation

FAX: 714-727-2109

ITT COMPONENTS, ITT Corporation, 5 Jenner St., Irvine, CA 92718, Tel: 714-727-3001, TELEX: 681-389, TWX: 910-595-1744; FSC No.: 61725; Empl.: 29; *Dist. Mgr.:* M. Pommier ..... **A•1086-1087; B•1544-1551**

Local Sales Offices & Reps

AL	Huntsville, JWL	205-883-1712
AZ	Scottsdale, Bill Earl Assocs. Inc.	602-994-3813
CA	Burbank, Darco	818-504-2425
CA	San Jose, Eclipse	408-437-7575
CO	Englewood, Romulus Elctrns.	303-770-4888
CT	Guilford, Data Mark, Inc.	203-453-0575
FL	Pompano Bch., Bolton Assocs.	305-781-8887
GA	Atlanta, JWL	404-320-7643
IL	Rolling Meadows, Heartland Tech. Sls.	312-577-9222
IN	Ft. Wayne, M/S Sls.	219-436-3023
KS	Wichita, Thunderbird Tech. Sls.	316-684-3941
MD	Lutherville, PGR	301-583-1360
MA	Sudbury, KSA of New England	617-443-5881
MI	Brighton, Elctrn. Sources Inc.	313-227-3598
MN	Minnetonka, J.P. & Assocs.	612-935-7930
MO	Maryland Hgts., Thunderbird Tech. Sls.	314-298-8940
NM	Albuquerque, Syntech	505-266-7951
NY	Fairport, Net Sls. Co.	716-223-1030
NY	Manhasset, Win Cor Elctrns.	516-627-9474
NC	Pineville, JWL & Assocs.	704-541-5750
OH	Centerville, Omega Sls.	513-434-5507
OH	Shaker Hgts., Omega Sls.	216-751-9600
PA	Prospect Pk., Elf Sls.	215-534-3340
TX	Richardson, Milco Mktg.	214-783-2716
WA	Redmond, EMG	206-882-0962

Local Distributors

AL	Huntsville, Time	205-721-1133
AZ	Tempe, Richey Impact Elctrns.	602-894-9251
AZ	Tempe, Shelley Ragon	602-894-2058
AZ	Tempe, Time	602-967-2000
CA	Anaheim, Time	714-937-0911
CA	Chatsworth, Shelley Ragon	818-998-3333
CA	Chatsworth, Time	818-998-7200
CA	Garden Grove, Richey Impact Elctrns.	714-895-0060
CA	Huntington, Capacitor Spec.	714-843-1815
CA	Irvine, Integrated Elctrns.	714-837-9960
CA	Irvine, ITT Multi Comps.	714-727-4001
CA	Sacramento, Integrated Elctrns.	916-424-5297
CA	San Diego, Richey Impact Elctrns.	619-271-4511
CA	San Diego, Shelley Ragon	619-453-7133
CA	San Diego, Time	619-586-1331
CA	San Jose, Integrated Elctrns.	408-263-1100
CA	San Jose, ITT Multicomps.	408-279-0685
CA	San Jose, Shelley Ragon	408-942-9111
CA	Santa Clara, Richey Impact Elctrns.	408-727-7411
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Sunnyvale, Time	408-734-9888
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Englewood, NEP Elctrns.	303-799-9898
CO	Englewood, Shelley Ragon	303-762-0670
CO	Englewood, Time	303-799-8851
CT	Cheshire, Time	203-271-3200
CT	East Haven, J.V. Elctrns.	203-469-2321
CT	New Haven, Greene Shaw Co.	203-397-0710
FL	Davie, ARCO Distrs.	305-473-2550
FL	Ft. Lauderdale, NRC	305-772-4500
FL	Ft. Lauderdale, Time	305-974-4800
FL	Orlando, Time	305-841-6565
FL	Tampa, Shelley Ragon	813-623-6560
GA	Norcross, Time	404-448-4448
IL	Chicago, Leeds Electro Comps.	312-825-3800
IL	Chicago, NEP Elctrns.	312-625-8400
IL	Hoffman Estates, Integrated Elctrns.	312-843-2040
IL	Lombard, Shelley Ragon	312-629-8833
IL	Wood Dale, Time	312-350-0610
IN	Indianapolis, CSE	317-879-9119
IN	Indianapolis, Mar Elctrns.	317-633-6699
IA	Cedar Rapids, Shelley Ragon	319-373-0525
MD	Beltsville, RESCO-Washington	301-937-9100
MD	Columbia, Time	301-964-3090
MD	Jessup, TREEKO Sls.	301-792-0112
MD	White Marsh, Resco	301-529-0500
MA	Canton, Impact Sls.	617-821-1500
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Peabody, Time	508-532-6200
MI	Livonia, Key Elctrns.	313-261-5972
MN	Edina, Time	612-835-1250
MN	Minneapolis, Sterling	612-831-2666
MN	St. Paul, Shelley-Ragon	612-642-2828
MS	Hazelwood, Shelley-Ragon	314-454-0480
MO	Independence, Shelley-Ragon	816-254-3410
MO	St. Louis, Time	314-391-6444
NV	Las Vegas, Kiesub Elctrns.	702-733-3888
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Pinebrook, Time	201-882-4611
NJ	Rockaway, Tonar Inds.	201-586-9000
NJ	W. Berlin, GCI	609-768-6767
NM	Albuquerque, Betatron Elctrns.	505-344-2381
NY	E. Syracuse, Time	315-432-0355
NY	Hauppauge, Time	516-273-0100
NY	Medford, Shelley-Ragon	516-447-2000
NC	Charlotte, Time	704-522-7600
NC	Oxford, Time	919-693-5166
OH	Cincinnati, Schuster	513-489-1400
OH	Cleveland, Schuster	216-425-8134
OH	Dublin, Time	614-761-1100
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Integrated Elctrns.	503-641-1690
OR	Portland, Time	503-684-3780
OR	Wilsonville, Shelley Ragon	503-641-1691
PA	Essington, Tri-Com	215-521-3080
PA	King of Prussia, Time	215-337-0900
TX	Austin, Time	512-339-3051
TX	Carrolltown, Time	214-241-7441
TX	Dallas, Shelley Ragon	214-349-2424
TX	El Paso, International Elctrns.	915-598-3406
UT	W. Valley, Beta	801-966-0236
UT	W. Valley, Time	801-973-8181
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Redmond, Time	206-882-1600
WA	Seattle, Richey Impact Elctrns.	206-575-1910
WA	Seattle, Shelley Ragon	206-241-1980
WI	New Berlin, NEP Elctrns.	414-785-9100

ITT ELECTRON TUBE, ITT Corp., Box 100, Easton, PA 18042, Tel: 215-252-7331, TELEX: 847494; FSC No.: 20948; Empl.: 350

ITT GILFILLAN, ITT Corp., 7821 Orion Ave., P.O. Box 7713, Van Nuys, CA 91409, Tel: 818-988-2600, TELEX: 651421, TWX: 910-495-1787; FSC No.: 24930; Empl.: 1800; *Sls. Mgr.:* Hollis White

ITT-HIGBIE MFG., Wagner Rd., Rochester, MI 48063, Tel: 313-651-5300, FAX: 313-651-2365; Empl.: 1500; *Sls. Mgr.:* R.M. Davie VP Sls.

ITT POWERSYSTEMS CORP., Box 688, Galion, OH 44833-0688, Tel: 419-468-5200, TELEX: 4972923, FAX: 419-468-3235; Empl.: 450; *Sls. Mgr.:* C. Searles; *Dist. Mgr.:* G. Ardolino

ITT Schadow

FAX: 612-934-9121

ITT SCHADOW, 8081 Wallace Rd., Eden Prairie, MN 55344, Tel: 612-934-4400, TELEX: 29-0556, TWX: 910-576-2469; Empl.: 150; *Sls. Mgr.:* Darrell Wilk; *Dist. Mgr.:* Scott Mork ..... **B•1758-1761**

Local Sales Offices & Reps

AL	Huntsville, Brandel-Stephens	205-883-0445
AZ	Phoenix, Shefler-Kahn	602-257-9015
CA	Carlsbad, Adchem	619-72909216
CA	Los Angeles, Landa & Assocs.	213-879-0770
CA	Mountain View, Straube Assocs.	415-969-6060
CA	Santa Ana, Landa & Assocs.	714-543-7805
CO	Boulder, Component Prod. Sls.	303-530-2800
CT	Guilford, Richard Purinton Inc.	203-453-4505
FL	Deerfield Beach, Brandel-Stephens	305-427-8558
FL	Orlando, Brandel-Stephens	305-425-3202
GA	Atlanta, Brandel-Stephens	404-261-7579
ID	Boise, J.J. Backer	208-622-7045
IL	Elk Grove, Control Sls.	312-595-2110
IN	Indianapolis, EMCI (Elec. Mktg. Consits., Inc.)	317-253-1668
IA	Marion, S.W.Assocs.	319-377-5244
KS	Parker, S.W. Assocs.	913-898-6552
MA	Andover, Richard Purinton, Inc.	617-475-7055
MI	Brighton, A.P. Assocs.	313-229-6550
MN	Eden Prairie, Hanna/Lind	612 942-8554
MO	St. Louis, S.W. Assocs.	314-576-4650
NJ	W. Caldwell, Grimm, Siegal Assocs.	201-575-9300
NM	Albuquerque, Shefler- Kahn	505-294-0499
NY	East Rochester, L-Mar, Inc.	716-381-9100
NC	Greensboro, Brandel-Stephens	919-274-6952
OH	Dayton, K. W. Elctrns.	513-890-2150
OH	Shaker Heights, K.W. Elctrns.	216-491-9177
OR	Beaverton, James J. Backer Co.	503-627-0775
PA	Allison Pk., K.W. Elctrn. Sls., Inc.	412-487-4300
PA	Trevose, P.S.A., Inc.	215-245-0513
TX	Austin, Fralia & Assocs.	512-835-7911
TX	Euless, Fralia & Assocs.	817-267-3577
TX	Houston, Fralia & Assocs.	713-772-1572
WA	Seattle, Jas. J. Backer Co.	206-285-1300
WI	Brookfield, Control Sls.	414-797-9500
Can	Rexdale, Electro Source	416-675-4490

Local Distributors

AZ	Tempe, Time Elctrn.	602-967-2000
CA	Garden Grove, Impact	213-768-3800
CA	Gardena, Cal-Switch	213-538-9830
CA	Irvine, ITT Multicomponents	714-727-3001
CA	Riverside, Electronic Supply	714-787-9220
CA	Santa Clara, Cypress	408-980-2500
CA	Sunnyvale, Time Elctrns.	408-734-9888
CO	Denver, Integrated Elctrns.	303-292-6121
FL	Fort Lauderdale, Time Elctrn.	305-974-4800
FL	Orlando, Hallmark	305-855-4020
IL	Crystal Lake, Sub-Sem	312-782-3954
IL	Wheeling, Hawk Elctrns.	312-459-4030
KS	Wichita, R.S.C. Elctrns.	316-267-5213
MD	Jessup, Treeko Sls.	301-470-3300
MA	Canton, Richey /Impact Sls. Co.	617-821-1500
MA	Hingham, Sager Elec.	617-749-6700
MI	Kentwood, R.M. Elctrns.	616-531-9300
MI	St. Clair Shores, Specialties Mfg.	313-771-2700
MN	Minneapolis, Berquist Co.	612-835-2322
NJ	Oakland, Relay Specialties	201-337-1000
NY	Buffalo, Summit Distr.	716-884-3450

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OH	Twinsburg, Schuster/Cleveland	216-425-8134
PA	Mckean, ADVACOM	814-476-7774
PA	Philadelphia, PEI/Genesis	215-568-7400
TX	Dallas, Hall-Mark	214-343-5000
TX	Stafford, Southwest Elctr.	713-240-4000
WA	Bellevue, Almac Elctrns	206-643-9992
Can	Concord, Ontario, ITT Multicomponents	416-736-1048

ITT SEALECTRO, 40 Lindeman Dr., Trumbull, CT 06611, Tel: 203-372-4118, TELEX: 71-425-501, FAX: 203-372-6224; FSC No.: 98291; Empl.: 1600; *Sls. Mgr.:* P. Tynan, Dir. Dist. Sls.; *Dist. Mgr.:* P. Tynan, Dist. Sls. Mgr.

ITT SEMICONDUCTORS, ITT Corp., 55 Merrimack St., So. Lawrence, MA 01843, Tel: 617-688-1881, TELEX: 947413, FAX: 617-975-7109; Empl.: 2300; *Sls. Mgr.:* S. Rastogi; *Dist. Mgr.:* S. Rastogi

ITW CORTRON, Illinois Tool Works, 400 W. Grand Ave., Elmhurst, IL 60126, Tel: 312-279-9110, FAX: 312-279-9709; Empl.: 125; *Sls. Mgr.:* Ken Buheit

ITW Fastex®

FAX: 312-595-2141

ITW FASTEX DISTRIBUTOR BUSINESS, 226 Gerry Dr., Wood Dale, IL 60191-1150, Tel: 312-350-8200; *Sls. Mgr.:* Andy Flis, Sls. Mgr./Direct Accts.; *Dist. Mgr.:* Dennis Singery, Distr. Sls. Mgr./Gen Mgr. ..... **C•1387**

ITW Paktron

FAX: 804-239-4730

ITW PAKTRON, Div. of Illinois Tool Works, P.O. Box 4539, 1205 McConville Rd., Lynchburg, VA 24502, Tel: 804-239-6941, TELEX: 710-871-1533; FSC No.: 19396; *Sls. Mgr.:* Tom Lee; *Dist. Mgr.:* Curt Miller ..... **A•1088-1092**

Local Sales Offices & Reps

AL	Huntsville, ACM, Inc.	205-881-5493
AZ	Paradise Valley, Astrocom Mktg.	602-991-6646
CA	Northridge, Pacific Elec. Assoc.	818-701-0114
CA	Playa-del-Ray, Corcoran Assoc.	213-823-4589
CA	Santa Clara, Synelect Mktg.	408-244-9900
CO	Parker, High Plains Mktg.	303-841-6464
FL	Cassel Berry, Dyne-A-Mark	407-831-2822
FL	Clearwater, Dyne-A-Mark	813-441-4702
FL	Ft. Lauderdale, Dyne-A-Mark	305-771-6501
GA	Norcross, ACM, Inc.	404-448-7025
IL	Rolling Meadows, Weisser Assoc.	312-392-5556
IN	Indianapolis, Central Regional Off.	317-257-3704
IN	Indianapolis, Leslie M. Devoe	317-842-3245
IA	West Des Moines, SPS Assocs., Ltd.	515-225-0607
KS	Olathe, SPS Assocs., Ltd.	913-764-4460

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MD	Annapolis, Parogem Inc.	301-269-1898
MA	Randolph, Hatch Assocs.	617-963-3306
MI	Oak Pk., A. Blumenberg Assocs. Inc.	313-968-3230
MN	Hopkins, Forsythe Assoc.	612-933-8267
MO	Earth City, SPS Assocs., Ltd.	314-291-0520
NE	Panama, SPS Assocs.	402-788-2536
NY	E. Rochester, L-Mar Assocs., Inc.	716-681-9100
NY	Poughkeepsie, L-Mar Assoc. Inc.	914-462-8025
NC	Raleigh, C-Tech	919-782-8100
OH	Solon, J R Thornberry Co. Inc.	216-248-4995
TX	Austin, Electra Reps, Inc.	512-339-1163
TX	Dallas, Electra Reps, Inc.	214-248-3852
VA	Lynchburg, Paktron Div.	804-239-6941
WA	Bellevue, Caruso & Co.	206-455-8811
WI	Hartland, Selective Sls. Inc.	414-367-1133
Can	Markham, Ont., Avotronics	416-475-2024
Can	Pointe Claire, Que., Avotronics	514-697-2135

Local Distributors

AZ	Phoenix, Future Elctrns.	602-272-7951
AZ	Tempe, Acacia/Deanco	602-882-9054
CA	Chatsworth, Future Elctrns.	818-772-6240
CA	Irvine, Acacia/Deanco	714-660-0834
CA	Irvine, Future Elctrns.	714-250-4141
CA	San Diego, Acacia/Deanco	619-565-4365
CA	San Diego, Future Elctrns.	619-278-5020
CA	San Jose, Future Elctrns.	408-434-1122
CA	Sunnyvale, Acacia/Deanco	408-745-7200
CA	Van Nuys, E.W. Elctrns.	818-782-9020
CO	Westminster, Future Elctrns., Inc.	303-650-0123
CT	Bethel, Future Elctrns.	203-743-9594
FL	Altamonte Springs, Future Elctrns., Inc.	305-767-8414
FL	Cassel Berry, Hall-Mark Elctrns.	407-830-5855
FL	Clearwater, Future Elctrns., Inc.	813-578-2770
FL	Clearwater, Hall-Mark Elctrns.	813-530-4543
FL	Ft. Lauderdale, N R C Elctrns.	305-772-4500
GA	Augusta, Dixie Elctrns., Inc.	404-722-2055
GA	Norcross, Future Elctrns., Inc.	404-441-7676
IL	Elk Grove Village, Bell Inds.	312-640-1910
IL	Rolling Meadows, RM Elctrns. Co.	312-358-0300
IL	Schaumburg, Future Elctrns.	312-882-1255
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Custom Svcs. Elec.	317-879-9119
IN	Indianapolis, RM Elctrns. Co., Inc.	317-291-7110
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Columbia, Future Elctrns.	301-290-0600
MD	Jessup, Treeko Sls.	301-470-3300
MD	Spencerville, U.S. Elctrns.	301-384-3300
MA	Billerica, Mayer Elctrns.	508-667-6900
MA	Westboro, Future Elctrns.	617-366-2400
MI	Grand Rapids, RM Elctrns. Co.	616-531-9300
MI	Livonia, Future Elctrns.	313-261-5270
MN	Eden Prairie, Future Elctrns.	612-944-2200
MN	Eitzen, Capacitor Assocs.	507-495-3306
MN	St. Paul, Gopher Elctrns.	612-483-3322
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NJ	Bellmaur, Mid Atlantic Elctrns.	609-931-5303
NJ	E. Hanover, State Elctrns.	201-887-2550
NJ	Fairfield, Future Elctrns.	201-227-4346
NJ	Mt. Laurel, Future Elctrns.	609-778-7600
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Hauppauge, Future Elctrns. Inc.	516-234-4000
NY	Liverpool, Future Elctrns.	315-451-2371
NY	Rochester, Future Elctrns.	716-272-1120
NY	Rochester, Simcona Elctrns.	716-328-3230
NC	Charlotte, Dixie Elctrns.	704-377-5413
NC	Charlotte, Elctrn. Mktg. Corp.	704-394-6195
NC	Charlotte, Future Elctrns.	704-529-5500
NC	Greensboro, Golden Elctrns.	919-294-4653
NC	Winston-Salem, Dixie Elctrns.	919-724-5961
OH	Columbus, Elctrn. Mktg. Corp.	614-299-4161
OH	Dayton, Elctrn. Mktg. Corp.	513-439-4711
OH	Highland Heights, Elctrn. Mktg. Corp.	216-442-3441
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Acacia/Deanco	503-646-3377
OR	Beaverton, Future Elctrns.	503-646-9454
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	McKean, Advacom, Inc.	814-476-7774
SC	Columbia, Dixie Elctrns., Inc.	803-779-5332
SC	Greenville, Dixie Elctrns., Inc.	803-297-1435
SC	N. Charleston, Dixie Elctrns.	803-552-2671
TN	Gray, Dixie Elctrns., Inc.	615-477-3838
TN	Knoxville, Dixie Elctrns., Inc.	615-938-4131
TX	Austin, Altair Co.	512-837-4970
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
TX	Richardson, Future Elctrns., Inc.	214-437-2437
UT	Salt Lake City, Future Elctrns. Inc.	801-972-8489
WA	Redmond, Future Elctrns., Inc.	206-881-8199
WI	Mequon, Taylor Elec.	414-241-4321
WI	Racine, Badger Elctrns. Co. Inc.	414-637-1256
WI	Waukesha, Bell Inds.	414-547-8879
EXP	Bucks, Eng., C & CD Ltd.	494-882-848
Can	Calgary, Alberta, Future Elctrns.	403-235-5325
Can	Downsview, Ont., Future Elctrns.	416-638-4771
Can	Edmonton, Future Elctrns.	403-438-2858
Can	Ottawa, Ont., Future Elctrns.	613-820-8313
Can	Point Claire, Que., Future Elctrns.	514-694-7710
Can	St. Foy, Que., Future Elctrns.	418-682-8092
Can	Vancouver, B.C., Future Elctrns.	604-294-1166
Can	Winnipeg, Manitoba, Future Elctrns.	204-786-7711

ITW Switches

FAX: 312-545-4450

ITW SWITCHES, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, Tel: 312-282-4040, TELEX: 275226; Empl.: 500; *Sls. Mgr.:* R. Mueller; *Dist. Mgr.:* P. Barthell ..... **B•1762-1774**

Local Sales Offices & Reps

AL	Huntsville, Electro Mech	205-880-0592
AZ	Glendale, The Knight Co.	602-433-2166
AR	Fort Smith, Electra Reps	501-452-7822
CA	Los Angeles, The Knight Co.	213-670-2833
CA	Santa Clara, Westrep	408-988-8833
CO	Parker, High Plains Mktg.	303-841-6464
CT	Clinton, Selmark Assoc.	203-573-9088
FL	Altamonte Springs, Semtronics	407-831-8233
GA	Atlanta, Electro Mech.	404-447-6478
IL	Elk Grove Village, Parcom	312-228-6360
IA	Cedar Rapids, R. F. Welch Co.	319-362-6824
KS	Kansas City, BC Elctrns.	913-342-1211
MD	Baltimore, MicroComp	301-644-5700
MA	Millis, Selmark Assoc.	508-376-2914
MI	Grand Rapids, Urban & Assoc.	616-245-0511
MN	Minneapolis, Comstrand	612-788-9234
MO	St. Louis, BC Elctrns.	314-521-6683
NJ	Red Bank, Varrelman-Gorman Co.	201-219-0088
NY	E. Syracuse, Fountain, Young & Co.	315-437-7733
NC	Raleigh, Electro Mech	919-790-9300
OH	Medina, Rockford Controls	216-725-3705
PA	Oreland, Precision Mktg.	215-233-9233
TX	Dallas, Electra Reps.	214-248-3852
WA	Redmond, EMG-Elctrn. Mktg. Grp.	206-882-0962
WI	Mequon, Parcom Inc.	414-241-8544

IVEK CORP., 43 Fairbanks Rd., N. Springfield, VT 05150, Tel: 802-886-2238, FAX: 802-886-8274; Empl.: 8; *Sls. Mgr.:* Peter Torney

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FAX: 201-542-2938

IVO INDUSTRIES, INC., 201 Industrial Way W., Eatontown, NJ 07724, Tel: 201-542-5151, 800-932-0489, TELEX: 132-414; Empl.: 10; *Sls. Mgr.:* Daniel Vannote ..... **B•1089, 1775, 1962; D•1148-1149**

Local Sales Offices & Reps

CA	Tustin, Sierra-Pacific Engrg.	714-731-3411

Local Distributors

CA	Agoura, Sibbald Instrs.	213-991-3864
CA	Santa Monica, Master Distr.	213-452-1229
FL	Lakeland, A A Electric	813-665-6941
GA	Norcross, A A Electric	404-449-8670
IL	Arlington Heights, Martec Assocs.	312-956-8090
MD	Towson, Kraft Indl.	301-828-5838
MN	St. Paul, Power/Mation Div.	612-645-0781
NJ	E. Rutherford, A A Electric	201-777-5477, 800-223-0119
NY	Clarence, Trott Elctrns.	716-634-8500
NC	Charlotte, Trott Elctrns.	704-376-2237
NC	Huntersville, Scott Equip.	704-875-1611
SC	Greenville, Automation Supp. Co.	800-845-5274
TX	Dallas, Dallas Meter Tek	214-349-6044
WI	Waukesha, Power/Mation Div.	414-542-2868
WI	Wausau, Control Specialist	715-359-9122
Can	Edmonton, Alberta, Alberta Indl. Controls	403-468-6080
Can	Surrey, B.C., E.B. Horseman & Son Ltd.	604-533-1275
Can	Toronto, Ontario, Lisle-Metrix Ltd.	416-249-9151

IXYS CORP., 2355 Zanker Rd., San Jose, CA 95131-1109, Tel: 408-435-1900, TELEX: 384928 SNJ SU; FSC No.: 408-435-1033; Empl.: 50; *Sls. Mgr.:* Dan Schwob

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FAX: 714-250-8957

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Local Sales Offices & Reps

AL	Huntsville, Glen White Assocs.	205-882-6751
AZ	Glendale, Camda, Inc.	602-842-2927
CA	Canoga Pk., Camda, Inc.	818-703-6132
CA	Lawndale, Camda, Inc.	213-219-0320
CA	Newport Beach, Camda, Inc.	714-852-9228
CA	San Diego, Camda, Inc.	619-571-4818
CA	Santa Clara, Pinnacle Sls.	408-249-7400
CO	Littleton, Con-Tek Mktg.	303-973-8490
CT	Southington, Cycle Sls.	203-755-2888
FL	Clearwater, Glen White Assocs.	813-726-0577
FL	Ft. Lauderdale, Glen White Assocs.	305-977-5885
FL	Ft. Lauderdale, JAE Elctrns.	305-563-3484, 800-248-0737
FL	Satellite Bch., Glen White Assocs.	305-773-4832
GA	Norcross, Glen White Assocs.	404-441-1447
IL	Arlington Hgts., Berndt Assocs. Inc.	312-632-0900
IN	Ft. Wayne, Frank J. Campisano Co.	219-486-6443
IN	Indianapolis/Ft. Wayne, Campisano Co.	317-253-7651
MD	Baltimore, Glen White Assocs.	301-321-7235
MA	Harvard, Cycle Sls.	617-456-6868
MN	Minneapolis, Berndt Assocs., Inc.	612-546-2021
MS	Jackson, Glen White Assocs.	601-856-5411
NJ	Mountainside, Henry R. Richter Co.	201-233-4615
NY	Fayetteville, Henry G. Richter Co.	315-637-6713
NC	Greensboro, Caravan Sls.	919-294-1500
NC	Raleigh, Glen White Assocs.	919-848-1931
OH	Cincinnati, Campisano Co.	513-574-7111
OH	Cincinnati, Frank J. Campisano Co.	513-574-7111
OH	Columbus, Campisano Co.	614-876-5405
OH	Medina, Frank J. Campisano Co.	216-722-5550
OH	Mentor, Frank J. Campisano	513-575-7111
OH	Mentor, Frank J. Campisano Co.	216-257-2961
OR	Hillsboro, Rhodes Sls. Corp.	503-640-6666
PA	Coraopolis, Campisano Co.	412-264-5151
PA	Phoenixville, Henry G. Richter Co.	215-495-6176
PA	Phoenixville, Henry Richter, Inc.	215-495-6176
SC	Greenville, Ellenburg Sls.	803-233-9942
TN	Gray, Glen White Assocs.	615-477-8850
VA	Annandale, Glen White Assocs.	703-354-3889
VA	Lynchburg, Glen White Assocs.	804-385-6110
WA	Bellevue, Electronic Sources	206-451-3500
WI	Milwaukee, Berndt Assocs., Inc.	414-545-8400

Local Distributors

AZ	Scottsdale, Cypress Elctrns.	602-949-0802
CA	Buena Pk., Cypress Elctrns.	213-744-0355, 714-521-5230
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CO	Wheatridge, Cypress Elctrns.	303-431-2622
CT	Yalesville, Glynn Elctrns.	203-265-2498
MA	Middleboro, Glynn Elctrns.	617-947-4262
NH	Manchester, Glynn Elctrns.	603-622-8131
NY	Deer Pk., Ramtronix Inc.	516-242-4700
OH	Akron, Aesco Elctrns.	216-762-8818
OH	Columbus, Aesco Elctrns.	614-882-6762
OR	Beaverton, Cypress Elctrns.	503-641-2233
PA	Bristol, AIM Elctrns.	215-785-3500
TN	Hixson, Techni-Tronics	615-842-0514
TX	Dallas, Cypress Elctrns.	214-869-1435
WA	Bothell, Cypress Elctrns.	206-483-1144

JAICO PRODUCTS, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622, Tel: 312-421-1090, FAX: 312-421-1165; Empl.: 35; *Sls. Mgr.:* John S. Jaidinger

JAMESBURY CORP., Div. of Combustion Engineering, Inc., 640 Lincoln St., Worcester, MA 01605, Tel: 617-852-0200, TELEX: 92-0448, TWX: 710-240-1268; Empl.: 900; *Sls. Mgr.:* C. A. Richardson

JAMES ELECTRONICS, 4050 N. Rockwell, Chicago, IL 60618, Tel: 312-463-6500, TWX: 910-221-5034; Empl.: 220; *Sls. Mgr.:* Vincent Kennedy

JANCO
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FAX: 818-842-3396

JANCO CORP., Box 3038-Glenoaks Sta., Burbank, CA 91504, Tel: 818-846-1800, TWX: 910-498-2701; FSC No.: 91812; Empl.: 185; *Sls. Mgr.:* Sam Kay, Jr. ..... **B•1778-1779**

Local Sales Offices & Reps

AZ	Tempe, Piper Sls.	602-949-0048
CA	San Diego & So. California, Gabriel & Assoc.	714-666-0660
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
CO	Longmont, Piper Sls.	303-651-2378
FL	Orlando, MacKay, Smith & Assocs.	305-423-4353
GA	Atlanta, MacKay, Smith & Assocs.	404-449-7444
IL	Addison, Vikeland Sls.	312-832-8425
IN	Ft. Wayne, Aktron Corp.	219-747-3650
KS	Wichita, T-Bird Tech. Sls. & Svc.	316-684-3941
MD	Ellicott, Tech. Sls. Inc.	301-461-3257
MA	Swansea, Eastrep Co.	617-672-0788
MN	St. Paul, Cahill, Schmitz & Cahill	612-646-7217
MO	Maryland Heights, T-Bird Sls. & Svc.	314-298-8940
NJ	Cherry Hill, Quality Comps.	609-428-6266
NY	Fairport, TAC Sls. Inc.	716-377-2250
NC	Charlotte, MacKay, Smith & Assocs.	704-372-1188
OH	Columbus, Tom Mulligan Company	614-457-2242
TX	Irving, Trice Mktg. Corp.	214-255-1877
WA	Seattle, Norwest	206-827-9562

Local Distributors

CA	Burbank, Merit Comp. Supp.	818-842-7607
CA	Westlake Village, Tech-Cable Prods.	818-991-4697

JAN HARDWARE MFG. CO., 47-27 36th St., Long Island City, NY 11101, Tel: 718-361-0800; FSC No.: 99813; Empl.: 60; *Sls. Mgr.:* Irwin E. Wasserman ..... **C•1582, 1586-1611**

Local Sales Offices & Reps

CA	Hillsboro, Long Assocs.	415-342-6544
CA	San Diego, James E. Fitch & Assocs.	213-945-2624
CA	Santa Fe Springs, James E. Fitch & Assoc.	213-945-2624
IN	Huntingdon, Ellet Sls.	219-356-1866
IA	W. Des Moines, Nevco Inc.	515-225-9866
MD	Gaithersburg, Naudain Assocs. South.	301-258-5040
MA	Brookline, Harman Assoc., Inc.	617-232-6687
MA	Lee, Harman Assoc., Inc.	413-243-1158
MN	Golden Valley, A.I.M.	612-542-8437
MO	Crestwood, Nevco, Inc.	314-343-7406
NJ	Englewood, Harold Gray Assoc.	201-894-0894
NJ	Marlton, Naudain Assoc.	609-983-5300
OH	Kettering, F. L. Ohmer & Assoc.	513-434-1454
OR	Beaverton, Cascade Sls. Co.	503-626-7978
TX	Richardson, AGM Sls. Co.	214-644-1475
Can	Scarborough, Ont., Banke Elctrns., Ltd.	416-292-5152

JAPANESE PRODUCTS CORP., 7 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-8880, TELEX: 516929 ANS BACK ENFD, FAX: 914-592-7001; Empl.: 8; *Sls. Mgr.:* Don Cassalia

JARO COMPONENTS, INC., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883, Tel: 305-771-7000, TELEX: 159007, FAX: 305-772-8899; Empl.: 30; *Sls. Mgr.:* Floyd Burwell; *Dist. Mgr.:* Floyd Burwell

JAYCO PLASTICS OF CALIFORNIA, INC., 507 W. Blueridge Ave., Orange, CA 92665, Tel: 714-974-1701, TELEX: 678401, FAX: 714-998-4954; Empl.: 30 ..... **B•1868-1869**

Local Sales Offices & Reps

AZ	Scottsdale, Advent Comps. Corp.	602-481-0044
CA	San Diego, Coastal Elctrn. Sls.	619-459-4148
CA	Sunnyvale, Pass Assocs.	408-735-9040
CO	Boulder, Stratford Grp.	303-530-3194
IL	Palatine, Somers-Reagan	312-991-1108
NY	New York, Breen Assocs.	201-696-8683

JAYCOR, P.O. Box 85154, San Diego, CA 92138, Tel: 619-453-6580, FAX: 619-452-7899; Empl.: 500; *Sls. Mgr.:* Steven Lutjens

JB ELECTRONIC TRANSFORMERS, 2300 W. Armitage Ave., Chicago, IL 60647, Tel: 312-342-0080, FAX: 312-342-9098; FSC No.: 11700; Empl.: 150

jbm

FAX: 603-623-0446

JBM ELECTRONICS, INC., 531 Front St., Manchester, NH 03102, Tel: 603-623-0222, TELEX: 953134, TWX: 710-220-8978; FSC No.: 62694; Empl.: Approx. 100 ..... **A•1578-1583**

Local Sales Offices & Reps

AL	Huntsville, ACM	205-881-5493
AZ	Scottsdale, Haas & Assoc., Inc.	602-994-3813
CA	San Jose, QCI Assocs.	408-432-1070
CA	San Jose, QCI Assocs., Inc.	408-432-1070
CO	Aurora, High-Tech Assocs.	303-695-1990
CT	N. Haven, Kitchen & Kutchin	203-234-9108
CT	No. Haven, Kitchen & Kutchin	617-239-0212
FL	Altamonte Springs, C Assocs., Inc.	305-831-1717
FL	Deerfield Beach, SEC, Inc.	305-426-4601
GA	Duluth, ACM	404-447-5499
IL	Highland Pk., Bransky Sls.	312-433-2375
MA	Burlington, Kitchen & Kutchin	617-229-2660
MN	Minneapolis, Boerger & Assoc.	612-560-3435
MN	St. Paul, Proud Assocs.	612-646-9428
MO	Lenexa, Midtec Assocs.	913-541-0505
NY	Albany, Reagan Compar	518-489-7408
NY	Roslyn Hgts., November Elctrn. Sls.	516-621-6378
NC	Charlotte, Quantum Mktg.	704-523-8822
NC	Raleigh, Quantum Mktg.	919-846-5728
OR	Portland, Earl & Brown	503-245-2283
PA	Glenside, Koebert & Assoc.	215-887-2310
PA	Glenside, Koebert Assocs.	215-887-2310
TX	Hurst, Procomp Sls.	817-589-0336
TX	Richardson, Procomp Sls.	214-669-1500
WA	Redmond, Earl & Brown	206-885-5064
WA	Renton, Excel Elctrn. Sls.	206-277-0940
WV	Inwood, Koebert Assocs.	304-229-8401
Can	Mississauga, Ont., Hi-Tech Sls.	416-670-0284
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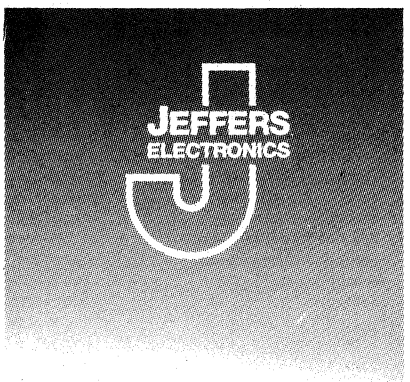

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J-B-T INSTRUMENTS, INC., Box 1818, New Haven, CT 06508-1818, Tel: 203-776-1111; Empl.: 25; *Sls. Mgr.:* Lillian Sharron ..... **D•1405**

Local Sales Offices & Reps

MN	Minneapolis, Hei-Lite Sls.	612-861-6051
TX	Dallas/Houston, Elcom Mktg., Inc.	214-241-2166
Can	Thornhill, Ont., R. C. Kahnert Sls., Ltd.	416-221-7755
Can	Winnipeg, Vancouver, Smith-Paterson & Assocs.	604-681-0743

Local Distributors

AL	Montgomery, Southern Controls	205-277-5030
AZ	Tempe, Crompton/Metermaster	714-921-2101
CA	Los Angeles, CMI/Metermaster	213-685-4340
CA	Sacramento, Sacramento Elctrns.	916-441-4821
CA	Wilmington, Wilmington Instrs.	213-834-1133
CO	Denver, E.I.L. Instrs.	303-534-4160
CO	Denver, Ward/Brownell	303-333-3541
CT	Middletown, E.I.L. Instrs.	203-346-6646
FL	Miami, Florida Precision	305-324-1731
GA	Augusta, Speciality Distributing	404-873-2521
IL	Bridgeview, E.I.L. Instrs.	312-430-2292
IL	Elk Grove Village, CMI/Metermaster	312-593-8650
LA	Lafayette, Ralph's Elctrns.	318-234-4507
MD	Sparks, E.I.L. Instrs.	301-771-4800
MA	Burlington, E.I.L. Instrs.	617-272-9450
MI	Grand Rapids, S-F Electra, Inc.	616-459-0216
MN	Minneapolis, Instrument Controls	612-871-2514
MS	Jackson, Ellington Elctrn. Supp.	601-355-0561
NJ	Belleville, Miscorp	201-751-8680
NJ	Newfoundland, Hosica Labs	201-697-6111
NY	Long Island City, Metermod	718-726-4850
NY	Lynbrook, Peerless Radio	516-593-2121
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cleveland, Weschler Elec.	216-238-2550
OH	Dayton, Scott-Friedman	513-298-5555
TN	Nashville, Electra Distributing	615-329-3971
TX	Ft. Worth, Swieco	817-335-6521
TX	Garland, CMI/Metermaster	214-271-5671
TX	Houston, Harrison Equip.	713-879-2600
WA	Seattle, Eicher-Richards	206-523-7888
WV	St. Albans, Preiser Scientific	304-727-2902
Can	Willowdale, Ont., Electrosonic	416-494-1666

JBT INTL INC., JI Haw Indl. Co., Ltd., 2750 Oregon Ct., Ste. M-9, Torrance, CA 90503, Tel: 213-328-0051, FAX: 213-328-0057

J-B-T SWITCHES, CUTLER-HAMMER PRODS., EATON CORP., Box 1904, New Haven, CT 06509, Tel: 203-772-2220; FSC No.: 55459; Empl.: 160; *Sls. Mgr.:* C. A. Peffer

Refer to Eaton Corp./Cutler-Hammer Prods., Areospace/Commercial Controls Div. for distributor information.

JC SYSTEMS, INC., 11175 Flintkote Ave., San Diego, CA 92121, Tel: 619-453-9980, FAX: 619-453-2115; Empl.: 20; *Sls. Mgr.:* Ralph Aniunas

JDK CONTROLS, INC., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593, Tel: 805-499-7779, FAX: 805-499-0990; Empl.: 40; *Sls. Mgr.:* Reece Kendall ..... **A•2112**

JEFFERS ELECTRONICS, Grand Plaza, 945 Grand Ave., Nogales, AZ 85621, Tel: 602-287-5851, TELEX: 165036; FSC No.: 59474; Empl.: 400; *Sls. Mgr.:* Ken Shobert; *Dist. Mgr.:* Steve Morris

Distributor

W. S. JENKS & SON, 1933 Montana Ave., NE, Washington, DC 20002, Tel: 202-529-6020; 800-673-8199, FAX: 202-832-3411 ..... **C**-1752, **D**-1294 689, 764, 817

JENSEN

FAX: 602-438-1690

JENSEN TOOLS, INC., Axia, Inc., 7815 S. 46th St., Phoenix, AZ 85044, Tel: 602-968-6241, TWX: 910-950-0115; Empl.: 250; *Sls. Mgr.:* Herb Oberman

JEROME INDUSTRIES CORPORATION

FAX: 201-353-1021

JEROME INDUSTRIES CORP., 730 E. Division St., Elizabeth, NJ 07201, Tel: 201-353-5700; Empl.: 150; *Sls. Mgr.:* Anthony Di Girolamo ..... **A•2313; D•1838-1841**

JERSEY SPECIALTY CO., See JSC Wire & Cable

JETA POWER SYSTEMS, INC

FAX: 213-426-2417

JETA POWER SYSTEMS, INC., 2675 Junipero, Signal Hill, CA 90806, Tel: 213-427-0095; Empl.: 110; *Sls. Mgr.:* Derek Steel ..... **D•1843-1845**

Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell & Assocs.	205-883-5150
CA	Anaheim, Alpha Sls.	213-215-0249
CA	Anaheim, Electro Sls.	714-826-4863
CA	Los Angeles, Power Partners	213-215-0800
CA	Mission Viejo, The Powerhouse, Inc.	714-770-9009
CA	Santa Clara, The Powerhouse	408-748-1555
CO	Arvada, Arrowhead/CSI Sls., Inc.	303-423-5597
CT	Vernon, George Urban & Assocs.	203-647-3991
GA	Atlanta, R. O. Whitesell & Assocs.	404-449-9190
GA	Norcross, R.O. Whitesell & Assocs.	404-449-9190
IL	St. Charles, XYZ Mktg.	312-584-3001
IN	Indianapolis, R. O. Whitesell	317-359-9283
MD	Wheaton, Brimberg Sls.	301-946-2670
MA	Chelmsford, Power Assocs.	617-459-0700
MA	Dover, George Urban & Assocs.	617-329-4068
MN	Minneapolis, Micrelectronic Sls., Inc.	612-829-0948
NH	Londonderry, George Urban Assoc.	603-437-3622
NY	Fairport, Hi-Tec Sls.	716-223-5922
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Fuguay-Varina, R.O. Whitesell & Assoc.	919-552-1122
NC	Greensboro, R.O. Whitesell & Assocs.	919-273-1945
OH	Cincinnati, R. O. Whitesell	513-521-2290
OH	Cleveland, R. O. Whitesell	216-447-9020
OH	Columbus, R. O. Whitesell	614-888-9396
OH	Dayton, R. O. Whitesell	513-298-9546
OR	Portland, J. J. Backer Co.	503-297-8744
OR	Salem, Jas. J. Backer Co.	503-362-0717
PA	Huntingdon Valley, Lynbar Grp., Inc.	215-947-3554
PA	Pittsburgh, R. O. Whitesell	412-963-6161
TN	Knoxville, R.O. Whitesell & Assocs.	205-883-5150
TX	Dallas, S. W. Tech. Sls.	214-243-0180
WI	Milwaukee, XYZ Mktg.	312-584-3601
Can	Montreal, Empro Sls.	514-341-6420

JETTRON PRODUCTS INC., P.O. Box 337, E. Hanover, NJ 07936, Tel: 201-887-0571, FAX: 201-887-4182; FSC No.: 04435; Empl.: 30; *Sls. Mgr.:* Joseph E. Fesi ..... **C•1392-1393**

Local Sales Offices & Reps

CA	El Cajon, A-Tronics	619-444-1501
CA	Woodland Hills, A-Tronics	818-703-7212
NY	New York, Eltron Export Co.	212-944-7635

JEWELL ELECTRICAL INSTRUMENTS, 850 Perimeter Rd., Manchester, NH 03108-4038, Tel: 603-669-6400, TELEX: 943435 JEWELL MAN, FAX: 603-669-5962; Empl.: 250; *Sls. Mgr.:* George Molleur; *Dist. Mgr.:* Bill Bolia

JFD ELCTRNS., See Murata Erie No. Amer., Inc.

JF MICROSYSTEMS, 3641 Frontier Road, Pasco, WA 99301, Tel: 509-297-4294, 800-532-2737; Empl.: 2; *Sls. Mgr.:* Jim Follansbee

JFW INDUSTRIES, INC., 5134 Commerce Sq. Dr., Indianapolis, IN 46237, Tel: 317-887-1340, FAX: 317-881-6790; FSC No.: 61162; Empl.: 80; *Sls. Mgr.:* Jackie Buescher

JKL COMPONENTS CORPORATION

FAX: 818-897-3056

JKL COMPONENTS CORPORATION, 13343 Paxton St, Pacoima, CA 91331, Tel: 818-896-0019; FSC No.: 55335; Empl.: 19; *Sls. Mgr.:* Mike Wolford; *Dist. Mgr.:* Bob Brandt ..... **B•1163**

Local Sales Offices & Reps

AL	Huntsville, Southern Sls. & Mktg.	205-830-9322
AZ	Mesa, Elec-Com Assocs.	602-844-0566
AZ	Tempe, Elec-Com	602-967-8644
CA	San Diego, Lawsco	619-755-0200
CT	Manchester, Manurep, Inc.	203-646-6064
FL	Seminole, Q-Rep	813-393-6393
IL	Park Ridge, Bob Burns & Assocs.	312-823-9360
IN	Carmel, APEX TEC, Inc.	317-846-3333
IN	Indianapolis, Apex-Tec, Inc.	317-842-5559
MI	Farmington Hills, Clark Sls.	313-553-0610
MN	Bloomington, Mumco	612-854-4161
NY	Syracuse, Lamtec	315-682-4780
OH	Chagrin Falls, Clark Sls. Co.	216-247-7848
OH	Painsville, Clark Sls. Co.	216-247-7848
PA	Philadelphia, Check Assoc.	215-487-3007
TX	Irving, Kite Elec. Sls.	214-986-0321

Local Distributors

AL	Huntsville, Powell Elec.	205-539-2731
AL	Mobile, Specialty Distr. Co.	205-344-0450
AZ	Phoenix, Capital Elctrns.	602-252-5899
CA	Garden Grove, Richey Western	714-895-0060
CA	Gardena, Cal. Switch & Signal	213-770-2330
CA	San Jose, Powell Elec.	408-943-9020
CA	Santa Clara, Richey/Western Elec.	408-727-7411
CA	Sunnyvale, Target Elec.	415-961-1170
CT	Cheshire, Time Elec.	203-271-3200
FL	Clearwater, Elec. Precepts of FL	813-544-3636
FL	Tampa, Specialty Distr. Co.	813-870-3315
GA	Norcross, Specialty Distrbg. Co.	404-446-3190
IL	Wheeling, Hawk Elec.	312-459-4030
IN	Indianapolis, Meunier Elctrns.	317-635-3511
IA	Cedar Rapids, Advnet Elec.	319-363-0221
KY	Louisville, Peerless Elec.	502-637-7674
MD	Columbia, Powell Elec.	301-621-8080
MD	Kensington, Marine Air Supp.	301-949-1353
MD	Rockville, M S Elctrns.	301-340-6400
MA	Hingham, Sager Elec.	617-749-6700
MA	Needham, Cronin	617-449-5000
MA	Westborough, Powell Elec.	617-366-6100
MN	Minneapolis, Bergquist Co.	612-835-2322
MN	St. Paul, Gopher Elec.	612-483-4450
MO	Richland, ATR Ent.	314-765-5219
NH	Hudson, Bell Ind.	800-258-1014
NJ	Clifton, Vantage Comps.	201-777-4100
NJ	Englewood, Powell Elec.	201-894-0800
NJ	Pomton Lakes, Pan American Elec.	201-839-0077
NM	Albuquerque, Walker Elec. Supply	505-883-2992
NY	E. Syracuse, Modutex	716-924-4400
NY	Hauppauge, Genelco	516-231-1144
NC	Cary, Powell Elec.	919-467-1212
NC	Greensboro, Hammond	919-275-6391
OH	Cincinnati, Schuster Elec.	216-425-8134
OK	Oklahoma City, Radio Supp. Inc.	405-232-6127
PA	Bristol, Aim Elec.	215-785-3500
PA	Philadelphia, Powell Elec.	215-365-1900
TN	Chattanooga, Specialty Distr. Co.	615-624-1040
TN	Chattanooga, Techni-Tronics	615-875-5449
TX	Dallas, Norvell Comp. Sls.	214-233-0020
TX	Las Colinas, Powell Elec.	214-550-0547
TX	Stafford, Southwest Elec.	713-240-4000
WA	Greenacres, Mica Co.	509-928-1720
WA	Redmond, Priebe Elec.	206-881-2363
WI	Milwaukee, Marsh Elec.	414-475-6000
WI	Oshkosh, Electronic Inds.	414-235-8930

JMJ

FAX: 201-762-9334

JMJ TECHNICAL PRODS., 50 Wheeler Point Rd., Newark, NJ 07105, Tel: 201-589-4257; Empl.: 8; *Sls. Mgr.:* Kevin Kolenut ..... **C•1612**

JMK

JMK, INC., 15 Caldwell Dr., Amherst, NH 03031, Tel: , , , 603-886-4115, TELEX: 955329; Empl.: 200; *Sls. Mgr.:* J. Kennedy ..... **A•1663-1665**

Local Sales Offices & Reps

CA	Santa Clara, Cummings & Assocs.	408-247-8656
CO	Englewood, Harthun & Assocs.	303-792-5050
IL	Chicago, Momak Sls.	312-963-6400
MD	Silver Springs, Mid-Atlantic Sls. Co.	301-593-7749
MA	Framingham, Sullivan Tech. Sls.	617-620-0195
MN	St. Paul, Arkco Sls.	612-777-7454
NJ	Princeton, Murtronics Assocs.	609-394-3737
NY	Syracuse, Nycom Inc.	315-437-8343
OR	Hillsboro, Temco N.W.	503-649-8375
WA	Bothell, Temco N.W.	206-821-5434
Can	Montreal, Que., A. R. Gray	514-694-6378

JMR ELECTRONICS, 1525 Blondell Ave., Bronx, NY 10461, Tel: 212-597-6050, FAX: 212-597-6137; Empl.: 50

JM TRANSFORMER CO., INC., 112 Florida St, Farmingdale, NY 11735, Tel: 516-293-0475, FAX: 516-293-3923; Empl.: 18; *Sls. Mgr.:* J. Millman ..... **A•2315-2319**

JOBMASTER CORP., 9010 Liberty Rd., Randallstown, MD 21133-0207, Tel: 301-655-1400, 800-642-1400, FAX: 301-521-5461; Empl.: 16; *Sls. Mgr.:* Danielle Hill ..... **A•1329**

JOHANSON DIELECTRICS, 2220 Screenland Dr., Burbank, CA 91505, Tel: 818-848-4465, TWX: 910-498-2735, FAX: 818-841-7261; Empl.: 300; *Sls. Mgr.:* Fred Luhrs ..... **A•1094**

Local Sales Offices & Reps

AZ	Phoenix, Compass Mktg. & Sls.	602-996-0635
AZ	Tucson, Compass Mktg. & Sls.	602-293-1220
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assocs.	303-426-0890
FL	Boca Raton, Lawrence Assocs	305-368-7373
FL	Clearwater, Lawrence Assocs.	305-339-3855
IL	Lisle, WG Controls	312-963-5954
IN	Kokomo, Schillinger Assocs.	317-452-4057
KS	Shawnee Mission, Florence & Meyer	913-722-5210
CT	Wethersfield, Compac Sls.	203-563-4784
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Minneapolis, Bill Deming & Assocs.	612-888-5000
NY	Huntington, Compar New York Inc.	516-423-5660
NY	Syracuse, Pitronics	315-455-7346
NC	Winston-Salem, Murcota	919-722-9445
OH	Westlake, Baehr Greenleaf Assocs.	216-892-1770
PA	Trevose, PSA Co.	215-245-0513
TX	Dallas, C & J Assocs.	214-539-0140
WA	Seattle, Northmar Inc.	206-524-5170

Local Distributors

CA	Los Alamitos, SEMI DICE	213-594-4631
CA	Santa Clara, SEMI DICE	408-980-9777
CA	Sunnyvale, Bell Inds.	408-734-8570
IL	Chicago, Newark	312-638-4411
MA	Canton, Semi Dice	617-821-0070

JOHANSON MANUFACTURING CORPORATION, 400 Rockaway Valley Rd., Boonton, NJ 07005, Tel: 201-334-2676, TWX: 710-987-8367, FAX: 201-334-2954; FSC No.: 91293; Empl.: 200 ..... **A•1095**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Phoenix, Compass Mktg. & Sls.	602-996-0635
AZ	Tucson, Compass Mktg. & Sls.	602-293-1220
CA	Escondido, Knight Co.	619-743-5136
CA	Los Angeles, Knight Co.	213-670-2833
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assoc., Mt. States	303-426-0890
CT	Wetherfield, Compak, Inc.	203-563-4784
FL	Boca Raton, Perrott Assocs.	305-482-6909
FL	Clear Water Bch., Perrott Assocs.	813-443-5214
FL	Orlando, Perrott Assocs.	305-298-7748
IL	Lisle, W.G. Controls	312-963-5954
IN	Kokomo, Schillinger Assocs.	317-455-2708
IA	Hiawatha, ARD Sales Co.	319-393-6392
MA	Hudson, Compak, Inc.	617-568-0331
MN	Bloomington, Bill Deming & Assoc.	612-888-5000
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Boonton, Johanson Mfg. Corp.	201-334-2676
NY	Mount Vernon, Friedman-Smith Elctrn. Sls.	914-664-4866
NY	Pittsford, NHA, Inc.	716-586-9002
NC	Winston-Salem, Murcota Corp.	919-722-9445
OH	Columbus, Baehr, Greenleaf & Assocs.	614-847-0220
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assoc.	216-842-1770
PA	Evans City, Baehr, Greenleaf & Assocs.	412-776-2151
PA	Trevose, P.S.A.	215-245-0513
TX	Austin, W. Pat Fralia & Assocs.	512-835-7911
TX	Bedford, W. Pat Fralia Co.	817-267-3577
TX	Houston, W. Pat Fralia & Assocs.	713-772-1572
UT	Salt Lake City, Straube Assocs., Mt. States	801-263-2640
VA	Oakton, PSA South	703-281-1806
WA	Seattle, Northmar	206-524-5170

Local Distributors

AZ	Tempe, Bell Inds.	602-966-7800
CA	Garden Grove, Bell Inds.	714-895-7801
CA	Gardena, Bell Inds.	213-515-1800
CA	San Diego, Bell Inds.	619-268-1277
CA	San Jose, All American Semiconductor	408-287-0190
CA	San Pedro, ASAP Elctrns./West	213-519-8377
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Thousand Oaks, Bell Inds.	213-826-6778
CA	Van Nuys, CW Swift & Assocs.	818-989-1133
CA	Westlake VL, Distel, Inc.	805-495-9998
CO	Wheatridge, Bell Inds.	303-424-1985
FL	Deerfield Bch., Bell Inds.	305-421-1997
FL	Orlando, Pelcor Co.	305-299-1541
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Elk Grove VL, Bell Inds.	312-640-1910
IN	Indianapolis, Bell Inds.	317-634-8202
MD	Baltimore, Radio Elec. Svc.	301-529-0500
MD	Beltsville, Radio Elec. Svc.	301-937-9100
MA	Seekonk, M-Squared	617-761-5490
MA	Wilmington, RC/Jaco Elctrns.	617-273-1860
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Mt. Vernon, ASAP Elctrns.	914-699-2727
NY	Syracuse, Newark Elctrns.	315-437-6611
OH	Dayton, Bell Inds.	513-435-8660
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Philadelphia, PEI-Genesis	215-673-0400
TX	Ft. Worth, PATCO Supplies	817-429-8596
TX	Irving, Newark Elctrns.	817-534-3696
UT	Salt Lake City, Bell Inds.	801-972-6969
WA	Bellevue, Bell Inds.	206-747-1515

JOHNSON, E. F., CO., P.O. Box 59089, Minneapolis, MN 55459-0089, Tel: 612-942-1000, TELEX: 290470; Empl.: 1400; *Sls. Mgr.:* Arnie Nicklin

JOHNSON CONTROLS, INC., Specialty Battery Div., 900 East Keefe Ave., Milwaukee, WI 53212, Tel: 414-961-6500, FAX: 414-961-6506; Empl.: 400; *Sls. Mgr.:* James M. Szollar

JOLO

FAX: 714-554-0306

JOLO INDUSTRIES, INC., 13921 Nautilus Dr., Garden Grove, CA 92643, Tel: 714-554-6840, TWX: 910-595-1138; FSC No.: 30035; Empl.: 20; *Sls. Mgr.:* J.S. Giampiccolo, Jr. ..... **C•1394-1396**

Local Sales Offices & Reps

CA	Mountain View, Leddy Assocs.	415-969-6313
CA	Santa Ana, Bee Jay Enterprises	714-836-7870
FL	Longwood, Mathias Assocs., Inc.	407-682-1700
IL	Chicago, McNulty & Assocs.	312-980-9868
MA	Reading, Lincoln Tech. Sls.	617-944-9594
NJ	Berkeley Heights, Cambridge-Allen & Assocs.	201-464-0203
OH	Cleveland, Geotronix Mktg. Assocs.	216-659-6100
WA	Seattle, Evergreen Mktg. Grp. Inc.	206-485-8063
Can	Nepean, Ont., Tech-Trad, Inc.	613-727-1272

Local Distributors

CA	San Ramon, Xstor	415-820-2048
FL	Miami, Elec. Equip.	305-526-6060
NJ	Berkeley Heights, Rockwood Sls. Co.	201-464-0203
OH	Richfield, Alpha Distr. Corp.	216-659-7100

JONARD INDUSTRIES CORP., 134 Marbledale Rd., Tuckahoe, NY 10707, Tel: 914-793-0700, TELEX: 996570, TWX: 710-562-0107, FAX: 914-793-4527; Empl.: 65; *Sls. Mgr.:* R. Fersen

JONATHAN MANUFACTURING CORP., 1101 So. Acacia Ave., Fullerton, CA 92631, Tel: 714-526-4651, FAX: 714-879-1212; Empl.: 375; *Sls. Mgr.:* Todd Leverich; *Dist. Mgr.:* Wm. Wachtel

JONES, HIRAM, ELCTRNS. INC., See Hiram Jones Elctrns. Inc.

JORI RESOURCES, 2128 Knoll Dr., Ventura, CA 93003, Tel: 805-642-2266, FAX: 805-642-5978; Empl.: 4

JOSLYN ELECTRONIC SYSTEMS, P.O. Box 817, Goleta, CA 93116, Tel: 805-968-3551, TWX: 910-334-3464, FAX: 805-968-2335; FSC No.: 23663; Empl.: 210; *Sls. Mgr.:* M. Melcher

JRW INDUSTRIES, INC., 2312 N Second St., Harrisburg, PA 17110, Tel: 717-236-1418; Empl.: 4; *Sls. Mgr.:* Kevin J. Williams, Sls. Mgr.

JSC WIRE & CABLE, Box 248, Burgess Pl., Wayne, NJ 07474, Tel: 201-694-6200, 1-800-572-9473, FAX: 201-694-8297; Empl.: 40; *Sls. Mgr.:* Richard Wojtovitz

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J.S.T. CORP., 1200 Business Ctr. Dr., Ste. 400, Mt. Prospect, IL 60056, Tel: 312-803-3300, FAX: 312-803-4918; *Sls. Mgr.:* Ron Lesky; *Dist. Mgr.:* Ron Lesky

JUDCO MFG. INC., P.O. Box 487-E84, 1429 240th St., Harbor City, CA 90710, Tel: 213-534-0959; *Sls. Mgr.:* Kevin Johnson

JUDD WIRE INC.

FAX: 413-863-2305

JUDD WIRE INC., 57 Turnpike Rd., Turners Falls, MA 01376, Tel: 413-863-4357, TWX: 510-290-2147; FSC No.: 3357; Empl.: 148; *Sls. Mgr.:* Steve Fritz ..... **B•1019; C•1865**

Local Sales Offices & Reps

AL	Huntsville, R & G Assocs.	205-536-6300
AZ	Phoenix, O'Donnell Associates	602-944-9542
CA	El Toro, English/Damco	714-837-3801
CA	Los Altos, Ewing Foley	415-941-4525
CO	Denver, Elcom	303-337-2300
FL	Coral Springs, HAI Elctrns.	305-752-7520
IL	Arlington Heights, Rozner Sls. Co.	312-577-0067
KS	Overland Pk., Spectrum Sls.	913-648-6811
MD	Baltimore, R. A. Wafer Assocs.	301-744-1133
MA	Marlborough, O.K. Engrg.	617-481-6400
MN	Bloomington, EMT Engineering	612-888-1020
MO	Hazelwood, Spectrum Sls.	314-731-5151
NJ	Haddonfield, Mesa Tech. Assocs.	609-429-9531
NM	Albuquerque, O'Donnell Assocs.	505-883-1030
NY	Rochester, Union Marketing	716-546-7820
NC	Resch. Triangle Pk., Naylor Assocs.	919-544-6630
OH	Worthington, Simcox Assocs.	614-885-8776
OR	Beaverton, Jas. J. Backer Co.	503-627-0775
TX	Dallas, Stevens Sls. Co.	214-702-0132
UT	Salt Lake City, Elcom	801-486-4233
WA	Seattle, Jas. J. Backer Co.	206-285-1300

Local Distributors

AL	Madison, Sea Wire & Cable	205-772-9616
CA	Concord, Control Master	415-939-3600
CA	Fountain Valley, Innovative Sys.	714-968-6383
CA	Irvine, Republic Elctrns.	714-855-2222
CA	Menlo Park, Bay Associates	415-321-2990
CA	San Leandro, Anixter	415-352-3100
CA	Torrance, Blake Wire & Cable	213-533-8141
CA	Valencia, Wirenetics Co.	805-257-2400
CO	Colorado Springs, SCI	303-598-6888
CT	East Hartford, E. J. Stephens Co.	203-282-9400
CT	Manchester, I.M.S.	203-649-4415
FL	Altamonte Springs, Royce Elctrns.	305-869-4700
FL	Ft. Lauderdale, Anixter	305-485-4455
FL	Ft. Lauderdale, Pacer Elctrns.	305-462-0902
IL	Brookfield, Conductors Unltd.	312-485-7855
MA	Woburn, Pacer Elctrns.	617-935-8330
MN	Bloomington, K. L. Tannehill	612-881-6700
NH	Amherst, North Country Wire & Cable	603-889-0063
NJ	Dover, Electro Spec.	201-361-6300
NY	Apalachin, Rogan Electronics	607-625-2949
NY	Farmingdale, Weico Elctrns.	516-293-0050
NY	Johnson City, HELP Elctrns.	607-729-3528
NY	Rochester, Simcona Elctrn.	716-328-3230
NC	Raleigh, Wholesale Electric	919-878-9400
OH	Dayton, Astro Inds.	513-429-5900
PA	Montgomeryville, Pyttronic Ind.	215-242-6700
TX	Dallas, Interstate Wire	214-553-1311
WA	Tukwila, Carlyle Inc.	206-251-0700
WI	New Berlin, Indl. Elec. Wire & Cable	414-782-2323

JUDD WIRE INC., 870 Los Vallecitos Blvd., San Marcos, CA 92069, Tel: 619-744-7720, TWX: 910-322-1149, FAX: 619-744-6089; FSC No.: 3357

Refer to Judd Wire, Turners Falls, MA for sales office and distributor information.

JULIE RESEARCH

FAX: 212-691-3320

JULIE RESEARCH LABS., 508 West 26 Street, New York, NY 10001, Tel: 212-633-6625, TWX: 710-581-5138; FSC No.: 07062; Empl.: 35; *Sls. Mgr.:* Pamela Spencer; *Dist. Mgr.:* Pamela Spencer ..... **A•1962; D•1300-1303**

Local Sales Offices & Reps

CA	Fresno, Lion Elctrn. Labs	209-233-9096

JUMO PROCESS CONTROL, INC., 37A Woodbine St., Bergenfield, NJ 07621, Tel: 201-501-0060, FAX: 201-501-0205; *Sls. Mgr.:* Bert Robinson

Local Sales Offices & Reps

IL	Addison, Hedge Assoc.	312-543-0888
IL	Chicago, Delta Technical Products	312-631-8899

JUPITER SYSTEMS, 1100 Marina Village Parkway, Alameda, CA 94501, Tel: 415-523-9000, TELEX: 6713004, FAX: 415-523-9151; FSC No.: 63872; *Sls. Mgr.:* Glenn Meyer

KAHGAN ELECTRONICS CORP., 605 Peninsula Blvd., Hempstead, NY 11550, Tel: 516-538-2300, TELEX: 261097 KAHG UR; Empl.: 31; *Sls. Mgr.:* Fred Strauss; *Dist. Mgr.:* Bernard Stapler

KAHLE ENGINEERING, 50 S. Center St., Orange, NJ 07050, Tel: 201-678-2020, TELEX: 42-7757, TWX: 710-992-8835, FAX: 201-678-0326; Empl.: 50; *Sls. Mgr.:* Julie Clark

KAISER ELECTRONICS, Kaiser Aerospace & Elctrns., 2701 Orchard Pkwy., San Jose, CA 95134, Tel: 408-432-3000, TWX: 910-338-0196, FAX: 408-433-0553; Empl.: 1300

KSI

FAX: 508-922-8374

KAISER SYSTEMS, INC., 126 Sohier Road, Beverly, MA 01915, Tel: 508-922-9300; FSC No.: IFD78; Empl.: 100; *Sls. Mgr.:* Steve Swech ..... **D•1846-1849**

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KALAMAZOO TECHNICAL FURNITURE, P.O. Box 1165, Kalamazoo, MI 49005, Tel: 616-385-2255, 800-832-5227; Empl.: 42; *Sls. Mgr.:* B. Smith ..... **C•1058**

KALGLO ELCTRNS. CO., INC., 6584 Ruch Rd., E. Allen Twp., Bethlehem, PA 18017-9359, Tel: 215-837-0700, 800-524-0400, TWX: 510-651-2101, FAX: 215-837-7978; FSC No.: 64521; *Sls. Mgr.:* Christopher L. Criswell

KALMUS & ASSOCS., INC., 2424 S. 25th Ave., Broadview, IL 60153, Tel: 312-343-7004, FAX: 312-343-7016; Empl.: 346

KAM COMPONENTS, INC., P. O. Box 192-EEM, Nesconset, NY 11767, Tel: 516-585-0666, FAX: 516-585-1580; Empl.: 29; *Sls. Mgr.:* Cheryl Day

K&L MICROWAVE, INC., 408 Coles Circle, Salisbury, MD 21801, Tel: 301-749-2424, FAX: 301-749-5725; FSC No.: 50140; Empl.: 550; *Sls. Mgr.:* Charles J. Schaub

K & M ELECTRONICS, 11 Interstate Dr., W. Springfield, MA 01089, Tel: 413-781-1350; FSC No.: 66613; Empl.: 700; *Sls. Mgr.:* Gerard F. Voity ..... **A•1963**

Local Sales Offices & Reps

CA	Fremont, C/G Assocs., Inc.	415-790-1193
CT	Marlborough, Precision Sls., Inc.	203-295-0580
FL	Melbourne, Reynolds & Assocs., Inc.	305-259-7000
IL	Westchester, W. G. Brouillette & Assocs.	312-345-6500
WA	Bellevue, Advanced Power Comps., Inc.	206-747-9127
EXP	Bremen, W. Germany, DK Elctrns.	0421-304-0205
EXP	Tel Aviv, Israel, MTI Engrg., LTD	492101

KAPPA NETWORKS, INC., 1443 Pinewood St., Rahway, NJ 07065, Tel: 201-396-9400, 1-800-223-0603, TELEX: 130081 Kappa Rhwy, FAX: 201-388-4786; FSC No.: 20933; Empl.: 175; *Sls. Mgr.:* Seymour Reich ..... **A•1585-1603**

Local Sales Offices & Reps

AZ	Scottsdale, Interstate Marketing	602-244-9050
CA	Sherman Oaks, Kappa Networks	818-995-2401
CA	Woodland Hills, Interstate Marketing	818-883-7606
CO	Wheatridge, Wescom Mktg.	303-422-8957
MD	Middletown, S.T./Woolard Co., Inc.	301-371-4500
MN	Osseo, Gaffney Sls. Co.	612-425-5484
NJ	Madison, Livera-Polk Assocs., Inc.	201-377-3220
NY	Cazenovia, S.T./Woolard Co., Inc.	315-655-8145
NY	Glen Head, Livera-Polk Assocs.	516-759-9300
PA	Erdenheim, Omni Sls., Inc.	215-233-4600
TX	Austin, Mil-Rep Assocs., Inc.	512-346-6331
TX	Houston, Mil-Rep Assocs., Inc.	713-444-2557
TX	Richardson, Mil-Rep Assocs., Inc.	214-644-6731
UT	Riverdell, Dytox Elctms.	801-621-0310
UT	Salt Lake City, Wescom Mktg.	801-269-0419
VA	Lynchburg, S.T./Woolard Co., Inc.	804-528-5421

Local Distributors

CA	Sherman Oaks, Delay Line Distrs. Co.	800-624-2617

KAPPA/VIZ TEST EQUIPMENT, 175 Commerce Drive, Ft. Washington, PA 19034, Tel: 215-643-6950, 1-800-523-3696, FAX: 215-643-5237; Empl.: 10; *Sls. Mgr.:* Frank Menichello; *Dist. Mgr.:* Frank Menichello **D•1304-1307**

Local Sales Offices & Reps

AR	Little Rock, Leo Barker Co.	501-834-2537
CA	N.Hollywood, Bert Moore Assoc.	213-877-5955
CA	San Francisco, Tech. Sls. Assocs.	415-467-1434
CO	Denver, Mountain Reps.	303-623-0972
FL	Valrico, UniRep, Inc.	813-681-3477
GA	Roswell, Henry W. Phillips Co., Inc.	404-992-3070
IL	Cary, Bob Burns & Assocs., Inc.	708-516-3322
IN	New Madison, Reptronics	513-996-0730
MD	Baltimore, TAD Elctm. Sls.	301-727-6651
MA	Milford, Jonel Sls. Assocs.	508-478-4650
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MO	Raytown, Marty Tarkski Sls. Co.	816-358-1442
NJ	Livingston, Applied Process Instrs., Inc.	201-994-9331
NY	Grand Island, L. J. McTaggart Assocs.	716-773-9222
OR	Portland, Caruso & Co.	503-692-0139
PA	Philadelphia, Instrmn. Specialties	215-742-0898
TX	Dallas, S.W. Mktg. Assoc.	214-341-8631
Can	Crescent West, B.C., H.W. Cowan Canada Ltd.	604-576-8230

Local Distributors

AL	Birmingham, Forbes Distrs.	205-251-4104
CA	Canoga Pk., Rag Elctms., Inc.	818-998-6500
CA	El Monte, Marshall Claude Michael	818-459-5500
AZ	Tempe, CMI/Metermaster	602-431-0880
FL	Orlando, Emsco/Hammond	305-849-6060
IL	Chicago, Newark Elctms.	312-784-5100
IL	Niles, Joseph Elctms.	312-297-4200
IN	Indianapolis, Meunier Elctm. Supp.	317-635-3511
MA	Needham, You-Do-It Elctms.	617-449-1005
MI	Saginaw, Shand Elctms.	517-799-2527
MN	St. Louis Pk., Edtronics Co.	612-938-7541
MO	Kansas City, Electronic Supp.	816-931-0250
NJ	Moorestown, Marlac	609-234-4200
NY	Lindenhurst, RNJ Elctms. Inc.	516-226-2700
NY	New York, Omnitron Elctms.	212-865-4900
NY	Plainsview, Kelvin Elctms.	516-349-7620
NY	Rochester, Transcat	716-458-4801
NC	Raleigh, Southeastern Elctms.	919-828-2311
OH	Dayton, Consolidated Elctms.	513-252-5662
OH	Mansfield, Brodhead-Garrett	419-589-8222
PA	Drexel Hill, Kass Elctms.	215-789-7700
TX	Ft. Worth, Allied Elctms.	817-336-5401
MD	Silver Springs, Print Products	301-622-1118
WI	Milwaukee, E-M Instrs.	414-272-7799

KAUT & BUX MANUFACTURING CO., 675 Tower Rd., P.O. Box 867, Mundelein, IL 60060, Tel: 312-949-8505, TELEX: 6871289 KBM UN/, FAX: 1-312-949-4250; *Sls. Mgr.:* Heinz Kutschera

KAVLICO CORP., 14501 Los Angeles Ave., Moorpark, CA 93021, Tel: 805-523-2000, TELEX: 65-1481, FAX: 805-523-7125; Empl.: 500; *Dist. Mgr.:* Drew Distin

KAYCEE INDUSTRIES LTD., 32 Ramjibhai Kamani Rd., B.E., Bombay-38, INDIA, Tel: 263521/22/23, TELEX: 011 73896; Empl.: 400

KAY ELEMETRICS CORP., 12 Maple Ave., Pine Brook, NJ 07058-9798, Tel: 201-227-2000, TWX: 710-734-4347; FSC No.: 80138; Empl.: 60; *Sls. Mgr.:* Stephen P. Crump **A•1785**

KAY-TOWNES, Div. of Alco Industries, Inc., P.O. Box 593, Rome, GA 30161, Tel: 404-291-9871, TWX: 810-764-4809; Empl.: 60; *Sls. Mgr.:* Charles S. Ford

KB ELECTRONICS, 73 Wortman Ave., Brooklyn, NY 11207, Tel: 718-257-3300, TWX: 710-584-2308, FAX: 718-257-4740; Empl.: 125; *Sls. Mgr.:* A Bueller

KD COMPONENTS, INC., 2710 S. Main St., Santa Ana, CA 92707, Tel: 714-545-7108, TWX: 910-595-2678, FAX: 714-549-7966; FSC No.: 58421; Empl.: 32; *Sls. Mgr.:* Wayne Devine

KDI/TRIANGLE ELECTRONICS, 60 S. Jefferson Rd., Whippany, NJ 07981, Tel: 201-887-5700, TWX: 710-986-8220; FSC No.: 64537; Empl.: 300

KEDMAN CO., Box 25667, Salt Lake City, UT 84125, Tel: 801-973-9112, FAX: 801-972-2756; Empl.: 100

KEITHLEY INSTRS., 28775 Aurora Rd., Cleveland, OH 44139, Tel: 216-248-0400, FAX: 216-248-6148; Empl.: 461; *Sls. Mgr.:* Mike Sciulli

KEL AM, See Teltec, Inc.

KELLY AMERICAN, INC., 640 Federal Rd., Brookfield, CT 06804, Tel: 203-775-2590, TELEX: 4750159ELECABUL, FAX: 203-775-9048; *Sls. Mgr.:* Robert Buckley

KELMET, INC., 569 W. Covina Blvd., San Dimas, CA 91773, Tel: 714-599-0954, FAX: 714-599-2835; Empl.: 6; *Sls. Mgr.:* Paul Hodge

KELTEC FLORIDA, INC., MICROWAVE PRO, Amstar Electronics Group, P.O. Box 2917, Ft. Walton Bch., FL 32549-2917, Tel: 904-244-0043, TWX: 510-730-7654, FAX: 904-243-0103; FSC No.: 09062; Empl.: 625; *Sls. Mgr.:* I. Rampurawala **D•1444**

Local Sales Offices & Reps

FL	Huntsville, Beacon Elctms. Assocs.	205-881-1136
AZ	Phoenix, J. Smith Assoc.	602-267-0981
CA	Mtn. View, Disman Bakner	415-969-3010
CA	Orange, Cain Technology	714-997-7311
CA	Sacramento, Disman Bakner	916-483-2664
CA	Van Nuys, Cain Technology	818-904-9392
CO	Englewood, Cain Tech	303-220-8118
GA	Atlanta, Beacon Elctms. Assocs.	404-256-9640
IL	Schaumburg, Engrg. Prods. Assocs.	312-882-7640
IN	Cicero, Engrg. Prods. Assocs.	317-984-5226
IN	Indianapolis, Engrg. Prods. Assocs.	317-352-0605
KS	Lenexa, Dytec/South	913-888-0215
MD	Ellicott City, VPI	301-461-2525
MA	Lexington, O'Sullivan & Murphy	617-862-6570
MA	Needham Hgts., O'Sullivan & Murphy	617-749-8680/1
MN	Edina, Engrg. Prods. Assocs.	612-835-9022
MN	Minneapolis, Engrg. Prods. Assocs.	612-835-9022
MO	Maryland Hgts., Dytec/South	314-739-0665
NJ	Westfield, Metro-M.I.C.S.	201-233-6116
NM	Albuquerque, J. Smith Assoc.	505-265-3406
NY	Hauppauge, Metro MICS	516-361-6134
NY	Syracuse, Em-Tech	315-437-6410
OK	Tulsa, Beacon Elctms. Assocs.	918-622-1494
PA	Montgomeryville, Rufo Sys.	215-368-8495
PA	Montgomeryville, Rufo Sys.	215-368-8495
TX	Austin, Beacon Elctms. Assocs.	512-345-3543
TX	Dallas, Beacon Elctms. Assocs.	214-437-1505
VA	Sterling, Beacon Elctms. Worth	703-478-2480
WA	Seattle, J.J. Elctms. Assocs. Inc.	206-246-6619

KELTLON CORP., Viking Modules Div., 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700, FAX: 617-899-9602; Empl.: 75; *Sls. Mgr.:* T. Chadurjian

KELTRON CORPORATION

FAX: 617-899-9602

KELTRON CORP., High Voltage Power Supply Div., 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700, TELEX: 948197; Empl.: 170; *Sls. Mgr.:* T. Chadurjian **D•1308**

Local Sales Offices & Reps

GA	Roswell, Electro Comp. S.L.S.	404-992-2344
IL	Park Ridge, Probe Elec.	312-696-2828
MA	Hingham, Shain Assoc.	617-740-2334
MN	Edina, J. H. Hanson Co.	612-893-9960
NH	Nashua, Shain Assoc.	603-881-4881
NY	Commack, R.C. Engrg.	516-543-3325
PA	Glenside, Koebert Assoc.	215-887-2310

KELTRON CORP., Miniprinters Div., 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700, TELEX: 948197, FAX: 617-899-9602; FSC No.: 18662; Empl.: 250; *Sls. Mgr.:* Steven P. Sargent

KELVIN INDUSTRIES, INC., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, Tel: 818-990-1192, FAX: 818-995-6460; FSC No.: 19587; Empl.: 180; *Sls. Mgr.:* R. A. Featherston **A•1964-1965**

Local Sales Offices & Reps

AZ	Phoenix, Sunwest Mktg.	602-893-7677
CA	San Diego, Wes-K Assoc.	619-695-2040
CA	San Jose, Tech Sls.	408-954-0400
CA	Sherman Oaks, Wes-K Assocs.	818-990-1302
FL	Lighthouse Point, R. C. Simon & Co.	305-941-2757
IL	Deerfield, Walt Krueger	312-945-3720
MA	Needham Hgts., Todino Engrg.	617-444-7925
MI	Birmingham, Forand Sls.	313-644-0087
MN	Minneapolis, Furber Sls.	612-881-3620
MO	St. Louis, Abrams & Assocs.	314-569-0447
NY	Great Neck, Trionic	516-466-2300
NY	Rochester, Foster & Wager	716-385-7744
NC	Burlington, P. J. Nahser	919-226-8053
OH	New Lebanon, J. N. Bailey & Assocs.	513-687-1325
OK	Tulsa, John B. Guenther	918-660-5126
PA	Hatboro, J.S. Wurts Co.	215-674-3562
TX	Dallas, John B. Guenther	214-691-8500
WA	Redmond, Frank Jackson	206-881-7277

Local Distributors

AZ	Phoenix, TTI, Inc.	602-861-0222
CA	Anaheim, Zeus	714-632-6880
CA	Chatsworth, Petell/Passive Comps.	818-341-1745
CA	Chatsworth, TTI	818-709-1010
CA	No. Hollywood, TTI, Inc.	818-709-1010
CA	San Diego, TTI, Inc.	619-587-4888
CA	San Jose, TTI, Inc.	408-946-5577
CA	San Jose, Zeus	408-998-5121
CO	Westminster, TTI	303-429-6806
CT	Stratford, Electro Comp.	203-375-1400
FL	Ft. Lauderdale, NRC	305-772-4500
FL	Orlando, TTI, Inc.	305-859-1000
GA	Norcross, TTI, Inc.	404-662-0911
ID	Spirit Lake, A-I Elctrns	802-635-1545
MD	Columbia, TTI	301-995-1331
MA	Woburn, TTI, Inc.	617-938-8800
MN	Eden Prairie, TTI	612-944-5080
NY	Farmingdale, Command Elec.	516-293-1212
NY	Ronkonkoma, TTI, Inc.	516-737-2000
OH	Dayton, Wright Source	513-293-1341
PA	York, ECI	717-843-8971
TX	Ft. Worth, TTI, Inc.	817-831-8300
TX	Richardson, Zeus	214-783-7010
WA	Tacoma, C & G Elec.	206-272-3181

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KEMET ELECTRONICS CORPORATION, Box 5928, Greenville, SC 29606, Tel: 803-963-6621, TELEX: 57-0496, TWX: 810-287-2536; FSC No.: 31433; Empl.: 6,200; *Sls. Mgr.:* Robert Taylor; *Dist. Mgr.:* Dan Manly **A•1096-1097**

Refer to Kemet, Union Carbide Corp., Elctrns. Div. for sales office information and for distributor listings.

Local Sales Offices & Reps

AL	Huntsville	205-830-1090
AZ	Tempe	602-831-2151
CA	Encino	818-609-7561
CA	Newport Beach	714-640-9320
CA	Santa Clara	408-986-0424
CO	Englewood	303-790-0494
FL	Ft. Lauderdale	305-731-2187
FL	Orlando	407-855-8886
GA	Norcross	404-441-7701
IL	Schaumburg	312-517-1030
IN	Carmel	317-844-7756
MD	Columbia	301-992-5600
MA	Stoneham	617-279-0400
MI	Farmington Hills	313-489-5850
MN	Edina	612-929-4642
NY	Elmsford	914-347-4390
NY	Liverpool	315-451-0720
NC	Raleigh	919-872-2877
OH	Columbus	614-885-3330
OK	Tulsa	918-664-8592
PA	Exton	215-363-8310
SC	Greenville	803-242-5789
TX	Austin	512-458-3181
TX	Irving	214-556-0009
WA	Kirkland	206-828-4853

KEMTRON CIRCUITS & ELCTRNS. CORP., 110 S. Long Bch. Rd., Rockville Centre, NY 11570, Tel: 516-766-2772; Empl.: 7; *Sls. Mgr.:* Walter Carlock

M.S. KENNEDY CORP., Sub of Hybrilonics, Inc., 8170 Thompson Rd., Clay, NY 13041, Tel: 315-699-9201, FAX: 315-699-8023; FSC No.: 51651; Empl.: 41; *Sls. Mgr.:* Greg Overend

KENTRON, INC., P.O. Box 142, Cedarburg, WI 53012-0142, Tel: 414-377-3733; *Sls. Mgr.:* Kenneth L. Krolski

KEN-TRON MFG., INC., 1204 Industrial Dr., Owensboro, KY 42301, Tel: 502-684-0431, TELEX: 20-4305, FAX: 502-684-0435; Empl.: 100; *Sls. Mgr.:* J. Douglas

KEPCO, INC., 131-38 Sanford Ave., Flushing, NY 11352, Tel: 718-461-7000, TWX: 710-582-2631, FAX: 718-767-1102; Empl.: 300; *Sls. Mgr.:* Paul Birman; *Dist. Mgr.:* Paul Birman ..... **D•1851-1885**

Local Sales Offices & Reps

AL	Huntsville, W. A. Brown, Inc.	205-830-9224
AZ	Phoenix, Aztec Entprs.	602-944-9185
CA	Los Alamitos, Reed Elctrn. Mktg.	213-598-6676
CA	San Diego, Earle Assocs., Inc.	619-278-5441
CA	Sunnyvale, N-S Westronics	408-745-1102
CO	Denver, Aztec Entprs.	303-779-5285
CT	Bethel, Ray Perron & Co., Inc.	203-798-0261
CT	Farmington, R. Perron Co.	203-673-4825
DC	Washington, Eastern Instrmn. Corp.	301-384-8500
FL	Ft. Lauderdale, W. A. Brown Instrs., Inc.	305-776-4055
FL	Melbourne, W. A. Brown Instrs., Inc.	407-723-0776
FL	Orlando, W. A. Brown Instrs., Inc.	407-648-9660
GA	Atlanta, W. A. Brown Instrs., Inc.	404-449-7160
KS	Kansas City, ATECH, Div. of ATA, Inc.	913-268-9644
MD	Baltimore, Eastern Instrmn. Corp.	301-792-7039
MA	Boston, R. Perron Co.	617-449-6162
MI	Detroit, Carter McCormic & Peirce	313-477-7700
MN	S. St. Paul, Northport Engrg.	612-457-8000
MO	St. Louis, ATECH, Div. of ATA, Inc.	314-576-2884
NH	Merrimack, Ray Perron & Co., Inc.	603-424-4423
NJ	Woodcliff Lake, Eastern Instrmn.	201-664-0907
NM	Albuquerque, Techn. Mktg. Assoc.	505-345-8921
NY	Liverpool, NTS Assocs., Inc.	315-451-1091
NC	Cary, W. A. Brown Instrs., Inc.	919-460-1120
OH	Cleveland, Carter McCormic & Peirce	216-826-0400
OH	Dayton, Carter McCormic & Peirce	513-836-0951
OK	Tulsa, Airep Elctrns.	918-494-7711
OR	Beaverton, H. Levinson Co.	503-690-1312
PA	Philadelphia, Eastern Instrmn.	215-355-7700
PA	Pittsburgh, Carter McCormic & Peirce	412-826-3800
TX	Austin, Airep Elctrns.	512-327-0778
TX	Dallas, Airep Elctrns.	214-349-4360
TX	Houston, Airep Elctrns.	713-944-8171
UT	Ogden, Aztec Entprs., Inc.	801-621-1655, 801-355-9256
WA	Seattle, H. Levinson Co.	206-382-1300
WI	Milwaukee, Star Engineering	414-645-3680
Can	Calgary, Alberta, Digidyne, Inc.	403-262-7744
Can	Montreal, DigiDyne Inc.	514-631-1891
Can	Ottowa, Ont., Digidyne, Inc.	613-727-5632
Can	Rexdale, Ont., Digidyne, Inc.	416-674-0444
Can	Vancouver, B.C., Digidyne, Inc.	604-738-0114

KEPRO CIRCUIT SYSTEMS, 630 Axminister Dr., Fenton, MO 63026, Tel: 314-343-1630; Empl.: 17; *Sls. Mgr.:* Jeff R. Keil; *Dist. Mgr.:* Jeff R. Keil

KEPTEL/ARMIGER, 56 Park Rd., Tinton Falls, NJ 07724, Tel: 800-526-3697, 201-389-8800; Empl.: 300; *Sls. Mgr.:* Kathy Plesnarski; *Dist. Mgr.:* Larry Bucknell

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KESSLER-ELLIS PRODS., 120 1st Ave., Atlantic Highlands, NJ 07716, Tel: 201-291-0500, 800-631-2165, TELEX: 13-2496-, FAX: 201-291-8097; FSC No.: 28222; Empl.: 85 ..... **D•1150**

Local Sales Offices & Reps

AL	Brimingham, Bryco	205-672-9760
CA	Costa Mesa, FLW	714-751-7512
CA	Hayward, FLW	415-786-9070
CA	San Diego, FLW	619-277-0993
IN	Indianapolis, Ronald Ray & Assoc.	317-841-9144
MA	Salem, CDM Assocs.	617-741-3166
MI	Southfield, Bill Coombe Sls. Co.	313-355-1511
NJ	Stanhope, Nota-Tek	201-347-1490
NC	Kernersville, Heritage Elctrl. Sls. Assocs.	919-996-4374
OH	Chagrin Falls, RPM Indl. Sls.	216-247-3295
TX	Dallas, Devices, Inc.	214-991-1202
WI	Oconomowoc, Atlas Instr.	414-367-8759

Local Distributors

AZ	Tempe, CMI	602-431-0015
CA	Costa Mesa, FIW	714-751-7512
CA	Dublin, Standard Meter Lab	415-828-4837
CA	Los Angeles, E.I.L. Instrs.	213-685-7020
CT	Middletown, E.I.L. Instrs.	203-346-6646
FL	Bartow, Chemco Elec. Supp.	813-533-3165
FL	Lakeland, AMJ Equipment	813-646-1487
FL	St. Petersburg, Chemco Elec. Supp.	813-577-7774
FL	Tampa, Chemco Elec. Supp.	813-621-8611
GA	Norcross, A A Elec.	404-449-8670
HI	Honolulu, Process Valve & Control	808-834-7675
IL	La Salle, Complete Indl. Entprs.	815-224-1485
IN	Indianapolis, Farrell Argast	317-546-4041
IA	Cedar Rapids, Crescent Electric	319-363-8191
IA	Cedar Rapids, Hupp Elec. Motors	319-366-0761
IA	Davenport, Hupp Elec. Motors	319-322-3168
LA	W. Monroe, Weaks Supp. Co.	318-323-8831
ME	Bangor, Holmes Distrs.	207-942-7357
ME	Portland, Holmes Distrs.	207-774-5901
MD	Sparks, E.I.L. Instrs.	301-771-4800
MA	Burlington, E.I.L. Instrs.	617-272-9450
MA	W. Springfield, Control Engrg.	413-781-1330
MA	Wilmington, Stan. Elec. Supp.	617-658-5050
MI	Ann Arbor, Madison Elec.	313-665-6131
MI	Ann Arbor, McNaughton & McKay	313-995-9515
MI	Jackson, Madsion Elec.	517-783-2735
MI	Kalamazoo, Madison Elec.	616-342-1965
MI	Madison Hgts., McNaughton & McKay	313-399-7500
MO	Maryland Hgts., French Gerleman Elec.	314-569-3122
MO	St. Louis, ISL	314-535-5760
NH	Manchester, Holmes Distrs.	603-669-5060
NJ	Cinnaminson, IMS Distribution	609-662-1770
NJ	Green Brook, Apparatus Elctrl. Supp.	201-752-8400
NY	Clarence, Trott Elctrns.	716-634-8500
NY	Elmira, Brady Supp.	607-733-6591
NY	Pittsford, Trott Elctrns.	716-586-8251
NY	Rochester, Niagara Electric	716-271-1223
NC	Charlotte, Count, Inc.	800-832-0422
NC	Charlotte, Trott Elctrns.	704-376-2237
OH	Cleveland, Pioneer Stan.	216-587-3600
OH	Solon, Pioneer Dayton	513-236-9900
OH	Toledo, Girkins Elec.	419-478-5600
OK	Oklahoma City, Tek Rep	405-947-8088
OR	Portland, Westcon, Inc.	503-283-0132
PA	Carnegie, Flow Media, Inc.	412-276-8055
PA	Newtown Square, QDI	215-359-1000
SC	Spartanburg, Roberts Electric	803-574-9350
TN	Nashville, A A Elec.	615-832-6632
TX	Houston, Texas Technical	713-526-0656
UT	Salt Lake City, Stuart Electric	801-466-8603
VA	Ashland, Hanover Controls	804-798-2007
WA	Kent, CB Parsons	206-882-3222
WI	Oconomowoc, Atlas Instrs.	414-367-8759

KESTER

FAX: 312-390-9338

KESTER SOLDER DIV., Litton Sys., Inc., 515 E. Touhy Ave, Des Plaines, IL 60018, Tel: 312-297-1600, TWX: 910-221-2100; Empl.: 350; *Sls. Mgr.:* Robert J.Murphy; *Dist. Mgr.:* Carl Voelkel ..... **C•1750**

Local Sales Offices & Reps

CA	Anaheim	714-871-0280
NJ	Newark	201-589-0246

KETEMA/RODAN DIVISION, 2900 Blue Star St., Anaheim, CA 92806, Tel: 714-630-0081, TWX: 910-591-1684, FAX: 714-630-4131; FSC No.: 15454;DESC-EQP-75-1387; Empl.: 170; *Sls. Mgr.:* J.F. Catrambone ..... **B•1898-1900**

Local Sales Offices & Reps

AL	Huntsville, Alpha Mktg.	205-533-0766
AZ	Phoenix, TC Elctrn. Sls., Inc.	602-994-5153
AZ	Scottsdale, TC Elctrn. Sls., Inc.	602-994-5153
CA	Los Angeles, Landa & Assocs., Inc.	213-879-0770
CA	San Jose, Arnold Tech. Sls.	408-954-0400
CO	Westminster, Straube Assocs.	303-426-0890
FL	Coral Springs, H.A., Inc.	305-752-7520
IL	Downers Grove, Richmar Elctrns.	312-968-0118
IN	Ft. Wayne, Menze Sls. Co.	219-747-5616
KS	Parker, S. W. Assocs., Inc.	913-898-6552
MA	Framingham, Marathon Sls. Ltd.	508-875-3566
MN	Mendota Hgts., G-II Sls.	612-454-3086
MO	St. Louis, Abrams & Assocs.	314-569-0447
NJ	Bellmawr, TAI Corp.	609-933-2600
NY	Melville, Comtronic Assocs.	516-249-0505
NY	Syracuse, Canavan-Scanlon Assocs.	315-437-1271
NC	Charlotte, Arthur, Harris Assocs.	704-542-9338
TX	Plano, Richmar Elctrns. Corp.	214-424-8388
TX	Round Rock, Richmar Elctrns. Corp.	512-255-2551
UT	Salt Lake City, Straube Assocs.	801-263-2640
WA	Vancouver, R. Over Sls.	206-695-6179

Local Distributors

AZ	Tempe, Elctrn. Supp.	602-276-1199
CA	Los Alamitos, Permag Pacific Corp.	213-594-6515
CA	Riverside, Elctrn. Supp.	714-543-9214
CA	San Diego, Elctrn. Supp.	619-693-8222
CA	Sunnyvale, Permag Sierra	408-738-1080
CO	Denver, Permag Corp.	303-693-6612
GA	Norcross, Permag S.E. Div.	404-448-4998
IL	Elk Grove Vl, Permag Cen. Div.	312-956-1140
MA	Billerica, Permag N.E. Div.	617-663-7500
MN	Eden Prairie, Permag Minnesota Div.	612-934-4635
NY	Hauppauge, Fairmont Elctrns.	516-231-3313
NY	Hicksville, Permag Atlantic Div.	516-822-3311
OH	Toledo, Permag Magnetics Div.	419-385-4621
TX	Richardson, Permag S.W. Div.	214-699-1121
WA	Bellevue, Permag N.W. Div.	206-882-2507
Can	Mississauga, Ont., R-Theta, Inc.	416-890-0221

KEWAUNEE SCIENTIFIC CORP., Technical Workstation Div., 901 FM 20, P.O. Box 930, Lockhart, TX 78644, Tel: 512-398-5292, TELEX: 752706, FAX: 512-398-5104; Empl.: 165 (This Location) 800 (Company Wide); *Sls. Mgr.:* Frank Johnson, Dir. Sls./Mktg.

Keystone CARBON COMPANY

FAX: 814-781-7648

KEYSTONE CARBON, Thermistor Div., 1935 State Street, St. Marys, PA 15857, Tel: 814-781-1591, TELEX: 91-4517; FSC No.: 75-263; Empl.: 1200; *Sls. Mgr.:* John A. Brock; *Dist. Mgr.:* John A. Brock ..... **B•1901-1903**

Local Sales Offices & Reps

CA	Orange, El Dorado Sls.	714-538-7252
CA	Redwood City, Hickey Inds. Sls.	415-594-9978
CA	San Diego, El Dorado Sls.	619-549-2202
CT	Wethersfield, L.J. Labant	203-529-0048
GA	Marietta, J.J. Arnold	404-427-1062
IL	Palatine, David J. Brock	312-359-0955
IN	Fort Wayne, R.O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R.O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R.O. Whitesell & Assocs.	317-457-9127
KS	Shawnee, Benson Engrg.	913-491-4446
MI	Farmington Hills, J.L. Montgomery Assocs.	313-489-0099
MN	Minneapolis, Dave Marrone	612-566-6573
MO	St. Louis, Frank H. Ring	314-863-2511
NY	Rochester, Foster & Wager	716-385-7744
OH	Cincinnati, R.O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R.O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R.O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R.O. Whitesell & Assocs.	513-298-9546
NC	Cary, J. E. Shea	919-481-2475
PA	Pittsburgh, R.O. Whitesell & Assocs.	412-963-6161
TX	Dallas, Benson Engrg.	214-352-7541
TX	Houston, Benson Engrg.	713-672-2194
EXP	NY, Inwood, Minthorne Int'l.	516-239-0767
Can	Burlington, Ont., Donald J. Hyslop	416-333-3520

Local Distributors

AZ	Scottsdale, Allied Elctrns.	602-990-9549
CA	Garden Grove, Allied Elctrns.	714-554-0731
CA	Inglewood, Newark Elctrns.	213-671-7066
CA	Redwood City, Hi-Cor	415-368-5087
CA	Santa Clara, Allied Elctrns.	408-727-1690
CO	Wheatridge, Allied Elctrns.	303-425-7144

FL Ft. Lauderdale, Allied Elctrns. 305-486-0500
GA Atlanta, Allied Elctrns. 404-237-3366
IL Chicago, Newark Elctrns. 312-638-4411
IL Elgin, Allied Elctrns. 312-697-8200
MA Wilmington, Allied Elctrns. 617-942-0150
MI Westland, Allied Elctrns. 313-595-6565
MN Minneapolis, Allied Elctrns. 612-559-9545
MN Thief River Falls, Digi-Key Corp. 1-800-344-4539
MO St. Louis, Allied Elctrns. 314-878-1229
NJ
NJ Frenchtown, Sintec 201-996-4093
NJ Springfield, Newark Elctrns. 201-376-9500
NY Mineola, Allied Elctrns. 516-248-2360
NC Cary, Allied Elctrns. 919-467-0720
OH Willoughby, Allied Elctrns. 216-951-0908
OK Tulsa, Allied Elctrns. 918-663-7630
PA Bala Cynwyd, Allied Elctrns. 215-667-6940
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Ft. Worth, Allied Elctrns. 1-800-228-6705
TX Houston, Allied Elctrns. 713-445-7123
VA Alexandria, Allied Elctrns. 703-836-5002
WA Seattle, Allied Elctrns. 206-767-5772
WI Milwaukee, Allied Elctrns. 414-463-2662

KEYSTONE ELECTRONICS CORP., 31-07 20th Rd., Astoria, NY 11105-2017, Tel: 718-956-8900, TELEX: 35-3700, FAX: 718-956-9040; FSC No.: 91833; Empl.: 80; *Sls. Mgr.:* Charles Gold

KEYTEK INSTRUMENT CORP., 260 Fordham Rd., Wilmington, MA 01887, Tel: 508-658-0880, TELEX: 951389 KEYTEK BURL, FAX: 508-657-4803; *Sls. Mgr.:* Michael Hopkins

KEYTEK KEYBOARDS CANADA INC., 16 Mary St., Units 3 & 4, Aurora, Ontario, Canada L4G 3W8, Tel: 416-727-9491, FAX: 416-727-7118; Empl.: 20

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CO Aurora, R & R Instrmn. 303-340-8728
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FL Plantation, EMS, Inc. 305-587-7146
FL Sarasota, EMS, Inc. 813-923-2804
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NM Albuquerque, Vic Myers Assocs., Inc. 505-884-6878
NY Rochester, EIC Elctrns. 716-544-4392
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OH Dayton, EQS Sys., Inc. 513-236-7676
OK Parkhill, Scientific Dvcs.-S.W. 918-457-4888
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TX Richardson, Scientific Dvcs. SW 214-231-8106
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IA Cedar Rapids, H. R. Brown Sls. Co. ... 319-366-0635
KS Olathe, M. E. Bettis Co. 913-764-0621
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MD Columbia, Tyler Griffin Co. 301-995-1215
MN Osseo, Gaffney Sls. 612-425-5484
MO St. Louis, Abrams & Assocs. 314-569-0447
NM Albuquerque, Cleveland Entprs., Inc. .. 505-265-7893
NY Great Neck, Trionic Assocs. 516-466-2300
NY Rochester, Lamb Comp., Inc. 716-323-1250
NY Syracuse, Lamb Comps., Inc. 315-455-2469
NC Winston-Salem, DGW, Inc. 919-768-7166
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OH Columbus, Electronic Comp., Inc. 614-231-2318
OH Miamisburgh, Electronic Comps., Inc. 513-866-3340
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TX Dallas, Caton Sls. Co. 214-243-4718
WA Redmond, Components West, Inc. 206-885-5880
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CT	E Hampton, Northeast Representatives	203-866-6030
FL		
FL	Altamonte Springs, APM Assocs.	407-869-6831
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MS	Jackson, Cartwright & Bean	601-981-1170
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NH	Milford, Northeast Representatives	603-880-8199
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TN	Memphis, Cartwright & Bean	901-362-8345
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PR	San German, Digit-Tech Sls.	809-892-4260

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AZ	Phoenix, Sterling Elctrns.	602-268-2121
AZ	Tempe, Shelley- Ragon	602-894-2058
AZ	Tempe, T.T.I.	602-431-1191
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CA	Chatsworth, Shelley-Ragon	818-998-3333
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MA	Wilmington, T.T.I.	617-658-4700
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NY	E. Syracuse, Add Elctrns.	315-437-0300
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NY	Hauppauge, Jaco	516-273-5500
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NY	Rochester, Summit Distrs.	716-334-8110
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NY	Ronkonkoma, Prime Comps.	516-737-1730
NY	Ronkonkoma, T.T.I.	516-737-2000
NY	Valley Stream, L & S Elctrns.	516-561-2474
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NC	Raleigh, Southeastern Radio	919-828-2311
OH	Cleveland, Roberts Elect. Corp.	216-238-1711
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WI	Oconomowac, G W Elctrns.	414-567-9445
Can	Mississauga, Ont., Prelco	416-678-0401
Can	Montreal, Que., Prelco	514-389-8051

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CA	Santa Clara, Tech-Ser, Inc.	408-496-1004
CA	Torrance, Cutlas Elctrns.	213-324-7360
CA	Torrence, Cutlas Elec.	213-324-7360
CA	Torrence, Tech-Ser,Inc.	213-370-7200
CO	Commerce City, Williams Assocs.	303-289-5647
GA	Rosswell, T.S.Williams & Assocs.	404-587-3353
IL	Schaumberg, K.W.Meyers Co.	312-882-4608
IN	Indianapolis, K.W.Meyers Co.	317-783-1030
IA	Cedar Rapids, K.W.Meyers Co.	319-363-8987
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LA	Jefferson, Butler & Land Inc.	504-734-8888
MD	Sparks, Black & Assocs.	301-472-2416
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MO	St. Louis, Mid-Tec Assocs. Inc.	314-275-8666
NJ	Elmwood Park, L&M Assocs.	201-797-0441
NM	Albuquerque, MG Electronics, Inc.	505-255-1638
NM	Albuquerque, Williams Assocs.	505-255-1638
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NY	Horsehead, Canavan-Scanlon Assoc.	607-739-0810
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KR ELECTRONICS, INC., 91 Avenel St., Avenel, NJ 07001, Tel: 201-636-1900, FAX: 201-636-1982; FSC No.: 55259; Empl.: 20; *Sls. Mgr.:* none ..... **A•1704-1705**

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KRISTEL CORPORATION, 833 Industrial Dr., West Chicago, IL 60185, Tel: 312-293-0850, TELEX: 297 159 KRIS, FAX: 312-293-1255; Empl.: 35; *Sls. Mgr.:* Don Matthiesen

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CA	Sepulveda, Gil & Assocs.	818-894-1262
FL	Boca Raton, Sls. Specialists	813-754-1329
IN	Indianapolis, CC Electro Sls.	800-423-7799
NH	Amherst, D. A. Crowley & Assocs.	603-673-7050
NY	Port Washington, Ashtec	516-767-0336
NY	Rochester, H. C. Johnson Agencies	716-586-0777
OH	Akron, Augnat Assocs.	216-273-1211
OK	Tulsa, Milco Mktg.	918-664-2277
PA	Wyndmoor, Precision Mktg. Grp.	215-233-9233
TX	Houston, Milco Mktg.	713-723-5003
TX	Richardson, Milco Mktg.	214-738-2716
UT	Salt Lake City, Sage Assocs.	801-467-5451
WA	Seattle, The Harry Levinson Co.	206-382-1300

Local Distributors

MA	Billerica, Baldwin Comps.	617-667-6710
NJ	Mountainside, ENOX Resistors	201-654-7600
NY	Ronkonkoma, Baldwin Comps. Center	516-588-5700,800-645-5608
PA	Harrisburg, Ad-Tech	717-939-8337

KROHN-HITE CORP., Avon Indl. Pk., Bodwell St., Avon, MA 02322, Tel: 508-580-1660, TWX: 710-345-0831, FAX: 617-583-8989; Empl.: 60; *Sls. Mgr.:* Dick Heitmann ..... **A•1699; D•1311**

Local Sales Offices & Reps

AL	Huntsville, Gentry Assocs.	205-837-0692
AZ	Phoenix, Odyssey 1	602-246-8846
CA	Huntington Bch., Sci-Dev West	714-840-3501
CA	San Jose, MCH Assocs.	408-246-7330
CO	Englewood, Odyssey 1	303-773-8176
FL	Ft. Lauderdale, Gentry Assocs.	305-791-8405
FL	Orlando, Gentry Assocs.	305-859-7450
FL	Tampa, Gentry Assocs.	813-886-0720
GA	Atlanta, Gentry Assocs.	404-998-2828
IL	Chicago, Berndt Assocs.	312-283-0713
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Park, Ramsey Assocs.	913-649-6996
LA	Gretna, Gentry Assocs.	504-367-3975
MD	Baltimore, Sci-Rep	703-385-0600
MI	Detroit, EQS Sys.	313-961-3042
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Ramsey Assocs.	314-878-5042
NJ	Englewood, Sci. Devices E.	201-871-3916
NM	Albuquerque, Odyssey 1	505-265-6645
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PA	Spring House, Scientific Devices East	215-643-3335
SC	Columbia, Gentry Assocs.	803-772-6786
TN	Knoxville, Gentry Assocs.	615-584-0281
TX	Houston, Barnhill Assocs.	713-444-1733
VA	Fairfax, Sci-Rep	703-385-0600
WA	Bellevue, Sci. Dvcs. N. W.	206-747-5169
WI	Milwaukee, Berndt Assocs.	414-545-8400

KRYSTINEL CORP., 126 Pennsylvania Ave., Paterson, NJ 07509, Tel: 201-345-8900, TWX: 710-988-5931, FAX: 201-345-1172; Empl.: 200; *Sls. Mgr.:* William Perkins ,Mgr.Customer Service

KSI, See Kaiser Systems, Inc.

K-SYSTEMS OF TEXAS, INC., 11501 Rojas Dr. Ste. P, El Paso, TX 79936, Tel: 915-598-9769, TELEX: WUI 6502763972, FAX: 915-593-2080; Empl.: 4; *Sls. Mgr.:* J.C. Kates

K-TRONICS, K. T. Elctrns. Inc., 341 Cobalt Way No. 206, Sunnyvale, CA 94086, Tel: 1-800-888-ELCO, FAX: 408-732-5049; *Sls. Mgr.:* Douglas Hemingway ..... **B•1375; D•1908-1909**

Local Sales Offices & Reps

AZ	Scottsdale, Luscombe Engrg.	602-949-9333
CA	Los Gatos, Luscombe Engrg.	408-370-2020
CO	Longmont, Luscombe Engrg.	303-772-3342
CT	Seymour, Sturdy Corp.	203-888-1480
FL	Orlando, DAI Sls.	407-299-7754
MA	Wellesley Hills, Sturdy Corp.	617-235-2330
OR	Lake Oswego, Luscombe Engrg.	503-636-6664
PA	Paoli, Tyler Griffin	215-647-1550
UT	Midvale, Luscombe Engrg.	801-565-9885
WA	Seattle, Luscombe Engrg.	206-223-1541

K-TWO INDUSTRIES, 4331 Miranda Ave., Palo Alto, CA 94306, Tel: 408-720-9316; Empl.: 5

KULITE SEMICONDUCTOR PRODS., INC., One Willow Tree Rd., Leonia, NJ 07605, Tel: 201-461-0900, TELEX: 685-3296, FAX: 201-461-0990; Empl.: 300

KULKA (DIALIGHT CO.), See Dialight Corp.

KURZ INSTRUMENTS INC., 2411 Garden Rd., Monterey, CA 93940, Tel: 800-424-7356, TELEX: 172275; FSC No.: 94-24-11681; Empl.: 72; *Sls. Mgr.:* Tom Wortman

K-W MANUFACTURING CO., INC., P. O. Box 508, Prague, OK 74864, Tel: 405-567-2285, TELEX: 4932625, FAX: 405-567-4153; Empl.: 60; *Sls. Mgr.:* Freda Pickard

KYCON CABLE & CONNECTOR, INC., 1772 Little Orchard St., San Jose, CA 95125, Tel: 408-295-1110, FAX: 408-295-8054; Empl.: 8; *Dist. Mgr.:* Stephanie Sherman ..... **C•1398-1399, 1867**

Local Sales Offices & Reps

CA	San Jose, Kycon Cable & Connector, Inc.	408-295-1110

Local Distributors

CA	Sunnyvale, PSC Elctrns.	408-737-1333

KYOCERA NORTHWEST, Electronic Components Group, 5701 E. Fourth Plain Blvd., Vancouver, WA 98661, Tel: 206-696-2840, TELEX: 49999 180, FAX: 206-695-5836; Empl.: 800; *Sls. Mgr.:* Koji Kanatani; *Dist. Mgr.:* Phil Elliott, Dist. Sales ..... **A•1100-1101, 1414-1415, 1976-1977**

LAB-LINE INSTRUMENTS, 15th & Bloomingdale, Melrose Park, IL 60160, Tel: 312-450-2600, TELEX: 6871028; Empl.: 225

LAFRANCE CORP., Entprs & Exec Aves, Philadelphia, PA 19153-3893, Tel: 215-365-8000, TELEX: 506-082, FAX: 215-365-4420; Empl.: 502; *Sls. Mgr.:* Brian McHenry

LAFRANCE CORP., PACTEC DIV., See PacTec Div., LaFrance Corp.

LAKE SHORE CRYOTRONICS, INC., 64 E. Walnut St., Westerville, OH 43081, Tel: 614-891-2243, TELEX: 24-5415, FAX: 614-891-1392; *Sls. Mgr.:* David L. Calvelage

LA MARCHE MFG., 106 Bradrock Dr., Des Plaines, IL 60018, Tel: 312-299-1188, TELEX: 28-2526; FSC No.: ;15736; Empl.: 225

LAMBDA ELECTRONICS, Veeco Instr., Inc., 515 Broad Hollow Rd., Melville, NY 11747, Tel: 516-694-4200, TWX: 510-224-6484, FAX: 516-293-0519; Empl.: 1200; *Sls. Mgr.:* I. Gutman

LAMBDA SEMICONDUCTORS, Veeco Instruments, 121 International Dr., Corpus Christi, TX 78410, Tel: 512-289-0403, 800-255-9606, TWX: 910-876-1404, FAX: 512-289-0472; Empl.: 200

LAMB INDUSTRIES, INC., 6585 S.W. Raleighwood La., Portland, OR 97225, Tel: 503-297-8878, TELEX: 263373LAMBUR, FAX: 503-297-8879; Empl.: 5; *Sls. Mgr.:* Gary Rhode; *Dist. Mgr.:* Joanne McIntyre ..... **B•1164, 1780-1781**

Local Sales Offices & Reps

CA	Mt. View, Del Bucchia/Onken	415-965-8043
CO	Broomfield, Conners Co.	303-466-9628
CT	Bloomfield, Zaslow Sls.	203-242-7781
IL	Des Plaines, Lincoln, Hodges	312-297-3810
IN	Ft. Wayne, MS Sls.	219-436-3023
MI	Ferndale, Shalco Inc.	313-547-4771
MO	St. Louis, KKB and Co.	314-647-2400
NH	Portsmouth, Zaslow Sls.	203-242-7781
NJ	Nutley, Falk Baker	201-661-2430
OH	Cleveland, KT/DEPCO	513-777-9399
OR	Portland, Lamb Inds.	503-297-8878
PA	Harrisburg, Beil and Whitaker	717-564-6900
TX	Carrollton, Impaq Sls.	214-247-3300
VA	Martinsville, ENG REPS Assoc.	703-632-2365
VA	Reston, Stinson & Assoc.	703-478-2252
Can	Montreal, Que., Dynatech Electronics	514-643-1702

Local Distributors

CA	San Carlos, Logan Elctrns.	415-594-0700
CA	Tustin, Western Switches	714-259-8144
CA	Van Nuys, EW Elctrns.	714-857-4422
CA	Van Nuys, Wes-Garde/Pacific Switch	213-873-4802
CT	Hartford, Wes-Garde	203-527-7705
FL	Lakeland, Wes-Garde	813-644-7564
MN	Minneapolis, Tor/Tec Corp.	612-866-3662
MN	New Brighton, Parts One	612-633-8079
NY	Freeport, KRP Elctrns.	516-623-3346
OH	Westerville, Wes-Garde	614-885-0319
OR	Portland, Radar Elctrns.	503-232-3404
TX	Austin, Galtronics	512-837-7470
WA	Seattle, Pacific Elctrns.	206-575-1050
WA	Seattle, Radar Elctrns.	206-282-2511
WI	Mequon, Lakeview Elctrns.	414-377-8250

LAMP TECHNOLOGY, INC., 1645 Sycamore Ave., Bohemia, NY 11716, Tel: 516-567-1800, TELEX: 279260; Empl.: 20; *Sls. Mgr.:* Neal Shupak

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FAX: 815-455-7916

LAMPTRONIX CO., LTD., 81 N. Williams St., Crystal Lake, IL 60014, Tel: 815-455-0400; FSC No.: 61342 ..... **B•1165**

Local Sales Offices & Reps

CA	Westlake V1., Casco	818-889-7889
WA	Lynnwood, The Nichols Co.	206-742-8761
IL	Crystal Lake, Bussey & Assocs.	815-459-3752
WI	Ripon, Kilgore Assocs.	414-748-7485

LAMTECH ELECTRONICS, 620 Easy Street, Garland, TX 75042, Tel: 214-272-3504, FAX: 214 272 7176; FSC No.: O7R487; Empl.: 100; *Sls. Mgr.:* Phillip Rasor; *Dist. Mgr.:* Phillip Rasor

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LANCER CHEMICAL, 80 Cutter St, Box 30, Warren, RI 02885, Tel: 401-245-5493

LANDIS & GYR, INC., 99 Castleton St, Pleasantville, NY 10570, Tel: 914-747-3540, TELEX: 137345, FAX: 914-592-1179; Empl.: 65; *Sls. Mgr.:* Joe Depaola; *Dist. Mgr.:* R. W. Strohm

LANDIS & GYR, INC., See Maxmar Controls Inc.

L & L SPECIAL FURNACE, 166 Kent Rd, Aston, PA 19014, Tel: 215-459-9216, FAX: 215-459-3689; Empl.: 20; *Sls. Mgr.:* Greg Lewicki; *Dist. Mgr.:* Stephen Lewicki

L & R MFG. CO., 577 Elm St, Kearny, NJ 07032, Tel: 201-991-5330, FAX: 201-991-5870; Empl.: 220; *Sls. Mgr.:* Robert Lasky

LANGLEY:FLEET AEROSPACE, INC., P.O. Box 2911, San Diego, CA 92112, Tel: 619-264-3181; FSC No.: 83549; Empl.: 110; *Sls. Mgr.:* A. Kremm

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LARK ELECTRONICS, INC., Box 390, New York, NY 10040, Tel: 212-569-0430; FSC No.: 52682

LARK ENGINEERING CO., Baier & Baier Inc., 26401 Calle Rolando, San Juan Capistrano, CA 92675, Tel: 714-240-1233, FAX: 714-240-7910; FSC No.: 33174; Empl.: 25

LARSON INSTRUMENT, Greenbush Rd., Orangeburg, NY 10962, Tel: 914-359-3800, FAX: 914-365-1581; Empl.: 18; *Sls. Mgr.:* A. D. Stephens

LASER CONCEPTS, Omega Organization Intl., P.O. Box 33623, Seattle, WA 98133, Tel: 206-364-7881; *Sls. Mgr.:* Roberta Forsythe

LASER DIODE, INC., Morgan Crucible, 1130 Somerset St, New Brunswick, NJ 08901, Tel: 201-249-7000, TWX: 710-998-0597, FAX: 201-249-9165; Empl.: 170; *Sls. Mgr.:* Greg Dougherty; *Dist. Mgr.:* Greg Dougherty

LASER PRECISION CORP., 1231 Hart St, Utica, NY 13502, Tel: 315-797-4449, TELEX: 646803; Empl.: 180; *Sls. Mgr.:* David Stehlin

LASER TECHNOLOGY, INC., 10624 Ventura Blvd, N. Hollywood, CA 91604, Tel: 818-763-7091, TELEX: Cable-LASTEC (No. Hollywood), FAX: 818-763-7382; Empl.: 22; *Sls. Mgr.:* Paul Jensen

LAW, R. E. INSTRUMENT, INC., 7735 W. 112th Pl, Palos Hills, IL 60465, Tel: 312-974-4000; FSC No.: 6685-6695; *Sls. Mgr.:* R. Gene Law; *Dist. Mgr.:* R. Gene Law

L-COM INC., 1755 Osgood St, N. Andover, MA 01845, Tel: 508-682-6936, FAX: 508-689-9484; Empl.: 16; *Sls. Mgr.:* Scott Black ..... **B•1782-1783; D•1313**

LDJ INCORPORATED, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219, Tel: 313-528-2202, TWX: 810-232-1509 LDJ TRMI, FAX: 313-689-2525; Empl.: 63; *Sls. Mgr.:* Jim Ling

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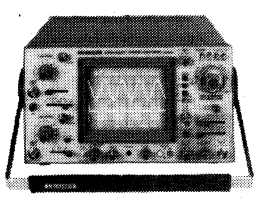

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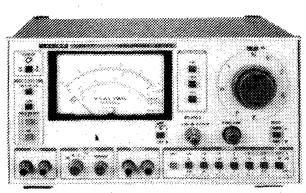

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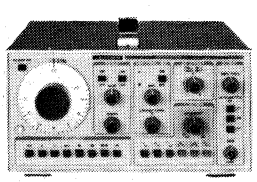

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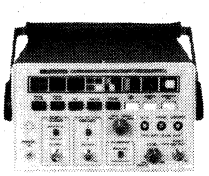

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LEACH RELAY DIVISION, Leach Corporation, 5915 Avalon Blvd., Los Angeles, CA 90003, Tel: 213-232-8221, TWX: 910-321-2303, FAX: 213-234-6461; FSC No.: 35344; Empl.: 750; *Sls. Mgr.:* P. Rohr; *Dist. Mgr.:* D. Robinson ..... **B•1559-1563**

Local Sales Offices & Reps

AL	Huntsville, R&G Assoc.	205-536-6300
AZ	Phoenix, O'Donnell Assocs. S.W.	602-944-9542
CA	Buena Pk., Leach Corp.	714-739-8151
CA	San Mateo, Halbar Assocs.	415-349-4700
FL	Oviedo, Conley& Assoc.	407-365-3283
KS	Wichita, Baka Corp.	316-682-8411
MD	Hunt Valley, Marktron	301-628-1111
MD	Rockville, Marktron	301-251-8990
MA	Needham, Comp. Techn.	617-449-8490
MI	Southfield, Rathsburg Assocs., Inc.	313-559-9700
MN	Edina, Mel Foster Tech. Sls., inc.	612-941-9790
MO	St. Louis, BAKA Corp.	314-429-2252
NM	Albuquerque, O'Donnell Assocs.	505-889-4522
NY	Commack, Leach Corp.	516-499-2449
OH	Dayton, Leach Corp.	513-434-8151
TX	Dallas, Leach Corp.	214-341-0811
WA	Bellevue, Leach Corp.	206-746-7263
Can	Kirkland, Que., Robin Aerospace Prods.	514-694-1315
Can	Mississauga, Ont., Robin Aerospace Prods.	416-673-1666
Can	Ottawa, Robin Aerospace Prod.,Ltd.	613-594-8884

Local Distributors

AL	Huntsville, Time Elctrns.	205-721-1133
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	San Diego, Time Elctrns.	619-586-1331
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CO	Englewood, Time Elctrns.	303-799-8851
CT	Cheshire, Time Elctrns.	203-271-3200
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
FL	Orlando, Time Elctrns.	407-841-6565
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NM	Charlotte, Time Elctrns.	704-522-7600
AZ	Dublin, Time Elctrns.	614-761-1100
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PA	King of Prussia, Time Elctrns.	215-337-0900
TX	Austin, Time Elctrns.	512-339-3051
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TX	Houston, Time Elctrns.	713-530-5972
TX	Houston, Time Elctrns.	713-530-0800
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Local Sales Offices & Reps

CA	Cypress, Leader Instrs. Corp.	714-527-9300

LEAR SIEGLER, INC., Telecommunications Div., 714 N. Brookhurst St, Anaheim, CA 92801, Tel: 714-774-1010, FAX. 714-535-4679; Empl.: 135; *Sls. Mgr.:* J. Horgan

LEBOW PRODUCTS, Eaton Corp., 1728 Maplelawn Rd., Troy, MI 48084, Tel: 313-643-0220, FAX: 313-643-0229; Empl.: 97; *Sls. Mgr.:* Michael J. Parker

LECROY CORP., 700 Chestnut Ridge Rd., Chestnut Ridge, NY 10977, Tel: 914-425-2000, FAX: 914-425-8967; Empl.: 500; *Sls. Mgr.:* Klaas Vogel

LECTRO MAGNETICS, INC., 6056 W. Jefferson Blvd., Los Angeles, CA 90016, Tel: 213-870-9383, (USA):800-325-9814, (CA):800-325-9815; FSC No.: 29098; Empl.: 60; *Sls. Mgr.:* Peter Deal

LECTRONIC RESEARCH LABS., INC., 1423 Ferry Ave., Camden, NJ 08104, Tel: 609-541-4200, FAX: 609-541-7852; FSC No.: 99228; Empl.: 20; *Sls. Mgr.:* Ken Reid

LECTROTECH, INC., 5810 N. Western Ave., Chicago, IL 60659, Tel: 312-769-6262, TELEX: 4993905 LECTRO; Empl.: 35

LEDCO DIV., 346 Chester St., St. Paul, MN 55107, Tel: 612-222-2791, FAX: 612-222-7639; FSC No.: 55292; Empl.: 25; *Sls. Mgr.:* Laurie Wilbrecht

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LEDTRONICS, INC., 4009 Pacific Coast Hwy., Torrance, CA 90505, Tel: 213-549-9995, TELEX: 4945454; FSC No.: 8Z410; Empl.: 25 ..... **B•1020, 1167-1170**

Local Sales Offices & Reps

AL	Madison, Southern Elec. Reps.	205-461-8925
CA	San Jose, Silicon Valley Sls.	408-432-1967
CT	Ansonia, Pace Assocs.	203-732-8756
CT	S. Glastonbury, Pace Assocs.	203-659-2266
IN	Carmel, Newton & Assocs.	317-848-2016
MN	Edina, Orrin Eames Tech. Sls.	612-944-3494
OR	Beaverton, Electronic Mfg. Svcs.	503-626-8254
PA	Camp Hill, All Tech Mktg. Inc.	717-763-4126
PA	West Chester, All Tech Mktg. Inc.	215-344-0134
TX	Grapevine, Dynamic Equip. & Sys., Inc.	817-481-4646
WI	Brookfield, McMahon Inc.	414-782-3335
Can	Markham, Ont., Avotronics	416-475-2024

Local Distributors

CA	Fremont, Vic-Tal	415-651-6420
CA	Hollywood, Yale Elctrns.	213-465-3186
CA	Industry, Ital Elctrns.	818-968-8515
CA	Tustin, Added Value Elctrns.	714-258-8259
CO	Wheatridge, Aved Inc.	303-422-1701
CT	Hartford, Wes-Garde	203-527-7705
FL	Largo, Elctrns. Precepts	813-544-3636
IL	St. Charles, Norman Lamps	312-377-3004
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MD	Spencerville, U. S. Elctrns.	301-384-3300
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PA	Drexel Hill, Kass Elctrns.	215-449-2300
TX	Dallas, Wes-Garde	214-357-1768
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TX	Pflugerville, RSI	512-251-1161
TX	Richardson, RSC Elctrns.	214-644-3444
UT	W. Valley City, Aved Inc.	801-975-9500
WA	Seattle, Westlake Elctrns.	206-622-6600
WI	Milwaukee, Progressive Image	414-321-4722

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MA	Woburn, Radian Assocs.	617-933-7386
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NY	Buffalo, Lynn Assocs., Inc.	716-631-0054
NY	Cazenovia, Naylor Elctrns.	315-655-8174
OH	Cincinnati, Frank Campisano & Co.	513-574-7111

LEKTRA SERVICE CORP., 129-07 18th Ave., P.O. Box 222, College Point, NY 11356, Tel: 718-939-7171; Empl.: 10; *Sls. Mgr.:* Ben Eisenberg

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CA	San Diego, Balzer-Wolf Assocs.	619-581-6060
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
CO	Wheat Ridge, Trembly Assocs.	303-421-8900
FL	Melbourne, Southern Elctrns., Inc.	407-242-9661
GA	Norcross, Hughes Assocs., Inc.	404-662-1587
IL	Northbrook, Raines & Assocs.	312-498-0890
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Rockville, Mechtronics Sls., Inc.	301-340-2130
MA	Lexington, Zieco	617-861-8300
MI	Detroit, Jack M. Thorpe Co.	313-779-6363
MN	Edina, Hanna Lind	612-942-8554
MS	Corinth, Hughes Assocs., Inc.	601-287-2915
MO	St. Louis, Midtec Assocs.	314-275-8666
NV	Las Vegas, Trembly Assocs.	702-739-9770
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NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Farmington, Canavan-Scanlon Assocs.	716-924-7450
NY	Syracuse, Canavan-Scanlon Assocs.	315-437-1271
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OR	Portland, Earl & Brown Co.	503-643-5500
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TN	Nashville, Hughes Assocs.	615-871-0908
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NJ	Bordentown, Eva Tec Mktg.	609-298-4307
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AZ	Phoenix, Mactronix	602-998-1848
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MI	Farmington Hills, Stone Comps. Sls.	313-476-6090
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NJ	Oak Ridge, P.G. Assocs.	201-697-0128
NJ	Pensauken, Vantage Sls.	609-663-6660
NC	Fripp Island, NPM Assocs.	803-838-2691
OH	Fairview Pk., Comp. Specialty	216-442-6200
PA	Bryn Mawr, J J Lyons Mktg.	215-687-2277
SC	Fripp Island, N.P.M. Assocs.	803-838-2691

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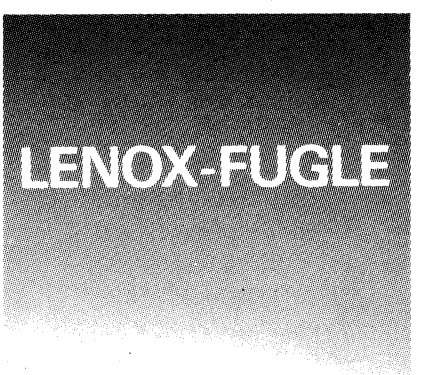

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RI	E. Providence, Omni-Rep	401-438-3423
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TX	Dallas, Advance Tech. Sls.	214-340-1300
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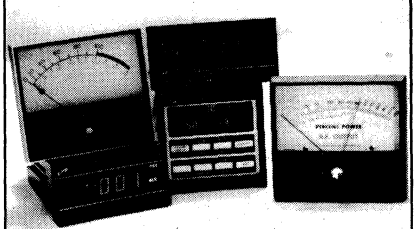

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MI	Grand Rapids, R. P. Urban & Assocs.	616-245-0511
MN	St. Paul, Countryman Assocs.	612-645-9151
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NJ	Englewood Cliffs, Mason-Esco Inc.	201-569-8868
NY	Hauppauge, Mason-Esco Inc.	516-273-3500
NY	Rochester, BRS Sls. Assocs.	716-586-1522
OH	Dayton, J. C. Hoffsteller Co.	513-296-1010
OH	Medina, J. C. Hoffstetter Co.	216-241-4880
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TX	Dallas, Reese & Assocs.	214-351-0703
UT	Slat Lake City, Gemini Elctrns.	801-278-0201
WA	Redmond, SPS Elctrns., Inc.	206-323-4140

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CA	Los Angeles, Master Distrs.	213-452-1229
CA	San Diego, Shanks & Wright	714-239-0176
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IL	Des Plaines, Byron Ellis Assocs.	312-298-7626
NM	Albuquerque, J. Smith & Assocs. Inc.	505-345-6501
NY	Liverpool, Syronics Inc.	315-451-0968
NC	Burlington, P. J. Nahser Co.	919-226-8053
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CO	Englewood, Wm. J. Purdy	303-790-2211
FL	North Haven, Coakley, Boyd & Abbett	407-831-2474
FL	Maitland, Hutto-Hawkins Assocs.	305-831-2474
FL	Pompano Beach, Hutto-Hawkins Assocs.	305-979-0330
FL	Tampa, Hutto-Hawkins Assocs.	813-251-2970
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IL	Mt. Prospect, C. P. Dombrow	312-253-3326
IN	Indianapolis, L. M. DeVoe	317-842-3245
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NJ	Springfield, Litton Electron Dvcs. Div.	201-379-3131
OH	Dayton, Litton Electron Dvcs. Div.	513-258-1243
TX	Plano, Litton Electron Dvcs. Div.	214-881-0822
VA	Arlington, Litton Electron Dvcs. Div.	703-920-4100

LITTON ENCODER DIV., 20745 Nordhoff St, Chatsworth, CA 91311, Tel: 818-341-6161, TWX: 910-494-1229, FAX: 818-882-4553; FSC No.: 17080; Empl.: 250 ..... **B•1963**

Local Sales Offices & Reps

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CA	Montrose, Luscombe Engineering	818-249-9000
CO	Denver, Motion Technology	303-757-3003
FL	Longwood, Boetto Corp.	305-331-1771
MA	Newton, Itek Encoder	617-969-7307
MI	Grand Rapids, Midwest Meridian Corp.	616-698-7391
MN	Eden Prairie, PWC, Inc.	612-934-1409
MO	St. Louis, Midwest Meridian Corp.	314-878-4441
OR	Tigard, Vantage Corp.	503-620-3280
PA	Clifton Heights, Clifton Precision	215-622-1000
TX	Garland, Carey, McMahill & Assocs.	214-681-1414
WA	Bellevue, Vantage Corp.	206-455-3460
Can	Markham, Ont., E.P. Elctrns.	416-475-8316

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MA	Sturbridge, Russ Persson	203-871-8900
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MN	Prior Lake, Midwest Meridian	612-447-8222
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TX	Dallas, Blair Engrg.	214-241-5655
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PA	Newtown Sq, Q D I	215-359-1000
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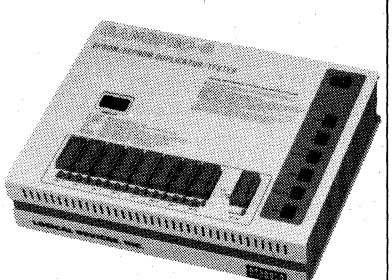
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CA	Encinitas, Craig Assocs.	619-942-8166
CA	Thousand Oaks, Craig Assoc.	818-887-2444
CT	Hartford, Dynamic Sls. of New England	203-693-6567
FL	Coral Springs, HAI Elctrns.	305-752-7520
GA	Norcross, R.O. Whitesell & Assocs.	404-449-9190
IN	Indianapolis, R.O. Whitesell & Assocs.	317-359-9283
KS	Wichita, D&O Engrg. Co.	316-686-2808
KY	Pewee Valley, R.O. Whitesell & Assocs.	502-241-1441
MA	Burlington, Dynamic Sls. of New England	617-272-5676
MN	Wayzata, White Sls. Co.	612-544-1374
MO	Southfield, R.O. Whitesell & Assocs.	313-559-5454
NY	Ronkonkoma, JL Sls.	516-737-2801
NC	Greensboro, R.O. Whitesell & Assocs.	919-273-1945
OH	Dayton, R.O. Whitesell & Assocs.	513-298-9546
OK	D&O Engrg. Co.	316-686-2808
PA	Churchville, Dynamic Elctrn. Sls.	215-322-2611
PA	Pittsburgh, R.O. Whitesell & Assocs.	412-963-6161
TN	Nashville, R.O. Whitesell & Assocs.	615-352-4760
TX	Dallas, D&O Engrg. Co.	214-241-3099
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VA	Front Royal, Eltron Sls. Ltd.	703-635-1933
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FL	Orlando, MacKay Smith Assocs.	407-423-4353
GA	Tucker, MacKay Smith Assocs.	404-496-9913
IL	Skokie, Electro Tech Mktg.	312-676-3151
IN	Greenfield, France Entprs.	317-462-6098
MA	Hudson, Compak	508-568-0331
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UT	Salt Lake City, Elctrn. Comp. Sls.	

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FL	Deerfield Beach, Brandel-Stephens	305-427-8558
FL	Orlando, Brandel-Stephens	305-425-3202
GA	Atlanta, Brandel-Stephens	404-261-7579
IL	Arlington Hgts., Berndt Assocs.	312-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Shawnee Mission, Lowell-Kangas & Assoc.	913-631-3515
MD	Hunt Valley, Marktron	301-628-1111
MD	Rockville, Marktron	301-251-8990
MA	Haverhill, L.K. Assocs.	617-373-1313
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Lowell-Kangas & Assoc.	314-821-4050
NJ	Flanders, K&R Engrg. Sls.	201-584-5235
NM	Albuquerque, Lindberg Co.	505-881-1006
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NY N. Syracuse, Micro-Tech Mktg. 315-458-5254
NY Rochester, Micro-Tech Mktg. Inc. 716-328-3000
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PA Pittsburgh, Bear Mktg., Inc. 412-531-2002
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TX Richardson, Barry Sales 214-234-0255
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WI Milwaukee, Berndt Assocs. 414-545-8400

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IL La Fox, Richardson Elctrns., Ltd. 312-456-0600

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MN Minneapolis, Josco/Melius, Inc. 612-861-3343
MO Maryland Heights, Thunderbird Tech. Sls. & Svcs. 314-298-8940
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WI Brookfield, Control Sls., Inc. 414-797-9500

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TX Ft. Worth, Midwest Meridian 817-589-1711

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LYNN ELECTRONICS, 915 Pennsylvania Blvd, Feasterville, PA 19047, Tel: 215-677-6700, 800-523-6075, TWX: 510-667-1988, FAX: 215-364-2944; FSC No.: 19151; Empl.: 125; *Sls. Mgr.:* H. T. Colas

LYN-TRON, INC., 3150 Damon Way, Burbank, CA 91505, Tel: 213-849-6211, 800-423-2734, TELEX: 662729, FAX: 818-840-9581; FSC No.: 05791; *Sls. Mgr.:* Alfred C. Redlitz; *Dist. Mgr.:* 107

LYON METAL PRODUCTS, 47 Railroad Ave., Aurora, IL 60507, Tel: 312-892-8941, TWX: 910-232-3132; Empl.: 600; *Sls. Mgr.:* R. R. Bodlund

LYTRON INCORPORATED, Dragon Court, Woburn, MA 01801, Tel: 617-933-7300, TELEX: 951-934, FAX: 617-935-4529; Empl.: 75; *Sls. Mgr.:* Edwin Carell

LZR*electronics,inc.*

FAX: 301-670-0436

LZR ELECTRONICS, INC., 8051 Cessna Ave., Gaithersburg, MD 20879, Tel: 301-921-9440; Empl.: 35; *Sls. Mgr.:* Phil Aliff; *Dist. Mgr.:* Dave Ballog ..... **B•1786-1787, 1875; C•1415-1436, 1868-1872; D•1033-1037, 1900-1907**

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FL Melbourne, Kennedy Assocs. 305-676-6875
IL Arlington Hgts., Gaertner & Assocs. ... 312-593-2332
MD Lutherville, DGR 301-583-1360
MA Norwood, JMG, Inc. 617-762-5333
NJ Clifton, ROI Sls. 201-340-1515
NY Liverpool, M. M. Hare Co. 315-457-6859
OH Troy, S-Tek 408-435-8004
OK Tulsa, Advance Tech. Sls. 918-664-0462
PA West Chester, TCA Assocs. 215-692-6853
TX Austin, Advance Tech. Sls. 512-346-5322
TX Dallas, Advanced Tech. Sls. 214-340-1300
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CA San Jose, Eclipse Sls. 408-435-3800
CT Cheshire, Connecticut Applied Technlg. 203-272-6564
FL Tampa, SRT Mktg. 813-884-4805
IL Elk Grove Vl, Tristar Grp., Inc. 312-593-0200
KS Olathe, Tech. Sls. Assocs. 913-829-2800
MA Burlington, Conti-Younger Assocs., Inc. 617-273-1582
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MN Golden Valley, Ambassador Indl. Mkg. 612-542-8437
MO Ferguson, Technical Sls. Assocs. 314-521-2044
NJ Cherry Hill, Vantage Sls. 609-424-6777
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NJ Medford, Champion Elctrn. Sls. Co., Inc. 609-983-0932/0807/9007
NY Cazenovia, S.T./Woolard Co. 315-655-8145
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SC Easley, R-A Sls. Co. 803-859-1859
SC Pickens, R-A Sls. Co. 803-859-1859
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TX Houston, Rem-Air Comps. 214-234-1069
CO Lakewood, Cristee Meade Co. 303-232-0287
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WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301
WI Milwaukee, Key Entpr., Inc. 414-453-9462

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Can Concord, Ont., Votron Elctrns., Ltd. 416-669-9870

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MARTEL ELECTRONICS, 27 Roulston Rd., P.O. Box 897, Windham, NH 03087, Tel: 603-893-0886, 800-821-0023, TELEX: 4974420, FAX: 603-898-6820; *Sls. Mgr.:* David DeVries

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PA Bridgeport, Penncat Corp. 215-272-0505
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MA Falmouth Hgts., RJC Assocs. 508-540-8832
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MO St. Louis, Comtel Midwest 314-991-5363
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VA	Alexandria, Allied Elctrns.	703-836-5002
WA	Seattle, Allied Elctrns.	206-767-5772

MAURY MICROWAVE CORP., 8610 Helms Ave., Cucamonga, CA 91730, Tel: 714-987-4715, TWX: 910-581-3408, FAX: 714-987-1112; FSC No.: 13047; Empl.: 104; *Sls. Mgr.:* M. A. Maury, Jr.

MAXI-SWITCH CO., Sub. of EECO, 9697 East River Rd., Minneapolis, MN 55433, Tel: 612-755-7660, TWX: 910-576-2690; Empl.: 160; *Dist. Mgr.:* E. C. Helme, Jr.

MAXMAR CONTROLS INC., 99 Castleton St, Pleasantville, NY 10570, Tel: 914-747-3540, FAX: 914-747-3567

MAXON PRECISION MOTORS, INC., 838 Mitten Rd., Burlingame, CA 94010, Tel: 415-697-9614, FAX: 415-697-2887; *Sls. Mgr.:* Edward Graham ..... **B•1278**

MAXTOR CORPORATION, 211 River Oaks Pkwy., San Jose, CA 95134, Tel: 408-432-1700, TELEX: 171074, FAX: 408-434-6469; Empl.: 2500; *Sls. Mgr.:* Jim Daly; *Dist. Mgr.:* Bob Cascarino

MAXWELL ELECTRONICS, P.O. Box 12033, Research Triangle Park, NC 27609, Tel: 919-846-1633; Empl.: 8; *Sls. Mgr.:* Joe Harrison

MAXWELL LABORATORIES, INC., 8888 Balboa Avenue, San Diego, CA 92123-1506, Tel: 619-279-5100, TWX: 910-335-2063, FAX: 619-277-6754; Empl.: 600; *Sls. Mgr.:* William Fox (Prods.)

MB DYNAMICS INC., 25865 Richmond Rd., Cleveland, OH 44146-1483, Tel: 216-292-5850, TELEX: 510-601, FAX: 216-292-5614; Empl.: 45; *Sls. Mgr.:* Ed Peterson

mc

FAX: 717-486-5920

MCCOY ELECTRONICS CO., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, Tel: 717-486-3411, TWX: 510-650-3548; FSC No.: 00136; Empl.: 545 ..... **A•1416-1425**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Sls., Inc.	205-533-1735
AZ	Tempe, Sunwest Mktg.	602-893-7677
CA	Mountain View, Thorson West	415-964-9300
CA	Sherman Oaks, Wes-K	818-990-1302
CO	Littleton, Advanced Tech Mktg.	303-798-4200
CT	Hartford, JMG, Inc.	203-278-9709
FL	Oviedo, Conley & Assocs.	305-365-3283
GA	Norcross, Elctrn. Sls., Inc.	404-448-6554
IL	Glendale Heights, Beta Technlg. Sls., Inc.	312-790-9886
IN	Kokomo, Schillinger Assoc., Inc.	317-452-4057
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Norwood, JMG, Inc.	617-762-5333
MI	Southfield, Fred H. Gehrke & Assoc.	313-559-5363
MN	Minneapolis, Dunlop Consits.	612-544-1070
KS	Merriam, Lorenz	913-384-6556
MO	University City, Lorenz Sls., Inc.	314-997-4558
NJ	Medford Lake, Gray Assocs.	609-953-9109
NM	Albuquerque, Sunwest Mktg.	505-898-6471
NY	Binghamton, Foster & Wager, Inc.	607-724-7093
NY	New Rochelle, Ascor Elctrns.	914-235-8838
NY	Rochester, Foster & Wager, Inc.	716-385-7744
NC	Cary, Elctrn. Sls., Inc.	919-467-8486
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
OR	Beaverton, Evergreen Mktg. Grp.	503-643-8020
WA	Seattle, Evergreen Mktg. Grp.	206-633-3160
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Richardson, R. F. Kimball Co.	214-231-3447
VA	Lynchburg, Burgin-Kreh Assocs.	804-239-2626
WI	Milwaukee, Beta Technlg. Sls., Inc.	414-543-6609
EXP	NJ, Oradell, Sylvan Ginsbury Ltd.	201-261-3200

MCCURDY RADIO INDUSTRIES LIMITED, 108 Carnforth Road, Toronto, Ont., CAN M4A 2L4, Tel: 416-751-6262, FAX: 416-751-6455; *Sls. Mgr.:* Murray Porteous; *Dist. Mgr.:* Murray Porteous ..... **D•1071**

MCE SEMICONDUCTOR, INC., 1111 Fairfield Dr., West Palm Beach, FL 33407, Tel: 407-845-2837, TELEX: 44105 (MCE UI), FAX: 407-863-8275; Empl.: 58; *Sls. Mgr.:* Arthur France

MCFADDEN SYSTEMS, INC., 11835 E. Smith Ave., Santa Fe Springs, CA 90670, Tel: 213-948-4414, TELEX: 677161, FAX: 213-948-1291; FSC No.: 25750; Empl.: 46

MCG ELECTRONICS INC

FAX: 516-586-5120

MCG ELCTRNS., 12 Burt Dr., Deer Park, NY 11729, Tel: 516-586-5125; FSC No.: 29779; Empl.: 45; *Sls. Mgr.:* Carolyn Schultz ..... **B•1350, 1387-1400**

Local Sales Offices & Reps

MA	Woburn, EMS	617-229-6686
MN	St. Louis Pk., Electro Midwest	612-922-7017
NJ	Caldwell, RTS Data	201-228-5249
NC	Charlotte, Data Directions	704-588-7400
OK	Oklahoma City, Computer Power	405-848-2522
TX	Richardson, Devices, Inc.	214-991-1202

MCGILL MANUFACTURING CO., INC., 909 North Lafayette Street, Valparaiso, IN 46383, Tel: 219-465-2200, FAX: 219-465-2456; Empl.: 295; *Sls. Mgr.:* Tom Morris/Dave Rickards ..... **B•1798-1800**

Local Sales Offices & Reps

AL	Huntsville, James E. Heusser Agy.	205-836-3896
AR	Hot Springs, Automation Supp., Inc.	501-767-5444
CA	Los Angeles, Mark Waggoner	213-904-0156
CA	Oceanside, Mark Waggoner	213-904-0156
CA	Rohnert Park, Joseph Foster	415-930-3496
CO	Englewood, E & M Sls.	303-936-8957
FL	Tampa, Monte Constantine	813-985-4376
IL	Roscoe, Richard Leff	312-299-2354
IN	Bremen, Jan Richard Stahly	219-282-3592
MI	Chelsea, Rick Mayday	313-995-2965
MN	Anoka, Steven Mau	612-924-3440
MO	St. Peters, Neil Klocke	314-947-2259
NH	Manchester, Michael Bowles	603-644-7427
NY	Brooklyn, Brian Kelly	718-830-5011
NY	Silver Creek, Scott Earsing	716-325-3485
OH	Columbus, Michael Airey	216-574-7164
SC	Columbia, Harold Heaton	803-733-0941
TN	Nashville, Richard Hardy	615-748-1150
TX	Dallas, Raley Sls. Co.	214-368-1683
VA	Ashland, Hutcheson & Co.	804-288-3236
WI	Kenosha, Wally Coats	312-299-2354
Can	Mississauga, Ont., Marr Elec. Ltd.	416-277-9481

MCGUIRK ELECTRONICS CO. INC., 212 So. Main St, P. O. Box 853, Middleton, MA 01949, Tel: 617-933-3500; FSC No.: 55902; Empl.: 10; *Sls. Mgr.:* L. McCarthy

mci

FAX: 516-587-0624

MCI TRANSFORMER CORPORATION, 411 Manhattan Ave., Babylon, NY 11704, Tel: 516-587-0510; Empl.: 50; *Sls. Mgr.:* Timothy J. Williams ..... **A•2333-2343**

Local Sales Offices & Reps

MA	Orange, MCI Transformers	508-544-8806

mckENZIE TECHNOLOGY

FAX: 415-651-1020

MCKENZIE TECHNOLOGY, 44370 Old Warm Springs Blvd., Fremont, CA 94538, Tel: 415-651-2700; Empl.: 1000; *Sls. Mgr.:* Nancy Vinerts; *Dist. Mgr.:* Vicky Wodopianov ..... **C•1437**

Local Sales Offices & Reps

AL Huntsville, Cartwright & Bean, Inc. 205-830-1540
AZ Phoenix, Mercury Engrg. Sls., Inc. 602-265-0344
CA Pleasanton, Moulthrop Sls., Inc. 415-463-0450
CA Westminster, West Elctrn. Sls. 714-898-0120
CA Westminster, West Elctrn. Sls., Inc. 213-493-5569
FL Orlando, Cartwright & Bean, Inc. 407-423-1756
GA Norcross, Cartwright & Bean, Inc. 404-368-0160
IL Elk Grove VL, Parcom, Inc. 312-228-6360
IN Indianapolis, Leslie M. DeVoe Co. 317-842-3245
KS Olathe, C-Tron 913-829-0073
MA Harvard, Entprs. Technlg. 508-772-6003
MA Plainville, Entpr. Technlg. 617-695-4700
MI Roseville, JFCO, Inc. 313-771-8241
MN Stillwater, The Kits Co. 612-439-8088
MS Jackson, Cartwright & Bean, Inc. 601-981-1170
MO St. Charles, C-Tron 314-928-8078
NY Hauppauge, Sticom 516-724-6814
NC Charlotte, Cartwright & Bean, Inc. 704-536-0303
NC Raleigh, Cartwright & Bean, Inc. 919-876-4130
OH Van Dalia, JFCO, Inc. 513-890-8322
OR Lake Oswego, RTS, Inc. 503-244-4123
TN Memphis, Cartwright & Bean, Inc. 901-362-8345
TX Dallas, JYS Co. 214-349-1650
TX Dallas, JYS Co., Inc. 214-349-1650
VA Front Royal, Eltron Sls., Ltd. 703-635-7201
WA Vashon, RTS, Inc. 206-285-1363
WI Mequon, Parcom, Inc. 414-241-8544
Can Ontario, White Radio Ltd. 416-632-6894

Local Distributors

AL Huntsville, Allied Elctrns. Inc. 800-433-5700
AZ Tempe, D.C. Elctrns. 602-438-1234
CA Fountain Valley, Comps Ctr., Inc. 714-979-0433
CA Fullerton, Pyramid Elctrns. 714-773-0781
CA Los Angeles, Allied Elctrns. 714-669-4190
CA Milpitas, R&D Elctrn. Parts 408-262-7144
CA San Diego, Pyramid Elctrns. 619-271-5404
CA San Francisco, Allied Elctrns. 415-487-5250
CA Santa Clara, Abacus Elctrns. 408-732-2000
CA Santa Clara, D.C. Elctrns. 408-980-1199
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CA Tustin, D.C. Elctrns. 714-259-9066
DC Allied Elctrns. Inc. 301-423-1061
FL Clearwater, Allied Elctrns. 800-433-5700
FL Pompano Bch., Allied Elctrns. Inc. 305-486-0500
GA Atlanta, Allied Elctrns. Inc. 404-377-3555
IL Bensenville, Voyager Elctrns. Corp. ... 312-860-1300
IL Chicago, Allied Elctrns. 312-697-8200
MA Boston, Allied Elctrns. Inc. 617-942-3150
MN Fridley, Voyager Elctrns. 612-571-7766
MN Stillwater, Elctrn. Depot Supp. Co. 612-439-9409
NH Atkinson, Astrum Elctrns. 603-898-3399
NY Mineola, Allied Elctrns. Inc. 516-248-2360
NC Raleigh, Allied Elctrns. 919-876-5845
OH Cleveland, CAM RPC Elctrn. 216-461-4700
PA Pittsburgh, CAM RPC Elctrn. 412-782-3770
RI Warwick, Cal-Greg Comps. 401-738-6170
TX Allen, Prime Distbg. Co. 214-231-0170
TX Dallas, Allied Elctrns. 214-553-4370
TX Ft. Worth, Allied Elctrns. 214-265-9341
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Stafford, Southwest Elctrns., Inc. 713-240-4000
WA Kent, Pyramid Elctrns. 206-872-5800

MCL, INC., 501 S. Woodcreek Rd., Bolingbrook, IL 60439-4999, Tel: 312-759-9500, TELEX: 910-683-1899; FSC No.: 16469; Empl.: 110; *Sls. Mgr.:* Frank Morgan ..... **D•1072-1073**

Local Sales Offices & Reps

GA Locust Grove, MCL, Inc./Bob Lundy .. 404-957-3413

MCLEAN ENGINEERING, Zero Corporation, 70 Washington Rd., Princeton Junction, NJ 08550, Tel: 609-799-0100, TWX: 510-685-2543; FSC No.: 03522; Empl.: 118; *Sls. Mgr.:* Craig A. Reed; *Dist. Mgr.:* Craig A. Reed ..... **C•1674-1675**

Local Sales Offices & Reps

AL Huntsville, Over & Over, Inc. 205-837-7105
AZ Fountain Hills, Halbar Assocs. 602-837-2464
CA Glendale, Halbar Assocs. 818-246-8263
CA San Mateo, Halbar Assocs. 415-349-4700
CO Denver, Component Tech 303-758-5750
FL Coral Springs, Over & Over, Inc. 305-753-7050
GA Norcross, Over & Over, Inc. 404-449-6205
IL Elmhurst, Scott Assocs. 312-279-5681
MD Hunt Valley, Marktron 301-628-1111
MD Rockville, Marktron 301-251-8990
MA Uxbridge, Motoreps 508-986-2277
NY Rochester, Talty Assocs. 716-323-1210
MI Roseville, Jim Finnegan 216-398-6300
MN Minneapolis, Scott Elctrn. Sls. 612-929-2985
MO Grandview, Harris-Hanson 816-763-6200
MO St. Louis, Harris-Hanson 314-432-3611
NJ Springfield, Sylvester Assocs. 201-376-3324
NM Albuquerque, Fry-Gates 505-262-1525
OH Cleveland, Jim Finnegan 216-398-6300
OH Vandalia, Jim Finnegan 513-890-8322
OR Beaverton, Halbar Assocs. 503-226-0451
PA Huntingdon Valley, Inacker Sls. 215-947-5660
PA Pittsburgh, Jim Finnegan 412-823-5400
TX Houston, Milco Mktg. 214-783-2716
TX Richardson, Milco Mktg. 214-783-2716
WA Redmond, Halbar Assocs. 206-882-0990
Can Guelph, Ont., Hammond Mfg. Co. 519-822-2960

Local Distributors

FL Ft. Lauderdale, Component Distrs. 305-971-4950
GA Norcross, Component Distrs. 404-441-3320
MI Ann Arbor, Wedemeyer Elctrn. Supp. Co. 313-665-8611
NC Raleigh, Component Distrs. 919-834-9465
TX Dallas, Component Distrs. 214-644-0373
Can Guelph, Ontario, Hammond Mfg. Co. .. 519-822-2960

CLIMATE CONTROLLERS
McLEAN MIDWEST

FAX: 612-569-0533

MCLEAN MIDWEST, Sub. of Zero Corporation, 4000 83rd Ave. N., Brooklyn Pk., MN 55443, Tel: 612-561-9400, TELEX: 29-0883; *Sls. Mgr.:* J. Buyse ..... **C•1676-1677**

Local Sales Offices & Reps

AZ Phoenix, Howe & Howe Sls., Inc. 602-264-7971
CA Laguna Hills, Western Automation 714-859-6988
CA Oakland, Powermatic Assocs. 415-635-6825
CO Boulder, Comp. Prod. Sls. Co. 303-530-2800
GA Norcross, Hollingsworth & Still, Inc. 1-800-241-5712
IL Elmhurst, Scott Assocs., Inc. 312-279-5681
MD Rockville, Marktron, Inc. 301-251-8990
MA Chelmsford, John E. Boeing Co. 617-256-5800
MI E. Detroit, Jack M. Thorpe Co. 313-779-6363
MN Minneapolis, Scott Elctrn. Sls. 612-929-2985
MO St. Louis, Harris-Hanson Co. 314-432-3611
NJ Franklin Lakes, Hansen & Hughes Co. 201-848-8900
NM Albuquerque, Fry-Gates, Inc. 505-262-1525
NY Endwell, Reagan/Compar Albany, Inc. 607-754-2171
OH Cleveland, Marlow Assocs. 216-991-6500
OK Tulsa, Milco Mktg., Inc. 918-582-9411
PA Huntingdon Valley, Inacker Sls. Inc. ... 215-947-5660
PA Pittsburgh, Marlow Assocs., Inc. 412-343-5050
TX Dallas, Milco Mktg., Inc. 214-783-2716
WA Vashon, RTS Inc. 206-285-1363

3M

FAX: 512-984-6972

3M-ELECTRONIC PRODUCTS DIVISION, P.O. Box 2963, Austin, TX 78769-2963, Tel: 512-984-1800; *Sls. Mgr.:* Bernie Graham ..... **C•1438-1441**

Local Sales Offices & Reps

AK Anchorage 907-561-1030
CA Los Angeles 213-726-6423
CA So. San Francisco 415-571-6700
GA Atlanta 404-447-7000
HI Honolulu 808-422-2721
IL Chicago 312-496-6500
MA Boston 617-449-0300
MI Detroit 313-827-2450
MN Eagan 612-736-9378
MO St. Louis 314-997-8500
NJ West Caldwell 201-575-2000
NC High Point 919-889-7181
OH Cincinnati 513-482-3100
OH Cleveland 216-362-1700
NJ Philadelphia 609-662-7077
TX Dallas 214-324-8100
WA Seattle 206-244-7200

Local Distributors

AL Huntsville, Powell Elctrns. 205-539-2731
AZ Phoenix, Arizona Comps. Co. 602-269-5655
AZ Tempe, Acacia/VWR Elctrns. 602-882-9054
CA Costa Mesa, Powell Elctrns. 714-754-1717
CA Garden Grove, Richey/Impact Elctrns. 714-895-0060,800-227-0060
CA Irvine, Acacia/VWR Elctrns. 714-660-0834, 213-971-2428
CA La Crescenta, Mulvin & Co. 213-245-1081
CA San Diego, Acacia/VWR Elctrns. 619-565-4365
CA San Diego, Richey/Impact Elctrns., Inc. 619-271-4511
CA San Jose, Powell Elctrns. 408-943-9020
CA San Jose, Richey/Impact Elctrns., Inc. 408-432-7100
CA San Jose, Shelley/Ragon 408-942-9111
CA Santa Clara, DC Elctrn. Supp. 408-980-1199
CA Sun Valley, Richey/Impact Elctrns., Inc. 818-768-3800,213-875-2862
CA Sunnyvale, Acacia/VWR Elctrns. 408-745-7200
CA Tustin, DC Elctrns. 714-259-9066
CO Englewood, Shelley/Ragon 303-762-0670
CO Lakewood, Acacia/VWR Elctrns. 303-232-2882
CT East Haven, JV Elctrns. 203-469-2321
CT Yalesville, Schaal Assocs./Deanco ... 203-269-3779
FL Clearwater, Tech. Sls. 813-539-7429
FL Ft. Lauderdale, Powell Elctrns. 305-979-5000
FL Winter Park, Deanco 305-671-5100
GA Marietta, Deanco 404-429-0126
IL Chicago, NEP Elctrns., Inc. 312-625-8400
IL Mt. Prospect, Magnuson Elctrns. 312-956-0700
IL Skokie, EL./Mech. 312-967-8530
IN Indianapolis, Graham Elctrns. 317-634-8202
MD Columbia, Aztech Elctrns. 301-621-8890
MD Columbia, Powell Elctrns. ..... 301-995-0410, 301-621-4070 in
MD Gaithersburg, Deanco 301-948-5444
MA Allston, Vector Sls. 617-787-2790
MA Burlington, Schaal Assocs./Deanco ... 617-272-1506
MA Canton, Richey/Impact Elctrns. 617-821-1500
MA Westboro, Powell Elctrns. 617-366-6100
MI Grand Rapids, RM Elctrns. 616-531-9300
MI Southfield, Michigan Lectrols 313-353-1350
MN St. Paul, Shelley/Ragon Elctrns. 612-642-2828
MO Independence, Shelley/Ragon Elctrns. 816-254-3410
MO St. Charles, Lectronix ... 314-946-6424,800-325-3348
MO St. Louis, El/Mech 314-527-4830
NJ Clifton, J-Mar Elctrns. 201-772-6400
NJ Englewood, Powell Elctrns. 201-894-0800
NJ Fairfield, Deanco 201-575-7960
NJ Union, Meridian Supp. 201-687-6220
NM Albuquerque, Alliance Elctrns. 505-292-3360
NY Farmingdale, Addem Distrs. 516-752-9303
NY Hauppauge, Schaal Assocs./Deanco 516-434-7100
NY Ithaca, Deanco 607-257-4444
NY Ronkonkoma, Zenith Wire & Cable ... 516-585-1444
NC Cary, Powell Elctrns. 919-467-1212
NC Charlotte, Elctrns. Mktg. Corp. 704-394-6195, 800-432-0549
NC Raleigh, Deanco, Inc. 919-851-2065
NC Raleigh, Meridian Supp. Co. 919-872-1565
OH Columbus, Elctrns. Mktg. Corp. 614-299-4161
OH Dayton, Elctrns. Mktg. Corp. 513-439-4711
OH Highland Heights, Elctrns. Mktg. Corp. 216-442-3441
OK Tulsa, Norvell Elctrns. 918-663-1247
OR Beaverton, Acacia/VWR Elctrns. 503-646-3377
OR Beaverton, Shelley/Ragon 503-641-1691
OR Tualatin, Moore Elctrns., Inc. 503-692-5333
PA Malvern, Transtek Inds. 215-296-4400
PA Philadelphia, Powell Elctrns. 215-365-1900
TN Nashville, Graham Elctrns. 615-367-4400
TX Allen, Prime Distrbg. 214-231-0170
TX Austin, Kent Elctrns. 512-834-1900
TX Austin, Norvell Elctrns. 512-837-5555
TX Dallas, Kent Elctrns. 214-669-2600
TX Dallas, Norvell Elctrns. 214-233-0020
TX El Paso, ERA Elctrns. 915-855-3600
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, Norvell Elctrns. 713-777-1666
TX Plano, Tactic Elctrns. 214-422-0777
WA Lynwood, Blair Hirsh Co. 206-774-8151
WA Redmond, Shelley/Ragon Elctrns. 206-883-2220
WA Seattle, Carlyle Inc. 206-251-0700
VA Virginia Bch., Deanco, Inc. 804-499-3322
WI Milwaukee, Elctrn. Expeditors, Inc. 414-228-8100
Can London, Ont., 3M 519-451-2500

3M FIBER OPTIC PRODUCTS, INC., 420 Frontage Road, W. Haven, CT 06516, Tel: 203-934-7961, TELEX: 358190; Empl.: 42; *Sls. Mgr.:* Raymond Coulombe

3 M PHOTODYNE INC., 3760 Calle Tecate, Camarillo, CA 93010, Tel: 805-388-8378, TELEX: 18-1159, FAX: 1-805-499-9311; FSC No.: 59912; Empl.: 100; *Sls. Mgr.:* Hal Halpern; *Dist. Mgr.:* Hal Halpern

MDF PRODUCTS INC., 7 Johnson Dr., Danbury, CT 06811, Tel: 203-743-3579, TELEX: 499-8051, FAX: 203-744-2704; FSC No.: 60628 ..... **D•1321**

MDS CALIBRATION LAB. INC., 437-H Mary Esther Cutoff, Ft. Walton Beach, FL 32548, Tel: 904-664-1234; *Sls. Mgr.:* Gerry Doiron

MEA DIV., See Mechanized Elctrn. Assembly Div., Universal Instrs. Corp.

MEASUREMENTS GROUP, INC., Box 27777, Raleigh, NC 27611, Tel: 919-365-3800, TELEX: 62919594, FAX: 919-365-3945

FAX: 203-853-6244

MEASUREMENT SYSTEMS, INC., 121 Water St, Norwalk, CT 06854, Tel: 203-838-5561, TELEX: 6813573, TWX: 710-468-2185; Empl.: 97; *Sls. Mgr.:* Tom Brass, Gen. Sls. Mgr. ..... **D•1152**

Local Sales Offices & Reps

AZ	Scottsdale, Advent Comps.	602-481-0044
CA	Anaheim, Gabriel & Assoc.	714-531-7674
IA	Cedar Rapids, S & O Sls.	319-393-7331
MD	Columbia, Robert Elctrn. Sls.	301-995-1900
MA	Hudson, Data Rep	508-481-0333
MN	Edina, Elctrn. Sls., Inc.	612-933-9070
MO	St. Louis, J. S. DeWeese Co.	314-469-7350
OH	Medina, J. C. Hofstetter Co.	216-241-4880
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
TX	Richardson, Scientific Sls. Co.	214-231-6541
VA	Richmond, Robert Elctrn. Sls.	804-276-3979

MEC A/S, Industriparken 23, Ballerup, Denmark DK-2750, Tel: 011-4542973366, TELEX: 9125649, TWX: 2381-125649, FAX: 011-4542 681514; Empl.: 50

FAX: 703-435-1837

MECHANICAL ENTERPRISES, 461 Carlisle Dr., Herndon, VA 22070, Tel: 703-435-9496, TWX: 710-832-0942; Empl.: 25; *Sls. Mgr.:* R.H. Twyford ..... **B•1801, 1876-1877**

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
CA	Cupertino, West-Comp	408-245-3100
CA	Irvine, Vale Electrn. Assocs.	714-551-4821, 619-693-0113
CO	Boulder, Stratford Grp.	303-530-3194
CT	Bristol, Technlg. Prod. Grp.	203-585-1643
IL	Arlington Heights, Coombs Assocs., Inc.	312-439-9810
IN	Carmel, Newton & Assoc.	317-848-2016
MA	Brookline, Technlg. Prods.	617-731-0858
MI	Jackson, Norwood Scroggs Co.	517-750-1170
MS	Jackson, Doby Assocs.	601-981-1138
NY	Cooperstown, Fitzelle Assoc.	607-547-9333
NY	Hauppauge, Sticom	516-366-4221
NY	LeRoy, Fitzelle Assocs.	716-494-1554
TX	Dallas, Stasco	214-239-4517
WI	Milwaukee, Coombs Assocs., Inc.	414-351-6123

Local Distributors

CA	Los Angeles, Electric Switches, Inc.	213-660-1310
CA	San Diego, Sigma Electrns.	619-565-2000
IL	Wheeling, Hawk Elctrns., Inc.	312-459-4030
NY	Yonkers, Kintronics, Inc.	914-968-7736, 800-431-1658

FAX: 517-782-2810

MECHANICAL PRODUCTS INC., 1824 River St. P. O. Box 729E, Jackson, MI 49204, Tel: 517-782-0391, TWX: 810-253-0827; *Sls. Mgr.:* Dave Olson ..... **B•1401**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech	205-533-2100
AZ	Tempe, Cantec Sls., Inc.	602-345-1276
CA	Los Angeles, Universal Components Co.	213-641-4255
CA	Sunnyvale, Pass Associates	408-735-9040
FL	Orlando, Honeyco	407-299-1000
GA	Atlanta, Electro-Mech	404-447-6478
IL	Barrington, Perhats Assocs.	312-381-6360
MD	Pikesville, Muncy Sls.	301-484-6376
MI	Rockford, Aidamark	616-874-8744
MN	St. Paul, Mackubin Grp.	612-636-5686
NH	Durham, C. H. Burnham Assocs.	603-868-2282
NJ	Pitman, Colrud Corp.	609-589-5866
NJ	West Caldwell, Grimm, Siegel Assocs., Inc.	201-575-9300
NC	Raleigh, Electro-Mech	919-851-8165
OH	Euclid, Rockford Controls Ohio, Inc.	216-725-3705,
RI	Johnston, C. H. Burnham Assocs.	401-231-7475
TN	Jonesboro, Electro-Mech	615-753-2964
Can	Downsview, Ont., Har Tech	416-665-7773
Can	Pointe Claire, Que., Har Tech	514-694-6110

Local Distributors

CA	Gardena, Cal Switch	213-770-2330/213-538-9830
CA	San Carlos, Campbell & George Co.	415-594-1994
CA	So. San Francisco, Nasam, Inc.	415-872-1155
FL	Ft. Lauderdale, Zelcon, Inc.	305-565-2555/6
FL	Lakeland, Wes-Garde Comps. Grp.	800-282-7619
IL	Carol Stream, Wes-Garde Comps. Grp.	800-323-9431
IL	Chicago, Nep Elctrns.	312-625-8400,
KS	Edwardsville, Tennant Elctrns.	913-441-1801
KS	Wichita, Airtechnics	316-267-2849
MA	Danvers, RCI	617-777-4441
MI	Grand Rapids, S & F Elec. Supp. Co., Inc.	616-459-0216
MN	Minneapolis, Berquist	612-835-2322
NJ	Mount Laurel, Techtron Components Corp.	609-234-1940
NJ	Oakland, Relay Specialties	201-337-1000
NY	Hauppauge, Genelco	516-231-1144/800-645-9802
NY	Hauppauge, Sager Elctrns.	516-289-9747
NY	Plainview, Linrose Elctrns.	516-293-2520
NY	Woodside, Switches Unlimited	800-221-0487
OH	Euclid, Rockford Controls Ohio, Inc.	216-731-5250
TX	Arlington, Bell Components Sls., Inc.	817-461-5303
TX	Dallas, Associated Aircraft Supp., Inc.	214-331-4381
Can	Scarborough, Ont., Carsten Elctrns. Ltd.	416-495-9999
Can	St. Laurent, Que., Tara Inds. Corp.	514-331-6550

MECHANIZED ELCTRN. ASSEMBLEY DIV., UNIVERSAL INSTRS. CORP., See Dover Electronics Manufacturing

MECHATRONICS/SAB, INC., See Seattle Aircraft Bearings

MECO INDUSTRIES, Mechanical Engraving Co., Inc., 4500 Bullard Ave, Bronx, NY 10470, Tel: 212-324-4455, FAX: 212-324-5500; FSC No.: 99040; Empl.: 35; *Sls. Mgr.:* Bernard W. Mandel

MEDA, INC., Macintyre Electronics Design Assocs., 11260 Roger Bacon Dr., Ste. 202, Reston, VA 22090, Tel: 703-471-1445; Empl.: 8

MEDIA RECOVERY INC., Box 1407, Graham, TX 76046, Tel: 800-527-9497, 214-630-9625 (Texas), TELEX: 73-2561; Empl.: 130; *Sls. Mgr.:* J. Ricciardi

MEISSNER INDUSTRIES, 551 Rte. 10, Dover, NJ 07801, Tel: 201-366-1700; Empl.: 10

FAX: 508-879-8669

MELCHER, INC., Melcher A.G., 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-881-4715, TWX: 5101003630; Empl.: 110; *Sls. Mgr.:* Richard Sakakeeny ..... **D•1910-1911**

Local Sales Offices & Reps

AL	Huntsville, Over & Over Inc.	205-837-7105
AZ	Phoenix, Blackhart & Assocs.	602-893-3488
CA	Huntington Beach, Mil-Com Sls., Inc.	714-840-2424
CA	Los Altos, PEI Assocs.	415-968-4409
CA	Santa Clara, Sourcetronics	408-988-8801
CO	Englewood, Taylor Mktg.	303-850-0207
FL	Altamonte Springs, Over & Over Inc.	305-332-1222
FL	Tampa, Over & Over Inc.	813-626-9100
GA	Norcross, Over & Over Inc.	404-449-6205
IL	Arlington Hgts., Phoenix Elctrn. Sls.	312-394-4422
IA	Des Moines, The Beams Co.	515-255-1148
MD	Hunt Valley, Eagle Sls. Corp.	301-666-3930
MA	Whitinsville, Power Factor & Assocs.	508-234-9878
MA	Whitinsville, Power Factor & Assocs.	617-234-6415
MI	Troy, CB Jensen & Assocs.	313-643-0506
NJ	Englewood, Technimat	201-569-4200
NC	Charlotte, Over & Over Inc.	704-542-9111
NC	Raleigh, Over & Over Inc.	919-782-9111
OH	Cleveland, Bradcor Elctrns. Co.	216-671-1200
OR	Portland, Power Factor	5039292-0820
PA	Horsham, TMI	215-441-4300
TX	Richardson, Jim D. Gray & Assocs., Inc.	214-699-9976
TX	Richmond, Jim D. Gray & Assocs., Inc.	713-342-1710
UT	Ogden, Taylor Mktg.	801-546-9570
WA	Lynwood, Power Sources Unltd.	206-743-6641
WI	Oak Creek, Phoenix Elctrns. Sls.	414-764-1455

FAX: 609-393-9461

MELCOR/MATERIALS ELCTRN. PRODS., 994 Spruce St, Trenton, NJ 08648, Tel: 609-393-4178, TELEX: 84-3314; FSC No.: 32333; Empl.: 180; *Sls. Mgr.:* M.A. Levine ..... **B•1904-1905**

Local Sales Offices & Reps

CO	Fort Collins, Rep Sls., Inc./Andy Cornedi	303-226-1504
NY	Rochester, R. G. Minges Agency	716-328-3410

Distributor

MELFESS FIVE, INC., 12304 Santa Monica Blvd., No. 121, Los Angeles, CA 90025, Tel: 213-826-8133, 800-533-2297, FAX: 213-820-6958; Empl.: 4; *Sls. Mgr.:* Michael S. Fisher ..... D•1096

MELLES GRIOT, INC., 1770 Kettering St, Irvine, CA 92714, Tel: 714-261-5600, TELEX: 678447; Empl.: 110; *Sls. Mgr.:* Candi Bauccio

MEL-RAIN CONTROLS, 42974 M-43 Hwy., Paw Paw, MI 49079, Tel: 616-657-2527; FSC No.: 639; Empl.: 20; *Sls. Mgr.:* Howard F. Walter

MEMBRONICS DIVISION, Chicago Decal Company, 3310 North Elston Avenue, Chicago, IL 60618, Tel: 312-463-4007, FAX: 312-463-4065; *Sls. Mgr.:* Dick Gorney

MEMCOR-TRUOHM INC.

FAX: 219-356-7376

MEMCOR-TRUOHM, INC., 1320 Flaxmill Rd., Huntington, IN 46750, Tel: 219-356-4300, TWX: 510-601-7258, ESYLNK: 62938315; FSC No.: 24681; Empl.: 250; *Sls. Mgr.:* Ray Vanderspool ..... **A•1980, 2131**

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
CA	American Canyon, Jacobson & Assoc.	707-552-4412
CA	Huntington Bch., Mil-Com Sls.	714-840-2424
FL	Indialantic, Raycom	305-727-8860
GA	Atlanta, Murcota	404-875-2525
IL	Chicago, D. Dolin Sls.	312-286-6200
IN	Ft. Wayne, Menze Sls.	219-747-5616
MI	St. Clair Shores, J.M. Thorpe	313-779-6363
MO	St. Charles, Hayes Elec. Sls. Co.	314-946-6677
NH	Atkinson, Mark Rep Assoc.	603-382-9563
NJ	Englewood Cliffs, Masin Esco	201-569-8868
NY	Hauppauge, Masin Esco	516-273-3500
NY	Marcellus, Mullahy Sls. Inc.	315-685-6280
NC	Burlington, Murcota	919-585-1577
NC	Winston-Salem, Murcota	919-723-1001
OH	Cleveland, Glover Sls.	216-842-4520
PA	Newtown Square, G.M. Conneen	215-353-2241
TX	Dallas, SW Elctrn. Ind.	214-233-9816
TX	Houston, SW Elctrn. Ind.	713-729-1670
WA	Redmond, Barrett-Squibb	206-885-6991

MEMODYNE, 200 Reservoir St., Needham Hgts., MA 02194, Tel: 617-444-7000, TELEX: 92-2537, TWX: 510-600-8774, FAX: 617-449-7023; Empl.: 40; *Sls. Mgr.:* Leonard Sacon ..... **D•1098-1100**

Local Sales Offices & Reps

AL Huntsville, Dean Assocs. 205-534-2255
AZ Scottsdale, A.M.I. 602-947-4297
CA Carson, Amasco 213-516-8561
CT Portland, BBI Elctrns. 203-342-0648
FL Orlando, DAI Sls. 305-299-7754
IL Elmhurst, Scott Assocs. 312-279-5681
MD Severna Park, Syronics 301-544-8652
MA Holbrook, McLellan Assocs. 617-767-4771
MI Detroit, EQS Sys. 313-961-3042
MI Pontiac, EQS Sys., Inc. 313-338-2280
MN Chanhassen, Jen-Ray Sys. 612-934-8607
NJ Boonton, PAF Assocs. 201-335-0680
NY Liverpool, Syronics 315-451-0968
NY Smithtown, PAF Assocs. 516-360-0940
OH Chesterland, EQS Sys. 216-729-2222
OH Columbus, EQS Sys. 614-228-3453
OH Dayton, EQS Sys., Inc. 513-236-7676
OH Huber Hgts., EQS Sys., Inc. 216-729-2222
OR Lake Oswego, Syntek 503-636-6793
PA Sellersville, Penn-Tech Sls. 215-257-2756
TX Irving, Trice Mktg. 214-255-1877
WA Kirkland, Syntek 206-488-0394

MEMORY PROTECTION DEVICES, INC., See Bogen Communications, Inc.

MEMORY X, 5205 Kearny Villa Way, No. 106, San Diego, CA 92123, Tel: 619-292-1151, FAX: 619-292-0774

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FAX: 517-652-2659

MEMTRON TECHNOLOGIES, INC., 1400 Weiss St., Frankenmuth, MI 48734, Tel: 517-652-2656, 800-234-7525; FSC No.: 6 V 417; Empl.: 116; *Sls. Mgr.:* Daniel T. Ortner ..... **B•1878**

Local Sales Offices & Reps

AZ Mesa, Inmark 602-830-9104
CA San Diego, Intramerica Technlg. 619-451-3383
CA Saratoga, Edward King & Assocs. 408-867-2111
CO Boulder, R. F. Mayo 303-442-2155
FL Maitland, EIR, Inc. 305-660-9600
GA Lawrenceville, Tek-Rep Mktg., Inc. 404-963-1600
IL Wheaton, Chadra-Schilke & Assocs., Inc. 312-653-8126
IN Indianapolis, EMCI, Inc. 317-253-1668
MA Framingham, Stone Comp. Sls. Corp. 617-875-3266
MO Saint Charles, Buckman & Assocs. 314-946-6201
NY Islip, ABS Technlgs., Inc. 516-277-7010
NY Liverpool, Syronics 315-451-0968
OH Columbus, Tom Mulligan Co. 614-457-2242
PA Southampton, Campbell Assocs. 215-322-6630
TX Richardson, Zonk & Assocs. 214-238-7651, 214-895-9131
VA Alexandria, Tech-Reps. Inc. 703-370-2600
WA Federal Way, K. R. Jensen Sls. 206-874-2772
Can Toronto, Ont., Reptech 416-863-9510

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FAX: 407-881-3300

MEPCO/CENTRALAB CORP. HDQRTR., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404, Tel: 407-881-3200, TELEX: 136461, TWX: 810-848-0228; *Dist. Mgr.:* Jess Hall ..... **A•1120-1124, 1981-1984; B•1022-1023**

Local Sales Offices & Reps

AL Huntsville, Over & Over 205-837-7105
AZ Tempe, Mepco/Centralab 602-820-2225
CA Anaheim, Mepco/Centralab 714-441-0385
CA Harbor City, Refrigeration Comp. 213-325-3420
CA Mission Hills, Mepco/Centralab 818-891-6299
CA Mtn. View, Brooks Tech. Grp. 415-960-3880
CA Pleasanton, Mepco/Centralab 415-462-2833
CA San Diego, Mepco/Centralab 619-453-0332
CO Englewood, Mepco/Centralab 303-779-9696
FL Altamonte Springs, Mepco/Centralab 407-339-5073
FL Ft. Lauderdale, Mepco/Centralab 305-485-0115
GA Norcross, Over & Over, Inc. 404-449-6205
IL Bannockburn, GMR Sls., Inc. 312-295-8440
IL Des Plaines, Mepco/Centralab 312-827-4487
IN Ft. Wayne, Corrao Marsh, Inc. 219-482-2725
IN Greenfield, Carrao Marsh, Inc. 317-462-4446
IN Indianapolis, Leslie M. Devoe Co. 317-842-3245
IA Cedar Rapids, Lorenz Sls., Inc. 319-377-4666
KS Merriam, Lorenz Sls. 913-384-6556
MD Columbia, Delta III Assocs. 301-730-4700
MA Woburn, Mepco/Centralab 617-438-6050
MI Farmington Hills, Mepco/Centralab ... 313-553-6010
MN Minneapolis, Electric Comps. Sls., Inc. 612-933-2594
MO University City, Lorenz Sls. 314-997-4558
NE Lincoln, Lorenz Sls. 402-475-4660
NJ Englewood Cliffs, Ed Glass Assocs. ... 201-592-0200
NJ Mendham, Mepco/Centralab 201-543-2556
NY Binghamton, Empire Tech. Assocs. ... 607-772-0651
NY Skaneateles, Empire Tech. Assocs., Inc. 315-685-5703
NC Charlotte, Over & Over, Inc. 704-542-9111
NC Raleigh, Over & Over 919-782-9111
OH Dayton, Mepco/Centralab 513-436-0066
OH Wickliffe, Mepco/Centralab 216-731-7721
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
PA Narberth, Bresson Assocs. 215-664-6460
TX Austin, Mepco/Centralab 512-331-8828
TX Richardson, Mepco/Centralab 214-231-8274
WA Redmond, Eclipse Mktg. Grp. 206-885-6991
WA Spokane, Eclipse Mktg. Grp. 509-922-3972
WI Milwaukee, Mepco/Centralab 414-228-4244
PR Hato Rey, M. Anderson Co. 809-751-2026
Can Montreal, PQ, Philips Elctrns. 514-342-9180
Can N. Vancouver, BC, Arwin Tech. Sls. ... 604-980-4557
Can Ottawa, Ont., Philips Elctrns. 613-722-1093
Can Pickering, Ont., Alltemp Prod. Co. 416-831-3311
Can Pickering, Ont., McHugh Elctrns. 416-831-4770
Can Scarborough, Ont., Philips Elctrns. 416-292-5161
Can Scarborough, Ont., Philips Elctrns. 416-292-8200
Can Vancouver, B.C., Philips Elctrns. 604-435-4411

MEPCO/CENTRALAB, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, Tel: 818-240-4880, TWX: 910-497-2282; *Sls. Mgr.:* G. Ollen ..... **A•1123, 1981; B•1022-1023**

MEPCO/CENTRALAB, North American Philips Corporation, 5900 Australian Avenue, W. Palm Bch., FL 33407, Tel: 305-842-3201, TELEX: 820677, TWX: 510-952-7631, FAX: 305-863-1811 ..... **A•1120**

MEPCO/CENTRALAB, North American Philips Corporation, 6071 St. Andrews Rd., Columbia, SC 29212-3198, Tel: 803-772-2500, TELEX: 805024, FAX: 803-772-2445; *Sls. Mgr.:* B. Cuirko ..... **A•1120-1124**

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MEPCO/CENTRALAB, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, Tel: 817-325-7871, TELEX: G.P.R.-881857/S.P.R.-820545, FAX: 817-325-7876; *Sls. Mgr.:* N. Egeland ..... **A•1981-1982, 1984; B•1022-1023**

MEP CONTROLS, Rising Sun Rd., Bordentown, NJ 08505, Tel: 609-298-7300, TWX: 510-685-3645, FAX: 609-298-1982; Empl.: 25; *Sls. Mgr.:* Thomas Thorn

MEPCOPAL

FAX: 619-481-1123

MEPCOPAL COMPANY, 11468 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-453-0332, TELEX: 62547100, TWX: 910-337-1120; Empl.: 160 ..... **A•2132-2134; B•1803**

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Local Sales Offices & Reps

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AZ Tempe, Mepco/Centralab 602-820-2225
CA Anaheim, Mepco/Centralab 714-441-0385
CA Mission Hills, Mepco/Centralab 818-891-6299
CA Mtn. View, Brooks Tech. Grp. 415-960-3880
CO Englewood, Mepco/Centralab 303-779-9696
FL Altamonte Springs, Mepco/Centralab 407-339-5073
GA Norcross, Over & Over Inc. 404-449-6205
IL Des Plaines, Mepco/Centralab 312-827-4487
IN Indianapolis, Leslie M. Devoe Co. 317-842-3245
IA Cedar Rapids, Lorenz Sls. Inc. 319-377-4666
KS Merrian, Lorenz Sls. Inc. 913-384-6556
MD Columbia, Delta III Assocs. 301-730-4700
MA Stoneham, Mepco/Centralab 617-932-4748
MI Farmington, Mepco/Centralab 313-553-6010
MN Minneapolis, Elec. Comps. 612-933-2594
MO University City, Lorenz Sls. Inc. 314-997-4558
NE Lincoln, Lorenz Sls. Inc. 402-475-4660
NY Binghamton, Empire Tech. Assocs. ... 607-772-0651
NY Rochester, Empire Tech. Assocs. 716-381-8500
NY Skaneateles, Empire Tech. Assocs. ... 315-685-5703
NC Charlotte, Over & Over Inc. 704-542-9111
OH Dayton, Mepco/Centralab 513-436-0066
OH Wickliffe, Mepco/Centralab 216-731-7721
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
PA Narberth, Bresson Assocs. 215-664-6460
TX Austin, Mepco/Centralab 512-331-8828
TX Richardson, Mepco/Centralab 214-231-8274
WA Redmond, Eclipse Mktg. Grp. 206-885-6991
WA Spokane, Eclipse Mktg. Grp. 509-922-3672
WI Milwaukee, Mepco/Centralab 414-228-4244
Can Scarborough, Ont., Philips Elctrns. 416-292-5161

Local Distributors

AL Huntsville, Hall-Mark Elctrns. 205-837-8700
AZ Phoenix, Hall-Mark Elctrns. 602-437-1200
CA Sunnyvale, Hamilton/Avnet 408-743-3355
CO Englewood, Shelley-Ragon 303-762-0670
CT Wallingford, Marshall Inds. 203-265-3822
FL Orlando, TTI, Inc. 407-859-1000
GA Norcross, Hall-Mark Elctrns. 404-447-8000
IL Chicago, Nep Elctrns. 312-595-8500
IN Indianapolis, Marshall Inds. 317-297-0483
MD Columbia, Aztech Elctrns. 301-995-6800
MA Wilmington, Marshall Inds. 508-658-0830
MI Livonia, Marshall Inds. 313-525-5850
MN St. Paul, Shelley-Ragon 612-642-2828
NE Omaha, Scott Elctrns. 402-734-6750
NJ Cherry Hill, Hamilton/Avnet 609-424-0100
NY Ronkonkoma, TTI, Inc. 516-737-2000
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WI Milwaukee, Marsh Elctrns. 414-475-6000
Can Scarborough, Ont., Philips Elctrns. 416-292-5161

MERCER ELECTRONICS, Simpson Electric Co., 853 Dundee Ave., Elgin, IL 60120, Tel: 312-697-2260, TELEX: 72-2416, FAX: 312-697-2272; *Dist. Mgr.:* George Oskandy, Sls. Admin. Mgr.

MERCURY PLASTICS, A UNIT OF ZERO CORP., 672 Fuller Rd., Chicopee, MA 01020, Tel: 413-267-5561, FAX: 413-592-5018; Empl.: 100; *Sls. Mgr.:* Roger St. Martin

MERECO PRODUCTS DIV., Metachem Resins Corp., 1505 Main St., West Warwick, RI 02893, Tel: 401-828-4550; Empl.: 100; *Sls. Mgr.:* John E. Powell, Jr.

MERET, INC., 1815 24th St., Santa Monica, CA 90404-4998, Tel: 213-828-7496, TELEX: 65-246 8 SNM, FAX: 213-828-7567; FSC No.: 53071; Empl.: 55; *Sls. Mgr.:* Jonathan Medved ..... **B•1215**

Local Sales Offices & Reps
CA West Covina, Eureka Tech. Sls., Inc. .. 213-331-8766
CO Lakewood, Technical Mktg. Mfg. Inc. .. 303-232-1516
MI Southfield, Video Concepts 313-358-2679
MO St. Louis, Engrg. Svcs. Co. 314-997-1515
NM Albuquerque, Tech. Mktg. & Mfg. 505-298-6893
IL Northrock, Emtech 312-564-2505
NY Elmsford, Metro-Tek Assocs. 914-347-4112
PA Glenside, Wyncote Instrmn. 215-572-6500
TX Dallas, The Thorson Co. 214-233-5744
VA Fairfax, Schibley Assocs.,Inc. 703-591-3008
WA Kirkland, Nycom Assocs. 206-827-4544

MERIX CHEMICAL CO., 2234 East 75th St., Chicago, IL 60649, Tel: 312-221-8242; Empl.: 15; *Sls. Mgr.:* E. O. Sonneman; *Dist. Mgr.:* E. O. Sonneman

MERRILL, INC., POB 308, 1316 Sumneytown Pike, Gwynedd Valley, PA 19437, Tel: 215-643-2116; FSC No.: 58624; Empl.: 10; *Sls. Mgr.:* J. Fournier

MERRIMAC INDUSTRIES, 41 Fairfield Pl, West Caldwell, NJ 07006, Tel: 201-575-1300, TELEX: 6853128, FAX: 201-575-0531; FSC No.: 12457; Empl.: 300

J. R. MERRITT CONTROLS, INC., 375 Fairfield Ave., Bldg., Stamford, CT 06902, Tel: 203-359-2113, TWX: 510-601-6932JRMC, FAX: 203-656-0162; *Sls. Mgr.:* Earl Atkins

MESUR-MATIC ELCTRNS., 10 Colonial Rd., Ste. 6, Salem, MA 01970-2294, Tel: 617-745-7000; Empl.: 29; *Sls. Mgr.:* Kosma L. Evangelidis

METALINK CORPORATION, P.O. Box 1329, Chandler, AZ 85244, Tel: 602-926-0797, TELEX: 4998050, FAX: 602-926-1198

METHODE ELECTRONICS, INC., 7444 W. Wilson Ave., Chicago, IL 60656, Tel: 312-867-9600, TWX: 910-221-2468, FAX: 312-867-9130; Empl.: 2000; *Sls. Mgr.:* S. Landeene

METHODE ELECTRONICS, INC., Interconnect Prods Div, 1700 Hicks Rd, Rolling Meadows, IL 60008, Tel: 312-392-3500, FAX: 312-392-9404; FSC No.: 95354; Empl.: 250; *Sls. Mgr.:* Suzi Landeene; *Dist. Mgr.:* Kathy Lindsey

METRA BYTE CORP., 440 Myles Standish Blvd., Taunton, MA 02780, Tel: 508-880-3000, TELEX: 503989; FSC No.: 1 FG 11; Empl.: 115; *Sls. Mgr.:* Bendrix Bailey; *Dist. Mgr.:* Bendrix Bailey ..... **D•1193**

Local Sales Offices & Reps
AL Huntsville, Magaro Assocs. 205-882-0827
AZ Phoenix, Louis James & Assocs. 602-992-0872
CA Orange, X. B. X. Sls. 714-998-8200
CA Santa Clara, Nelson Elctrn. 408-980-1950
CO Commerce City, Louis James & Assocs. 303-287-4657
GA Atlanta, Magaro Assocs. 404-451-8862
IL Chicago, Berndt Assocs. 312-283-0713
IN Carmel, Berndt Assocs. 317-844-0114
MI Livonia, Lowell-Wendt Mktg. 313-464-2722
MN Minneapolis, Berndt Assocs. 612-546-2021
NJ W. Caldwell, PCS 201-575-7464
NC Greensboro, Magaro Assocs. 919-294-4783
PA Jenkintown, Monument Tech. Assocs. 215-884-3737
UT Salt Lake City, Louis James & Assocs. 801-487-3851
WA Woodinville, Louis James & Assocs. .. 206-788-5228
WI Milwaukee, Berndt Assocs. 414-545-8400
Can St. Laurant, Quebec, Techmatron Inst., Inc. 514-689-5889

METRA INSTRUMENTS, INC., 1874 Lundy Ave., San Jose, CA 95131, Tel: 408-432-1110, TELEX: 296698; Empl.: 60; *Sls. Mgr.:* Douglas J. Stock

METRAPLEX CORP., 5305 Spectrum Dr., Frederick, MD 21701, Tel: 301-662-8000, TELEX: 697-4248 MPX CORP, FAX: 301-695-8099; Empl.: 105

METRIC SYSTEMS, 645 Anchors St., Ft. Walton Beach, FL 32548-9990, Tel: 904-244-9600, TELEX: 70-2447; FSC No.: 12339; Empl.: 700

METRIX INSTRUMENT CO., 1711 Townhurst, Houston, TX 77043, Tel: 713-461-2131, TELEX: 77-5486, FAX: 713-461-8223; Empl.: 50; *Sls. Mgr.:* W. B. Brown

METROLAB INSTRUMENTS SA, 6, Chemin du Clos, Geneva (Lancy), Switzerland CH-1212, Tel: (41-22)794 11 21, TELEX: 41-22-794 11 20

METRON OPTICS INC., P.O. Box 690, Solana Beach, CA 92075-0690, Tel: 619-755-4477, FAX: 619-755-4752; Empl.: 22

METROPOLE PRODUCTS INC., P. O. Box 309, Stafford, VA 22554, Tel: 703-659-2132, 703-971-7082, FAX: 703-659-2133; FSC No.: 55908; *Sls. Mgr.:* John DePaola

METROSONICS, INC., Box 23075, Rochester, NY 14692-3075, Tel: 716-334-7300, TELEX: 853348, FAX: 716-334-2635; FSC No.: 55381; Empl.: 80; *Sls. Mgr.:* R. Branch; *Dist. Mgr.:* S. Macioulis

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FAX: 201-679-3222

METUCHEN CAPACITORS, INC., 139 White Oak Ln., P.O. Box 499, Old Bridge, NJ 08857, Tel: 201-679-3366, TWX: 710-998-0892; FSC No.: 55969; Empl.: 25; *Sls. Mgr.:* George Wolter ..... **A•1126-1133, 1706-1707; C•1442-1445**

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MD Potomac, C.E. Tech. Elctrns. 301-235-1942
MA Lowell, Underwood Sls. 617-256-8191
MO Grandview, R. R. Burton Assocs. 816-763-5385
NJ Brielle, EMC Technigsts. 201-223-6699
NY Medford, EMC Technigsts. 516-286-5522
PA So. Eastern, EMC Technigsts. 215-265-1665

MEYER WIRE & CABLE CO., Div. of Cole Hersee Co., 1072 Sherman Avenue, Hamden, CT 06514, Tel: 203-281-0817, FAX: 203-281-9648; Empl.: 45; *Sls. Mgr.:* Spencer G. Molloy, VP Sls.

MFE INSTRUMENTS CORP., 19 Keewaydin Dr., Salem, NH 03079, Tel: 603-893-1921, ESYLNK: 953145; FSC No.: 6695,6685,6625; Empl.: 60; *Sls. Mgr.:* A.V. Beauregard, Mgr. Mktg./Sls.; *Dist. Mgr.:* Dennis Doscher

MF ELCTRNS. CORP., 10 Commerce Dr., New Rochelle, NY 10801, Tel: 914-576-6570, TWX: 710-563-0643; FSC No.: 08111; Empl.: 100; *Sls. Mgr.:* Zaw Nawaday; *Dist. Mgr.:* Frank Aliberga ..... **A•1426-1427**

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AZ Scottsdale, Bill Earl Assocs. 602-944-3813
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CA San Jose, Mac Tron 408-446-8224
CO Denver, Matthews & Assocs. 303-450-6476
CT Meriden, Orion Group 203-621-8371
FL Tampa, SRT Mktg. 813-884-4805
MA Wakefield, The Orion Group 617-245-5220
MN Edina, Peterson Sls. & Assoc. 612-944-0030
NC Raleigh, Tingen Tech. Sls. 919-878-4440
OR Portland, Core II 503-641-0877
PA Prospect Park, ELF Sls. 215-534-3340
TX Dallas, Matthews & Assocs. 214-248-7881
WA Seattle, Core II Mktg. 206-467-0622

Local Distributors
CA Anaheim, Pacesetter Elctrns. 714-779-5855
CA Burbank, Atwater Elctrns. 714-670-1426
CA Sunnyvale, Pacesetter 408-734-5470
NJ Bellmawr, Mid Atlantic 609-931-5303
NY Bohemia, RBD Elec. 516-589-7717
NY Cen. Islip, Domino Comps. 609-931-5303
NY Mt. Vernon, Janesway Elec. 914-699-6710

MFG, Parabam Div., 1130 Watsoncenter Rd, Carson, CA 90745, Tel: 213-549-5044; Empl.: 85

MFI, 12304 Santa Monica Blvd., Ste. 121, Los Angeles, CA 90025, Tel: 213-826-8133, 800-533-2297, FAX: 213-820-6958

MFM TECHNOLOGY, INC.
An Affiliate of UNITRODE Corporation

FAX: 516-467-5176

MFM TECHNOLOGY, INC., Affiliate of Unitrode Corp., 200 Thirteenth Ave., Ronkonkoma, NY 11779, Tel: 516-467-5151, TELEX: 221-500ASAS; Empl.: 25 ..... **B•1279**

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CO Denver, Koenig Engrg. 303-799-6616
NY Plainview, Motion Control Sls. 516-756-5656
NJ Princeton, Assocd. Controls Inc. 609-799-7020
OH Toledo, Cubbedge Controls, Inc. 419-535-5530
OR Portland, ControlTek, Inc. 503-641-0876
CA Alhamba, C. E. Mello Co. 818-282-2000
CA San Jose, Motion Control-North 408-997-0544

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FAX: 516-582-3229

MG ELECTRONICS, 32 Ranick Rd., Hauppauge, NY 11788, Tel: 516-582-3400; Empl.: 14; *Sls. Mgr.:* John Kibbit; *Dist. Mgr.:* Stan Grey ..... **D•1043**

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MICHIGAN MAGNETICS, 203 W. Third St., Vermontville, MI 49096, Tel: 517-726-0590, FAX: 517-726-0078; Empl.: 50; *Sls. Mgr.:* Tom Krul

MICREL SEMICONDUCTOR, 560 Oakmead Parkway, Sunnyvale, CA 94086, Tel: 408-245-2500, TWX: 910-379-0007, FAX: 408-245-4175; FSC No.: 60496; Empl.: 135; *Sls. Mgr.:* Steve Kelly

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MICROCAP, INC., A MicroSemi Company, 501 South Andreasen Drive, Escondido, CA 92025, Tel: 619-480-1906, FAX: 619-480-6741; Empl.: 65; *Sls. Mgr.:* Ken Miller, Sls. Mgr.

MICROCHIP TECHNOLOGY INC., Sub. of General Instrument Corp., 2355 W. Chandler Blvd., Chandler, AZ 85224, Tel: 602-963-7373, TWX: 910-950-1963, FAX: 602-899-9210; *Sls. Mgr.:* Phil Hubbert

MICRO-CIRCUIT ENGRG., See MCE Semiconductor

MICRO-CIRCUITS CO., INC., 10792 Maublin Rd., New Buffalo, MI 49117, Tel: 616-469-2727, FAX: 616-469-2742 ..... **C•1123**

MICRO-COAX COMPONENTS, INC., a UTI Company, Box E, Collegeville, PA 19426, Tel: 215-489-3700, FAX: 215-489-1103; Empl.: 50; *Sls. Mgr.:* Lloyd Deery

MICROCOSM, INC., 15275 S.W. Koll Parkway, Beaverton, OR 97006, Tel: 503-626-6100, TELEX: 759527 (Microcosm UD), FAX: 503-644-9906; Empl.: 30; *Sls. Mgr.:* M. L. Epperson

MICRO CRYSTAL DIVISION / SMH

FAX: 212-505-6787

MICRO CRYSTAL DIVISION, SMH, 35 E. 21st Street, New York, NY 10010, Tel: 212-505-5340, TELEX: 239 865 eta ur; *Sls. Mgr.:* Thomas Camazza; *Dist. Mgr.:* Thomas Camazza ..... **A•1429-1432**

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MICRODIMENSIONS, INC., 7345 Production Dr., Mentor, OH 44060, Tel: 216-974-8070, FAX: 216-974-1648; Empl.: 30 ..... **B•1091**

MICRODOT, INTERCONNECT SYSTEMS DIVISION, 201 Progress Dr., Montgomeryville, PA 18936, Tel: 215-699-5373, FAX: 215-699-5536; FSC No.: 91886; *Sls. Mgr.:* K. A. Neumuller

MICRODRY, INC., 7450 Hwy. 329, Crestwood, Kentucky 40014, Tel: 502-241-8933, FAX: 502-241-5907; Empl.: 14; *Sls. Mgr.:* Frank Smith

MICRO ELECTRONIC SYSTEMS, INC., 3 Quarry Road, Brookfield, CT 06804, Tel: 203-775-1440, 800-243-7254, TELEX: 969659, FAX: 203-775-6903

MICRO-ETCH PRODUCTS, INC., 94 Dodge Ave., P.O. Box 9712, Stratford, CT 06497, Tel: 203-378-8610, FAX: 203-375-6276; FSC No.: 24846; Empl.: 42; *Sls. Mgr.:* Frank Dichiara; *Dist. Mgr.:* Frank Dichiara

MICROFLECT CO., INC., 3575 25th St. S.E., P.O. Box 12985, Salem, OR 97309-0985, Tel: 503-363-9267, TWX: 510-599-0107, FAX: 503-363-4613; Empl.: 100; *Sls. Mgr.:* John J. Kranitz

MICRO HYBRIDS, INC., 2864 Route 112, Medford, NY 11763, Tel: 516-732-3448, FAX: 516-732-3393; FSC No.: 5962; Empl.: 7; *Sls. Mgr.:* Bruce Richardson

MICRO INDUSTRIES, 691 Greencrest Drive, Westerville, OH 43081, Tel: 614-895-0404, ESYLNK: 759200, FAX: 614-882-6357; *Sls. Mgr.:* Susan Lawton; *Dist. Mgr.:* Walt Smucker

MICRO INSTRUMENT COMPANY, 2250 Micro Pl, Escondido, CA 92025, Tel: 619-746-2010, TELEX: 882205 MICROINST ESCD, FAX: 619-746-0433; FSC No.: FSCM 24836; Empl.: 45; *Sls. Mgr.:* C. Marks (Eastern)

MICROLAB/FXR, 10 Microlab Rd., Livingston, NJ 07039, Tel: 201-992-7700, TWX: 710-994-4850; FSC No.: 00929; Empl.: 80

MICRO LAMPS INC., 1530 Hubbard, Batavia, IL 60510, Tel: 312-879-0900; *Sls. Mgr.:* Shirley A. Jaeger

MICROMETALS, 1190 N. Hawk, Anaheim, CA 92807, Tel: 714-630-7420, TWX: 910-591-1690, FAX: 714-630-5891; FSC No.: 12856; Empl.: 70; *Sls. Mgr.:* K. Baker, Jr.

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IL	St. Charles, Atwater Assoc.	312-668-2303
MA	Westborough, Anchor Engrg.	617-898-2724
MI	Ypsilanti, Atwater Assocs.	313-483-2251
MN	St. Paul, Atwater Assocs.	612-572-4135
NY	Hempstead, Kahgan Sls.	516-538-2300
WI	West Bend, Atwater Assocs.	414-338-3881

MICRO MODE PRODS., 1870 John Towers Ave., El Cajon, CA 92020, Tel: 619-449-3844, TWX: 910-331-1673; FSC No.: 15907; Empl.: 55; *Sls. Mgr.:* V. DeMarco; *Dist. Mgr.:* V. DeMarco

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FAX: 813-821-6220

MICRO MO ELECTRONICS, INC., 742 2nd Ave. S., St. Petersburg, FL 33701, Tel: 813-822-2529, TELEX: 807-982; Empl.: 32; *Sls. Mgr.:* S. J. O'Neil ..... **B•1220, 1280-1283, 1966; D•2245**

MICRO-MOUNTING DEVICES, 4092 Keith Dr., Campbell, CA 95008, Tel: 408-866-4626; FSC No.: 59058

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MICRONEL U.S., 2142F Industrial Ct., Vista, CA 92083, Tel: 619-727-7400; FSC No.: 61655; Empl.: 10; *Sls. Mgr.:* N. Linko ..... **C•1678-1679**

MICRONETICS, 36 Oak St., Norwood, NJ 07648, Tel: 201-767-1320, TWX: 710-991-9603; FSC No.: 54487; Empl.: 26; *Sls. Mgr.:* Dick Farrell

MICRO NETWORKS, Unitrode Corporation, 324 Clark St., Worcester, MA 01606, Tel: 508-852-5400, FAX: 508-853-8296; Empl.: 318; *Sls. Mgr.:* Skip Osgood

MICRONICS TECHNOLOGY INC., 7 Alexander Place, Glen Cove, NY 11542, Tel: 516-759-5600, FAX: 516-759-5603; *Sls. Mgr.:* John Mruz ..... **A•1433**

Local Sales Offices & Reps

CA	Palo Alto, Microwave Mktg. Assoc.	415-941-0247
CA	Westlake Vl., West Tech Microwave, Inc.	818-991-9219
MD	Laurel, CSDS	301-490-3800
MA	Natick, Wayland Assocs.	508-655-6080

MICRON INDUSTRIES, 1830 N. 32nd Ave., Stone Park, IL 60165, Tel: 312-345-0788, FAX: 312-345-0047; FSC No.: 30882; Empl.: 115; *Sls. Mgr.:* Michael Kitun; *Dist. Mgr.:* Mike Kitun

MICRO-NOW INSTR. CO., INC., 8260 N. Elmwood St., P. O. Box 1488, Skokie, IL 60077, Tel: 312-677-4700, TELEX: RCA 297214-MICRO-UR, FAX: 312-677-0394; FSC No.: 33288; Empl.: 25; *Sls. Mgr.:* C. Arnow

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AL	Huntsville, W. A. Brown Instr.	205-830-9224
CA	Los Angeles, Mc Dougall/Mc Laughlin	213-477-8556
CA	Mountain View, Mark V Assoc.	415-964-6275
CO	Boulder, H. Bass Assocs.	303-499-7509
CT	Wallingford, Pat Jenks Assoc.	203-269-1741
FL	Orlando, W. A. Brown Instrs., Inc.	407-648-9660
GA	Norcross, W. A. Brown Instrs., Inc.	404-449-7160
MA	Beverly, Pat Jenks Assoc.	508-921-4600
NM	Albuquerque, IMEC	505-883-5010
NY	E. Syracuse, E.M. Tech	315-437-6410
NY	Kings Park, USTM Tech. Mktg.	516-724-1542
WA	Seattle, Datacom	206-285-2525

FAX: 818-358-6478

MICRO-OHM CORP., 1088 Hamilton Rd., Duarte, CA 91010, Tel: 818-3575377, TWX: 910-587-3425; FSC No.: 20940; Empl.: 109; *Sls. Mgr.:* Chas. Schwab; *Dist. Mgr.:* Chas. Schwab ..... **A•1986-1990; B•1907**

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AZ	Phoenix, Toward Engrg.	602-955-3193
CA	Houma, Terrebonne Gauge House	504-851-7871
CA	Laguna Hills, Cravins Assoc.	714-240-7242
CA	San Diego, Cerco	619-450-1754
CA	San Juan Capistrano, Craven & Assocs.	714-240-7242
CO	Denver, William Purdy Co.	303-790-2211
CO	Englewood, Wm. J. Purdy Co.	303-790-2211
IL	Lake Bluff, R & R Mktg. Assocs.	312-295-6600
MA	Canton, N E E S Co.	617-828-4835
MN	Maple Grove, Elctrn. Prods. For Ind.	612-784-5554
OH	Cleveland, Jim Finnigan & Co.	216-238-5905
OH	Vandalia, JFCO	513-890-8322
OK	Tulsa, Hugh J. Daly Co.	918-494-7711
OR	Beaverton, P.M.S.	503-641-9373
OR	Beaverton, Pacific Mktg. Specialists, Inc.	503-641-9373
TX	Austin, Sage Mktg.	512-335-0300
EXP	Herzlia, Israel, RelCom	922-34254

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CA	Costa Mesa, Orange County Comps.	714-979-3597
CA	Huntington Bch., Wyle Labs	714-891-80087388900
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Shelley Elctrns.	619-453-7133
CA	San Diego, Shelley-Ragon	619-453-7133
CA	San Jose, Rose Elctrns.	408-943-0255
CO	Englewood, Arrow Elctrns.	303-790-4444
MN	Minneapolis, Electronic Center, Inc.	612-378-2442
MN	Minneapolis, Electronic Ctr.	612-371-5200
NH	Atkinson, Astrum Elctrns.	603-898-3399
NH	Hampstead, Astrum Elctrns.	603-329-5656
NY	New Rochelle, Derf Elctrns.	914-235-4600
NY	Oceanside, Tritech	516-678-6222
OH	Toledo, J R Inds.	419-865-1408
PA	McKean, Advacom	814-476-7774
TX	Ft. Worth, Industrial Elect.	817-731-7321
UT	Provo, Central Utah Elctrns. Supp.	801-373-7522
UT	Salt Lake City, Nytronics	800-242-7612
VT	Salt Lake City, Nytronics	801-973-6359
EXP	Basle, Switzerland, Siabalco W. Siegrist & Co. AG	845-962851
EXP	Huntingdale, Australia, Stewart Elctrn. Comps. Pty.	790-AA36908

MICROPAC INDS., INC., General Sensors Div., 905 E. Walnut St., Garland, TX 75040, Tel: 214-272-3571, TWX: 910-860-5186, FAX: 214-494-2281; Empl.: 120; *Sls. Mgr.:* Richard Schlueter

MICROPHASE, 587 Connecticut Ave., Norwalk, CT 06856, Tel: 203-866-8000, TWX: 710-468-0003; Empl.: 230; *Sls. Mgr.:* F. S. Parin

MICRO PLASTICS INC., Hwy 178 North, P.O. Box 149, Flippin, AR 72634, Tel: 501-453-2261, TELEX: 783036, FAX: 501-453-8676; FSC No.: 13764; Empl.: 150; *Sls. Mgr.:* J. H. Beijen; *Dist. Mgr.:* N. Vandermast

MICROPLEX, INC., 1977 State College Blvd., Anaheim, CA 92806, Tel: 714-979-8833, 714-634-1535, FAX: 714-634-8375; Empl.: 30

MICRO PNEUMATIC LOGIC, INC., 2890 N. W. 62nd Street, Fort Lauderdale, FL 33309-1786, Tel: 305-973-6166, TELEX: 522316, ESYLNK: 62202960, FAX: 305-973-6339; Empl.: 100; *Sls. Mgr.:* Brian Irving

MICRO POWER INTL., INC., 10770 Black Mountain Rd. Ste. 248, San Diego, CA 92126, Tel: 619-271-0831, 619-271-5942; Empl.: 58

MICRO POWER SYS. INC., 3151 Jay St., Santa Clara, CA 95054, Tel: 408-727-5350, TWX: 910-338-0154, FAX: 408-748-9045; FSC No.: 54186; Empl.: 200; *Sls. Mgr.:* Jim Young; *Dist. Mgr.:* Jim Young

MICRO-PRODUCTS ENGINEERING CO., 230 Ridgewood Ave., Newark, NJ 07108, Tel: 201-824-8467, FAX: 201-824-5668; Empl.: 100; *Sls. Mgr.:* Gerald Muller

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MICROSEMI CORP. COLORADO, Microsemi Corp., 800 Hoyt St., Broomfield, CO 80020, Tel: 303-469-2161, FAX: 303-466-3775; Empl.: 140; *Sls. Mgr.:* Robert H. Werner; *Dist. Mgr.:* George Avila

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CA	Torrance, Detomasi & Grupp	213-618-8898
FL	Orlando, Brennan Assoc.	813-446-5006
IA	Cedar Rapids, S & O Sls.	319-363-7323
MD	Ellicott City, V.P.I.	301-461-2525
MA	Lexington, O'Sullivan & Murphy	617-862-6570
NJ	Glen Gardner, F & M Tech. Sls.	201-832-7216
NY	Liverpool, R & D Assocs.	315-457-0100
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TX	Dallas, Gamma Opt	214-783-4758

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Can	Scarsdale	416-293-8111
Can	Vancouver	604-430-3100
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MICRO/SYS, 1011 Grand Central Ave., Glendale, CA 91201-3010, Tel: 818-244-4600, TELEX: 170788

MICROSYSTEMS DEVELOPMENT CORP., INC., 1560 Teaneck Rd., Teaneck, NJ 07666, Tel: 201-837-0051, FAX: 201-837-0504; *Sls. Mgr.:* L. G. Mansoor

MICRO SYSTEMS ENGINEERING, INC., 6024 S.W. Jean Rd., Lake Oswego, OR 97035, Tel: 503-635-4016, TELEX: 151-538, FAX: 503-635-9610; FSC No.: 75800; Empl.: 110; *Sls. Mgr.:* Maury Reiter

MICROTECH, 1420 Conchester Hwy., Boothwyn, PA 19061, Tel: 215-459-3566; Empl.: 22; *Sls. Mgr.:* H. Carter

MICRO TECHNICAL INDUSTRIES, 23132 La Cadena Dr. Ste. E, Laguna Hills, CA 92653, Tel: 714-855-4326, TELEX: 371-9688, FAX: 714-855-9545; Empl.: 20; *Sls. Mgr.:* Joe Duarte

MICROTOUCH SYSTEMS INC., Ten State Street, Woburn, MA 01801, Tel: 617-935-0080, TELEX: 530264; FSC No.: 935-0133; Empl.: 60; *Sls. Mgr.:* William N. Keller

FAX: 516-561-1117

MICROTRAN CO. INC., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, Tel: 516-561-6050, TWX: 510-225-8412; FSC No.: 00348; Empl.: 75; *Sls. Mgr.:* W. Benscher ... **A•1253, 2214, 2344-2360**

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
AZ	Scottsdale, F. Schoeffler	602-948-1004
CA	Campbell, Kottmeier Assocs.	408-371-8700
CA	Walnut, Cook Entprs.	714-594-0091
CO	Englewood, Omega, Ltd.	303-762-1921
FL	Altamonte Springs, Over & Over, Inc./FL	407-332-1222
FL	Coral Springs, Over & Over, Inc./FL	305-753-7050
FL	Tampa, Over & Over, Inc./FL	813-626-9100
GA	Norcross, Over & Over	404-449-6205
IL	Wheaton, Chadra-Schilke Assoc.	312-653-8126
IN	Fishers, R & D Elctrn. Sls.	317-849-2026
IA	Marion, AEM, Inc.	319-377-1129
KS	Lenexa, AEM, Inc.	913-888-0022
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Reading, Meco, Inc.	617-944-6660
MN	Minnneapolis, RK Sales	612-571-1001
MO	St. Louis, AEM, Inc.	314-298-9900
NJ	Englewood Cliffs, E. Glass Assocs.	201-592-0200
NM	Albuquerque, C.T. Carlberg & Assocs.	505-836-1448
NY	Marcellus, Mullahy-Welch Sls.	315-673-3891
NY	Rochester, J.G. Welch Assocs.	716-244-1100
NC	Charlotte, Over & Over	704-542-9111
NC	Raleigh, Over & Over Inc.	919-782-9111
OH	Columbus, John O. Olsen Co.	614-478-9911
OH	Garfield Heights, J.O. Olsen	216-662-3454
OH	Goshen, J.O. Olsen Co.	513-722-3320
PA	Jenkintown, Arnold Assocs.	215-887-7870
PA	Pittsburgh, J.O. Olsen Co.	412-279-2550
TX	Houston, Spectra Sls. Corp.	713-270-8212
TX	Richardson, Spectra Sls. Corp.	214-234-3600
VA	Lynchburg, Burgin-Kreh Assocs.	804-239-2626
Can	Montreal, Quebec, H. W. Brieger Sls., Inc.	514-486-5869

Local Distributors

AL	Birmingham, MG Elctrns. & Equip.	205-328-4525
CA	Fullerton, Pyramid/Fullerton	714-773-0781

CA San Diego, Pyramid Elctrns. 619-271-5404
CA San Jose, Sierra West Elctrns. 408-435-7477
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CA Santa Monica, Master Distrs. 213-452-1229
CO Englewood, Shelley/Ragon Inc. 303-762-0670
FL Largo, Elctrn. Precepts of Florida 813-544-3636
FL Pompano Beach, Peerless Radio Corp. 800-327-4993
IL Northbrook, Classic Comp. 312-272-9650
IN Indianapolis, Bell Inds./Graham Elctrns. 317-634-8202
IA Cedar Rapids, Deeco, Inc. 319-365-7551
MA Hingham, Sager Elec. Supp. 617-749-6700
MN Minneapolis, Bergquist 612-835-2322
NJ Kenilworth, Federated Elctrns. 201-272-0505
NM Albuquerque, Walker Elctrn. Supp. 505-883-2992
NY Buffalo, Summit Distrs. 716-887-2800
NY Johnson City, Help Elctrns. 607-729-3528
NY Lynbrook, Peerless Radio 516-593-2121
NY Rochester, Summit Distrs. 716-334-8110
NC Raleigh, Southeastern Elctrns. 919-828-2311
OH Dayton, J.A. Becker Co. 513-226-1341
PA McKeesport, Barno Radio Co. 412-751-5971
PA Philadelphia, Shap Elctrns. 215-969-3300
TX Houston, Lenert Co. 713-225-1465
WA Redmond, Priebe Elctrns. 206-881-2363
WI Mequon, Lake-View Elctrns. Corp. 414-377-8250
WI New Berlin, Classic Comp. 414-786-5300

MICROWAVE APPLICATIONS GROUP, 3030 Industrial Pkwy., Santa Maria, CA 93455, Tel: 805-928-5711, TWX: (MAGSAMA) 910-351-5808, FAX: 805-925-5903; FSC No.: 26357; Empl.: 60; *Sls. Mgr.:* D. W. Prigge

MICROWAVE DESIGN SVCS., INC., 437-H Mary Esther Cutoff, Ft. Walton Beach, FL 32548, Tel: 904-664-1234

MICROWAVE DEVELOPMENT LABORATORIES, 10 Michigan Dr., Natick, MA 01760, Tel: 617-655-0060, TWX: 710-386-6850, FAX: 617-655-6972; Empl.: 180; *Sls. Mgr.:* R. Tucker

Local Sales Offices & Reps

AZ Phoenix, Blackhart Assocs. 602-893-3488
CA Chino, MDL W. Coast 714-628-4731
CA San Mateo, H. R. Grove 415-579-0555
CO Boulder, Herb Bass Assocs. 303-530-7509
FL Winter Springs, Hi Co. 407-365-3867
IA Marion, Ensco-Rep 319-377-8551
KS Wichita, Ensco-Rep 316-683-1070
MA Wayland, Hi-Tech Sls. 617-653-3838
MO Maryland Heights, Ensco-Rep 314-423-3935
NY DeWitt, D.B. Assocs. 315-446-0220
NY Great Neck, Trionic 516-466-2300
NC Raleigh, M. Lader Co. 919-848-3253
PA Conshohocken, M. Lader 215-825-3177
TX Dallas, Texas Microwave 214-351-4773
UT Bountiful, Herb Bass Assocs. 801-295-7100
VA Alexandria, Vanguard Engrg. 703-768-1660
WA Seattle, J.J. Assocs. 206-246-6619
Can Montreal, RF Microwave Ltd 514-335-2335

MICROWAVE DIODE CORP., Washington St-Box 250, W. Stewartstown, NH 03597, Tel: 603-246-3362/3363, FAX: 603-246-8161; FSC No.: 57777; Empl.: 15; *Sls. Mgr.:* Daniel E. Shea

MICROWAVE FILTER INC., 6743 Kinne St., East Syracuse, NY 13057-0486, Tel: 315-437-3953, 800-448-1666, TELEX: 249-613, FAX: 315-463-1467; FSC No.: 27834; Empl.: 95; *Sls. Mgr.:* E. Bostick, Sls. & Mktg. ..... **A•1703**

Local Sales Offices & Reps

MD Laurel, CSDS, Inc. 301-490-3800
NH Brookline, Higgins Microwave 603-673-1862
PA Ambler, Beta Sls. 215-641-9776

MICROWAVE PRODUCTS DIV., Adams-Russell Elctrns. Co. Inc., 9533 Irondale Ave., Chatsworth, CA 91311, Tel: 818-882-3434, TWX: 910-494-2771, ESYLNK: 62770857, FAX: 818-709-8094; FSC No.: 16798; Empl.: 100; *Sls. Mgr.:* Steven J. LaLonde

MICROWAVE SOLUTIONS, INC., 3200 Highland Ave., Ste 3A, National City, CA 92050, Tel: 619-474-6906, FAX: 619-263-2995; FSC No.: 65151; Empl.: 12; *Sls. Mgr.:* Edward M. Teyssier

MICROWAVE SYSTEMS INC., 6075 E. Molloy Rd., Syracuse, NY 13211-2100, Tel: 315-437-9951, TWX: 710-541-0408, FAX: 315-437-8095; FSC No.: 26058; Empl.: 35; *Sls. Mgr.:* Diane L. Conklin

MIDCOM, INC., 121 Airport Dr., Watertown, SD 57201, Tel: 605-886-4385, FAX: 605-886-4486; Empl.: 200; *Sls. Mgr.:* Dean Ward

MIDDLEBERG CORPORATION/MIDDCO CONNECTORS, 95 Albany Turnpike, Canton, CT 06019, Tel: 203-693-8361, FAX: 203-693-6403; Empl.: 20; *Sls. Mgr.:* Judy Nelson

MID-EASTERN INDUSTRIES, 100 Campus Dr., RR30, Mt. Holly, NJ 08060, Tel: 609-267-3811, FAX: 609-267-3813; FSC No.: 06179; Empl.: 10; *Sls. Mgr.:* Daniel Ellenback ..... **D•1912-1916**

Local Sales Offices & Reps

CA Los Angeles, Dyna Sls. 213-268-1175
CA San Ramon, Tech. Consits. 415-830-0829
IL Des Plains, Marsland Assocs., Inc. 312-298-2620
IN Indianapolis, Marsland Assocs., Inc. 317-293-5437
IA Cedar Rapids, Marsland Assocs., Inc. 319-364-1575
MI Warren, Dietrich & Assocs. 313-751-4990
MN Minneapolis, Marsland Assocs., Inc. 612-545-4481
MO St. Louis, Marsland Assocs., Inc. 314-991-1399
NH Londonberry, Bennetron 603-732-9092
NM Albuquerque, Westahl Assocs. 505-881-0995
NY Huntington, C.R. Mayer Co. 516-WA1-7876
OH Cincinnati, Dietrich & Assocs. 513-984-8924
OH Independence, Dietrich & Assocs. 216-642-7965
PA Pittsburgh, Dietrich & Assocs. 412-892-2992
WA Seattle, Eicher-Richards Co. 206-LA3-7888
WI New Berlin, Marsland 414-786-6611

MIDGET LOUVER, 800 Main Ave., Norwalk, CT 06852, Tel: 203-866-2342; Empl.: 10; *Sls. Mgr.:* Francis J. Miller; *Dist. Mgr.:* Holly Monroe

MIDLAND-ROSS CORP., NEL UNIT, See NEL Frequency Controls, Inc.

Midtex Relays, Inc.

FAX: 915-772-1116

MIDTEX RELAYS, INC., 9B2 Butterfield Trail, El Paso, TX 79906, Tel: 915-772-1061, 1-800-MIDTEX1, TWX: 910-240-3407, ESYLNK: 62752541; Empl.: 275; *Sls. Mgr.:* Craig Law; *Dist. Mgr.:* Craig Law ..... **B•1580-1585**

Local Sales Offices & Reps

AL Huntsville, Twentieth Century Mktg. 205-533-9281
AZ Tempe, A5 Co. 602-968-4923
AR Hot Springs, Automation Suppliers, Inc. 501-767-5444
CA Hayward, Pacific Mktg., Inc. 415-887-1620
CA Los Altos, J.W. Wilholt 415-961-3660
CA Tustin, Schoenbachler-Dobson 714-544-1888
GA Norcross, Twentieth Century Mktg. 404-446-1999
IL Downers Grove, Richmar Elctrns. 312-968-0118
IN Indianapolis, Richmar Elctrns. 317-577-9950
KS Overland Pk., Thomas Dowell 913-638-7373
MN Edina, Graydon & Flemmer 612-941-1120
MO St. Louis, Thomas Dowell & Assocs. 314-849-4234
NH Nashua, Bell Controls 603-882-6984
NJ Englewood, Harold Gray & Assocs. 201-894-0894
NY Rochester, Lamb Comps. 716-323-1250
NC Cary, Twentieth Century Mktg. 919-481-3370
OH Beachwood, Elctrn. Salesmasters, Inc. 216-831-9555
PA Trevose, PSA 215-245-0513
TN Knoxville, Twentieth Century Mktg. 615-966-2099
TX Richardson, DJ Sls. 214-783-8876
TX Richardson, Milco Mktg. 214-783-2716
WA Vashon, RTS, Inc. 206-285-1363
WI Butler, Richmar Elctrns. 414-781-1730
Can Toronto, Ont., CEA Assocs. 416-231-9717

Local Distributors

AL Huntsville, Hall-Mark 205-837-8700
AZ Phoenix, Hall-Mark 602-437-1200
AZ Tempe, Control Design Supp. 602-829-7981
AR Little Rock, Newark Elctrns. 501-225-8130
CA Anaheim, Control Design Supp. 714-821-1516
CA Bay Area, Hall-Mark 408-432-0900
CA Irvine, Integrated Elctrns. 714-837-9960
CA Orange County, Hall-Mark 714-669-4100
CA San Carlos, Control Design Supp. 415-592-4806
CO Santa Monica, Master Dists. 213-452-1229
CO Denver, Integrated Elctrns. 303-292-5537
CT Wallingford, Mid State Elctrns. 203-265-9900
FL Altamonte Springs, Control Design 305-788-3220
FL Ft. Lauderdale, Hall-Mark 305-971-9280
GA Stone Mtn., Control Design 404-979-3500
IL Chicago, Hall-Mark 312-860-3800
IL Chicago, Newark Elctrns. 312-784-5100
IL Schaumburg, Control Design 312-307-8900
IN Indianapolis, Control Design 317-788-4559
IA Cedar Rapids, Dee Elctrns. 319-365-7551
KS Kansas City, Control Design 913-362-4248
KY Louisville, Newark 502-423-0280
LA Shreveport, Indl. Elec. Supp. 318-222-9459
MD Columbia, Hall-Mark 301-988-9800
MA Boston, Hall-Mark 617-667-0902
MA Newton, Green-Shaw Inc. 617-969-8900
MA Woburn, Control Design Supp. 617-932-9404
MI Oak Pk., Newark 313-967-0600
MI St. Clair Shores, Spemco 313-771-2700
MN Minneapolis, Control Design 612-721-1628
MN Minneapolis, Hall-Mark 612-941-2600
MS Jackson, Newark 601-956-3834
MO St. Louis, Control Design Supp. 314-426-3150
NE Omaha, Newark 402-392-1221
NV Las Vegas, Newark 702-796-5090
NH Nashua, Newark 603-888-5790
NY Buffalo, Genesse Indl. 716-873-9661
NY Long Island, Hall-Mark 516-737-0600
NJ Oakland, Relay Specialties 201-337-1000
NJ Paterson, Feldman Bros. 201-742-7329
NY Rochester, Masline 716-546-5373
NY Woodside, Switches Unltd. 718-478-5000
NC Charlotte, Control Design 704-588-4410

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OH Cinicinnati, Schuster Elec. 513-489-1400
OK Tulsa, Hall-Mark 918-251-1108
PA Malvern, Control Design Supp. 215-296-0150
PA McKean, Advacom 814-476-7774
PA Philadelphia, Hall-Mark 609-235-1900
PA Pittsburg, CMD 412-678-6020
SC Greenville, Newark 803-288-9610
TN Memphis, Newark 901-365-8060
TX Dallas, Control Design Supp. 214-358-1441
TX Dallas, Force-Heiland 214-247-9955
TX Dallas, Hall-Mark 214-553-4300
TX El Paso, Midtex (Export) 915-772-1061
TX Houston, Hall-Mark 713-781-6100
UT Salt LAke City, Hall-Mark 801-972-1008
VA Falls Church, Newark 703-522-0880
WA Bellevue, Integrated Elctrns. 206-455-2727
WV Dunbar, Newark 304-768-6872
WI Milwaukee, Marsh Elctrns. 414-475-6000
WY Gillette, Gifford 307-682-7203
Can Scarborough, Ont., Carsten Elctrns. ... 416-495-7705

MIDWEC, See Industrial Midwec Capacitors

MIDWEST COMPONENTS INC

FAX: 616-773-4307

MIDWEST COMPONENTS, INC., 1981 Port City Blvd, Muskegon, MI 49443, Tel: 616-777-2602, TWX: 510-394-4130; FSC No.: 50157; Empl.: 250; *Sls. Mgr.:* Greg Hoffman ..... **B•1908-1911**

Local Sales Offices & Reps

AL Huntsville, Glen White Assoc. 205-883-7938
CA San Diego, Hadden Assocs. 619-565-9444
CA Saratoga, Testco 408-253-1900
CA Westminster, West Elctrns. 714-898-0120
GA Norcross, Glen White Assoc. 404-441-1447
IL Chicago, D. Dolin Sls. 312-286-6200
IN Ft. Wayne, TMC Corp. 219-432-5553
MD Timonium, Glen White Assoc. 301-252-6360
MN St. Paul, R. G. Ragon 612-488-0201
NJ West Cauldwell, Grimm, Siegel Assoc. 201-575-9300
NC Raleigh, Glen White Assoc. 919-787-7023
OH Dayton, Jay Engrg. 513-253-2151
OH N. Royalton, Jay Engrg. 216-237-4235
TN Gray, Glen White Assoc. 615-477-8850
TX Dallas, Norcom 214-386-4888
TX Houston, Norcom 713-988-0022
VA Lynchburg, Glen White Assoc. 804-237-6291
WI Milwaukee, D. Dolin Sls. 414-482-1111

Local Distributors

OK Tulsa, Hugh Daly Co. 918-494-7711
WA Redmond, SPS Elctrns. 206-323-4140

MIKRON INSTR., 445 W. Main St., Wyckoff, NJ 07481, Tel: 201-891-7330, TELEX: 361870, FAX: 201-891-1205; Empl.: 60; *Sls. Mgr.:* K. Irani

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MILFORD RIVET & MACH., 857 Bridgeport Ave., Milford, CT 06460, Tel: 203-878-4631, TELEX: 964363, TWX: 710-462-0538, FAX: 203-878-5071; Empl.: 250

JAMES MILLEN ELCTRNS., Caywood Elec. Inc., 87 Belmont St., No. Andover, MA 01845, Tel: 508-475-7831, FAX: 508-474-8949; Empl.: 6; *Sls. Mgr.:* R. Jannini

MILLER DIAL CORP., 4400 N. Temple City Blvd., El Monte, CA 91731, Tel: 818-444-4555, TWX: 910-587-3438, FAX: 818-443-3267; FSC No.: 91345; Empl.: 200; *Sls. Mgr.:* P. J. Wener, V.P. Membrane

MILLER, J.W., CO., See Bell Inds.

MILLER, L.C., CO., 717 Monterey Pass Rd., Monterey Pk., CA 91754, Tel: 213-268-3611; Empl.: 45

MILLER, SANFORD, CORP., See Sanford-Miller Corp.

MILLER, W. A., CO., Mingo Loop, P.O. Box 337, Oquossoc, ME 04964-0337, Tel: 207-864-3344, 800-227-1415; Empl.: 15

MILLER-STEPHENSON CHEM. CO., INC., George Washington Hwy., Danbury, CT 06810-0950, Tel: 203-743-4447, TELEX: 643-711; *Sls. Mgr.:* Mrs. Fran Bodnar

MILLIFLECT, 37444 Sycamore St., Bldg. A, Newark, CA 94560, Tel: 415-791-5188, TELEX: 466465, FAX: 415-791-5237; FSC No.: 52426; Empl.: 39; *Sls. Mgr.:* Don Koijane; *Dist. Mgr.:* Alex Nilva

MILLIVAC INSTRUMENTS, INC., Box 997, Curry Rd. Ext., Schenectady, NY 12301, Tel: 518-355-8300, FAX: 518-356-5161; FSC No.: 85711; Empl.: 30; *Sls. Mgr.:* Jan B. Metzger ..... **D•1323**

Local Sales Offices & Reps

CA San Diego, Advanced Prods. Sls. 619-487-0294
CA Westlake Vl., Advanced Prods. Sls. 818-706-8351
MD Laurel, CSDS Inc. 301-490-3800
MA Needham, Addelco Corp. 617-444-4754
MA Needham, Addelco, Co. 617-444-4754
NY Fayetteville, Martin P. Andrews 315-637-5291
OH Cleveland, Emil F. Kirik & Assocs. 216-581-7722
TX Houston, Scientific Sls. 713-460-9170
TX Richardson, Sci. Sls. 713-645-6218
VA Fairfax, CSDS Inc. 703-385-0139
Can Downsview, Ont., Tradeport Elctrns. Grp. 416-736-0866

MILL-MAX MANUFACTURING CORP., P.O. Box 300, Oyster Bay, NY 11771-0300, Tel: 516-922-6000, TWX: 510-221-1820, FAX: 516-922-9253; FSC No.: 3N087; Empl.: 200; *Sls. Mgr.:* Richard M. Weiner ..... **C•1447-1449**

Local Sales Offices & Reps

AL Huntsville, Elctrn. Sls., Inc. 205-533-1735
AR Little Rock, Erickson Sls., Inc. 501-455-0618
CA Dana Point, Patrick Conahan Assocs. 714-493-9822
CA San Jose, Patrick Conahan Assocs. ... 408-723-2200
CO Boulder, R. G. Entprs. 303-447-9211
CT Hartford, Olsen Tech. Sls. 203-728-3229
FL Boca Raton, Sales Specialists 407-391-3717
GA Norcross, Elctrn. Sls., Inc. 404-448-6554
IL Palatine, Houlihan Sls. Co. 312-705-0400
LA Chalmette, Erickson Sls., Inc. 504-271-1976
ME Kittery, Olsen Tech. Sls. 207-439-0280
MA Scituate, Olsen Tech. Sls. 617-545-5101
MN St. Paul, Johnson Co. 612-641-1878
MO St. Louis, KKB & Co. 314-647-2400
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PA Doylestown, G. A. Recentio Assocs. ... 215-348-7577
TX Dallas, Erickson Sls., Inc. 214-739-5833
WA Bellevue, Comtec 206-453-1188

Local Distributors

AL Birmingham, American Elctrns. 205-942-4656
AZ Phoenix, Arizona Comps. Co. 602-269-5655
AZ Tempe, Acacia/VWR Elctrns. 602-894-2874
AZ Tempe, DC Elctrns. Supp. Inc. 602-438-1234
AZ Tempe, Elctrn. Hardware 602-967-1691
AZ Tucson, Pioneer Screw & Nut 602-623-9800
AR Little Rock, Carlton-Bates Co. 501-562-9100
CA Anaheim, Bisco Inds. 714-635-0380
CA Campbell, Gourmet Elctrns. 408-374-0552
CA Chatsworth, West Valley Inds. 818-700-0700
CA City of Industry, Ital Elctrn. Sls. 714-990-0922
CA Costa Mesa, Eric Elctrns. 714-751-1185
CA Fremont, Alatec Prods. 415-657-7701
CA Irvine, Kelex Elctrns. 714-863-1230
CA Mission Hills, Coast Air 818-898-2288
CA N. Hollywood, Alatec Prods. 818-764-5600
CA N. Hollywood, Elctrn. Hardware 818-982-6100
CA San Jose, Bisco Inds. 408-946-8980
CA San Jose, Eric Elctrns. 408-432-1111
CA San Jose, Pro Fasteners 408-943-9177
CA Santa Clara, DC Elctrns. Supp. 408-980-1199
CA Sunnyvale, Power Supp. Comps. 408-737-1333
CA Tustin, DC Elctrns. Supp. 714-259-9066
CO Denver, Hardware Specialty Co. 303-371-8553
CT Danbury, Heilind Elctrns. 203-797-8600
FL Sanford, Elctrn./Fasteners 407-321-4000
GA Norcross, Atlanta Hardware Specialty 404-449-3000
IL Addison, Belford Elctrns., Inc. 312-691-1100
IL Franklin Park, Bisco Inds. 312-451-1230
IN South Bend, PEI/Genesis Elctrns. 800-348-2996
LA Shreveport, Carlton-Bates Co. 318-636-9975
MD Gaithersburg, Capital Fasteners 301-948-9310
MA Canton, EPC Elctrns., Inc. 617-821-2111
MA Marlborough, Hardware Specialty Co. 508-481-8622
MA Middleboro, Glynn Elctrns., Inc. 617-947-4262
MA Westford, Elpakco 617-692-5425
MA Wilmington, Heilind Elctrns. 617-657-4870
MA Winchester, Rush Inds., Inc. 617-729-5800
MI Grand Rapids, S.F. Elctrns. Supp. 616-459-0216
MN Minneapolis, Aero-Space Computer Supps. 612-884-4725
MO Bridgeton, Alatec Prods. 314-298-0010
MO Springfield, Carlton-Bates, Co. 417-862-1699
NH Atkinson, Astrum Elctrns., Inc. 603-898-3399
NJ Cherry Hill, Hardware Specialty 609-663-0034
NJ Pinebrook, Alatec Prods. 201-227-8140
NJ Union, Meridian Mfg. & Supp. Co. 201-687-6220
NY Baldwinsville, Scibetta Distr. 315-622-3993
NY Edgewood, Kaytech Inds. 516-242-6606
NY Fairport, Willex Indl. 716-223-9365
NY Holbrook, Micro Genesis, Inc. 516-472-6000
NY Holtsville, Tower Fasteners Co. 516-289-8800
NY L.I. City, Hardware Specialty Co. 718-361-9393
NY Mt. Vernon, QAR Ind. Elec. Sls. 914-699-2224
NC Raleigh, Century Fasteners 919-787-1800
OH Warren, REM Elctrns. 216-373-1300
OK Tulsa, Carlton-Bates Co. 918-250-1626
OK Tulsa, Radio, Inc. 918-587-9123
OR Beaverton, Acacia/VWR Elctrns. 503-646-3377
OR Beaverton, Component Resources 503-641-8488
PA McKean, Advacom 814-476-7774
PA Philadelphia, PEI/Genesis Elctrns. 800-523-0727
SC Taylors, Cantrell Whlsl. Prods. 803-268-1194
TN Memphis, Carlton-Bates, Co. 901-365-3539
TX Carrollton, Connec/Tek, Inc. 214-245-1266
TX El Paso, Ideal Indl. Supp. 915-779-6647
TX Farmers Branch, Force Elctrns. 214-247-9955
TX Houston, Wofford Elctrns. 713-847-3583
UT Salt Lake City, Standard Supp. Co. 801-486-3371
Can Mississauga, Ont., Rush Elctrns. 416-677-7280

MILROSS CONTROLS, INC., 511 Second St. Pike, Southampton, PA 18966, Tel: 215-355-0200, TWX: 510-667-1702, FAX: 215-355-6326; FSC No.: 07047; Empl.: 100; *Sls. Mgr.:* Scott R. Tate

MILLS RESISTOR CO., 3840 Catalina St., Los Alamitos, CA 90720, Tel: 213-598-2454, FAX: 213-430-8309; FSC No.: 34238; Empl.: 50 ..... **A•1991**

Local Sales Offices & Reps

CA Los Altos, Frauman Assocs. 415-941-0660
CA Sacramento, Mills Resistor Co. 916-422-5461
CT Rocky Hill, Jim McPhail 203-721-1802

KS Leawood, James Dick Co. 913-649-0805
MA Waltham, Dynasel Assocs. 617-890-6777
OR Gaston, SPS Elctrns. 206-323-4140
TX Houston, Ev Smith Co. 713-649-5756
WA Seattle, SPS Elctrns. 206-323-4140

Local Distributors

FL Ft. Lauderdale, Jaro Elctrns. 800-327-5551
PA Harrisburg, ADTECH 717-939-8337
PA McKean, Advacom 814-476-7774

MILTOPE BUSINESS PRODUCTS, Miltope Grp., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, 516-756-7650, TWX: 510-221-1803, FAX: 516-756-7606; Empl.: 650

MILTOPE CORP., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, TWX: 510-221-1803; Empl.: 750; *Sls. Mgr.:* Frederick S. Korb; *Dist. Mgr.:* William Jennings

MILWAUKEE ELECTRONICS, 7817 W. Clinton Ave., P.O. Box 23765, Milwaukee, WI 53223, Tel: 414-358-4000, FAX: 414-358-4001; FSC No.: 98664; Empl.: 60; *Sls. Mgr.:* James Scholler

MRC

FAX: 414-271-9876

MILWAUKEE RESISTOR CORP., 700 W. Virginia St., Milwaukee, WI 53204, Tel: 414-271-9900; FSC No.: 82807;15109; Empl.: 65; *Sls. Mgr.:* W. R. Pollock; *Dist. Mgr.:* W. R. Pollock ..... **A•1992-1996**

Local Sales Offices & Reps

CA San Carlos, Electro Pacific 415-592-3114
IL Burr Ridge, PVA Corp. 312-655-3355
LA Covington, Cartwright & Bean 504-892-1780
MA Stoughton, EECS-Mel Botsian 617-344-5139
MS Jackson, Cartwright & Bean 601-981-1170
NY Rochester, Gislason Sls. 716-328-7400
NY Whitestone, M. H. Lynn co. 718-352-9233
OH Westlake, Assocd. Elctrl. Comps. 216-835-9960
TN Memphis, Cartwright & Bean 901-362-8345

MILWAUKEE TRANSFORMER CO., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223, Tel: 414-358-5300; *Sls. Mgr.:* Fred A. Lewis; *Dist. Mgr.:* Fred A. Lewis

MIMIC, INC., P. O. Box 705, Islington, MA 02090-0705, Tel: 617-329-9593; Empl.: 5; *Sls. Mgr.:* S. Thurston

MINC INCORPORATED, 1575 York Rd., Colorado Springs, CO 80918, Tel: 719-590-1155, FAX: 719-594-4708; *Sls. Mgr.:* Wayne Gutschick

MINCO PRODUCTS, 7300 Commerce La., Minneapolis, MN 55432, Tel: 612-571-3121, FAX: 612-571-0927; FSC No.: 09359; Empl.: 475; *Sls. Mgr.:* J. Anderson

MIN-E-CON, 1791 Reynolds, Irvine, CA 92714, Tel: 714-250-0474, TWX: 910-595-1144, FAX: 714-250-1713; FSC No.: 54455; *Sls. Mgr.:* Jeff Sander

MINELCO INC. - A TALLEY IND., 135 S. Main St., Thomaston, CT 06787-0459, Tel: 203-283-8261, TWX: 710-475-1091, FAX: 203-283-6527; FSC No.: 07479; Empl.: 70; *Sls. Mgr.:* James A. Myles ..... **B•1175**

Local Sales Offices & Reps

AL Huntsville, L & D Inc. 205-837-1469
AZ Phoenix, R. W. Riedel & Co. 213-283-7694
CA Alhambra, M.W. Riedel & Co. 213-283-7694
CA Hayward, Liaison, Inc. 415-783-1131
CO Denver, West Inc. 303-477-8180
CT Old Saybrook, F.J.S Assocs. 203-388-5374
FL Orlando, Delmac 305-831-0040
GA Atlanta, L & D, Inc. 404-395-7079
MI Grand Rapids, Midwest Meridian 616-698-7391
IA Cedar Rapids, J.R. Sls. Engrg. 319-393-2232
MD Ellicott City, Eastern Tech Corp. 301-461-7720
MA Burlington, F.J.S. Assocs. 617-273-5959
MN Minneapolis, TWC Sls. 612-636-1770
MO St. Louis, Midwest Meridian 314-878-4441
NJ Hasbrouck Hgts., Comp-Tech Sls. 201-288-7400
NY Syracuse, J. R. Costello 315-472-0322
NC Greensboro, L & D, Inc. 919-292-3201
OH Cleveland, Jim Finnegan & Co. 216-238-5905
PA Downingtown, McCoy, Inc. 215-363-0350
TX Fort Worth, CMR 817-379-6540
WA Bellevue, Caruso & Co. 206-455-8811
Can Rexdale, Ont., Myelco, Inc. 416-674-1636

MINIATURE METAL FORMING DIV., 4819 Emerald St., P.O. Box 2962, Torrance, CA 90509, Tel: 213-370-3679, FAX: 213-370-5430; Empl.: 35; *Sls. Mgr.:* Fred Kramer

Mini-Circuits

FAX: 718-332-4661

MINI-CIRCUITS LAB., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, Tel: 718-934-4500, TELEX: 125460, 620156 (Int'l); FSC No.: 15542 ... **A•1787-1851**

Local Sales Offices & Reps

AL Huntsville, Beacon Microwave & Instrum., Inc. 205-881-1136
AZ Scottsdale, Thorson Desert States, Inc. 602-998-2444
CA Los Altos, Cain-White & Co. 415-948-6533
CA Tustin, Youngewirth & Olenick Assocs. 714-838-5144
CO Aurora, Thorson Desert States, Inc. ... 303-671-7344
FL Clearwater, Beacon Elctrns. 813-796-2378
FL Longwood, Beacon Elctrns. 407-332-1940
GA Atlanta, Beacon Elctrns. 404-256-9640
IL Mt. Prospect, Cain-Forlaw Co., Inc. 312-253-3578
MD Columbia, M. Lader Co. 202-296-2497
MA Waltman, Scientific Dvcs. 617-890-2252
NM Albuquerque, Thorson Desert States, Inc. 505-293-8555
NY Hartsdale, Spectrum Sls., Inc. 914-472-8600
NY Skaneateles, Robtron 315-685-5731
NY Skaneateles, Robtron, Inc. 315-685-5731
NC Greensboro, M. Lader Co. 919-674-8970
NC Raleigh, Beacon Elctrns 919-787-0330
NC Raleigh, Beacon Elctrns. 919-787-0330
NC Raleigh, M. Lader Co. 919-828-3870
OH Lancaster, Cain Forlaw Co. 614-654-4800
OH Lancaster, Cain-Forlaw Co., Inc. 614-654-4800
OK Tulsa, Beacon Elctrns. 918-622-1494
PA Conshohocken, M. Lader Co. 215-825-3177
PA Lafayette Hill, M. Lader & Co. 215-825-3177
TX Austin, Beacon Elctrns. 512-345-3543
TX Dallas, Beacon Elctrns. 214-437-1505
UT Salt Lake City, Thorson Rocky Mtn., Inc. 801-973-7969
WA Bellevue, Cain-White & Co. 206-462-2118
PR Santurce, Beacon Elctrns. 809-728-5040
Can Brockville, Ont., R.F. Specialists 613-345-2343
Can Ottawa, Ont., Giga-Tron Assocs., Ltd. 613-225-4000
Can Vancouver, B.C., Penstock/Canada ... 604-662-3475

Local Distributors

AL Huntsville, Comp. Distrs., Inc. 205-883-7501
AL Huntsville, Component Distrs., Inc. 205-883-7501
AZ Scottsdale, Spirit Elctrns 800-543-8696, 602-998-1533
AZ Scottsdale, Spirit Elctrns. 602-998-1533
AR Little Rock, Comp. Distrs., Inc. 501-227-6278
CA N. Hollywood, Crown Elctrns. 213-877-3550
CA Sunnydale, Penstock/West 408-730-0300
CA Sunnydale, Penstock, Inc. 408-730-0300
CA Sunnyvale, Penstock, Inc. 408-730-0300
CO Aurora, Spirit Distrs. 303-671-7344
CO Aurora, Spirit Elctrns. 303-671-7344
FL Melbourne, Comp. Distrs., Inc. 305-724-9910
FL Melbourne, Component Distrs., Inc. ... 407-724-9910
GA Norcross, Comp. Distrs., Inc. 404-441-3320
GA Norcross, Component Distrs., Inc. 404-441-3320
IL Mt. Prospect, CFC Distrs., Inc. 312-253-3578
MD Columbia, MLC Distrs. 215-825-3177
NY New Rochelle, RDI Dists. Inc. 914-632-2828
NC Greensboro, MLC Distrs. 919-674-8970
NC Raleigh, Comp. Distrs., Inc. 919-834-9465
NC Raleigh, Component Distrs.,Inc. 919-834-9465
NC Raleigh, MLC Distrs. 919-848-3253
PA Conshohocken, MLC Distrs. 215-825-3177
PA Lafayette Hills, MLC Distrs. 215-825-3177
TX Dallas, Comp. Distrs., Inc. 214-644-0373
TX Dallas, Component Distrs., Inc. 214-644-0373

MINI COMPUTER TECHNOLOGY, 696 E. Trimble Rd., San Jose, CA 95131, Tel: 408-435-1616, TWX: 910-338-2281, FAX: 408-435-2709; Empl.: 22; *Sls. Mgr.:* John P. Lazare; *Dist. Mgr.:* John P. Lazare

MINI-MAGNETICS CO., INC., 1100 Fulton Place, Fremont, CA 94539, Tel: 415-490-7500, FAX: 415-490-7502; Empl.: 45; *Sls. Mgr.:* William Fine

MSI

FAX: 508-695-6076

MINI-SYSTEMS, INC., Thick/Thin Film Division, 20 David Rd., North Attleboro, MA 02761, Tel: 508-695-0203, TWX: 710-348-0564; FSC No.: 50316; Empl.: 150 ..... **A•1997**

Local Sales Offices & Reps

TX Lewisville, C & J Assocs. 214-539-0140

MINI-SYSTEMS, INC., Electronic Package Div., 168 E. Bacon St., P.O. Box 1597, Plainville, MA 02762, Tel: 508-695-2000, TWX: 510-600-4340, FAX: 508-695-8758; *Sls. Mgr.:* Heather Edwards ..... **A•1752**

Local Sales Offices & Reps

CT Fairfield, Wexler-Court Sls. 203-334-1122
NC Raleigh, Spears & Assocs. 919-846-9711
WA Bellevue, Advanced Power Comps. ... 206-747-9127
Can Ontario, CN, Intrade Canada 613-727-1272

MINI-SYSTEMS, INC., Sunbelt Microelectronic Division, 237 Enterprise Rd., Deltona, FL 32725, Tel: 407-574-0208, FAX: 407-574-8262

MINOR RUBBER CO., INC., Ackerman St., Bloomfield, NJ 07003, Tel: 201-338-6800, 800-433-6886, FAX: 201-893-1399; *Sls. Mgr.:* Tom Fitzhenry

MISCO/MINNEAPOLIS SPEAKER CO., INC., 3806 Grand Avenue, Minneapolis, MN 55409, Tel: 612-825-1010, FAX: 612-825-7010; FSC No.: 14208; *Sls. Mgr.:* Don Ringham

MITEC ELECTRONICS, 104 Gun Avenue, Pointe Claire, Quebec, Canada H9R 3X3, Tel: 514-694-6666, TWX: 510-101-2790, FAX: 514-694-3814; FSC No.: FSCM 38494; Empl.: 100; *Sls. Mgr.:* M. Monzon

MITECH ELECTRONICS CORP., 411 Washington St., Otsego, MI 49078, Tel: 616-694-9471, FAX: 616-692-2651; Empl.: 78; *Sls. Mgr.:* Kendall Meyer

MITEL SEMICONDUCTOR, MITEL CORPORATION, 360 Legget Dr., PO Box 13320, Kanata, Ont., Canada K2K 1X5, Tel: 613-592-5630, TELEX: 053 3221, FAX: 613-592-6909; Empl.: 1000; *Sls. Mgr.:* Les Thurlow; *Dist. Mgr.:* Bill Stone

MITEQ INC., 100 Davids Drive, Hauppauge, NY 11788, Tel: 516-436-7400, TELEX: 6718148, FAX: 516-436-7430; Empl.: 210

MITRONICS, P.O. Box 2129, 4000 Palos Verdes Dr.N., Ste. 201, Rolling Hills, CA 90274, Tel: 213-377-2022

MITSUBISHI ELECTRONICS, 991 Knox Street, Torrance, CA 90502, Tel: 213-217-5732, TELEX: 06-4703-M USA LSA, TWX: 66-4787-MELA TRNC; Empl.: 423; *Sls. Mgr.:* Jerry Grimson ,Distbn.Sls.Mgr.; *Dist. Mgr.:* Bob Crooks, OEM, V.P.Sls.

MITSUBISHI ELCTRNS. AMERICA, INC., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086, Tel: 408-730-5900, TELEX: 172296, TWX: 910-339-9549, FAX: 408-749-0453; Empl.: 145; *Sls. Mgr.:* John Zucker; *Dist. Mgr.:* Bob Olszewski

MKC ELECTRONICS CORP., 9205 Quivira Road, Overland Park, KS 66215, Tel: 913-894-9711; Empl.: 26

MKS INSTRUMENTS, INC., Six Shattuck Road, Andover, MA 01810, Tel: 508-975-2350, TELEX: 94-9375, FAX: 508-975-0094; Empl.: 500

MLI INDUSTRIES, INC., 3 East Main Street, Apalachin, NY 13732, Tel: 607-754-5800, FAX: 607-625-2022; Empl.: 485; *Sls. Mgr.:* Michael T. Mackenzie

MMI-MIRCO MACHINES, INC., P. O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, TWX: 910-338-0260; *Sls. Mgr.:* Frank J. Andezzone

MOBILE-TRONICS CO., INC., Box 1022, Tustin, CA 92680, Tel: 714-546-0884; Empl.: 2

MODULAIR, 4674 Aircenter Circle, Reno, NV 89502, Tel: 702-829-2033, FAX: 702-829-2029; Empl.: 50

MODULAR AUDIO PRODUCTS, Modular Devices, Inc., Brookhaven R & D Plaza, One Roned Road, Shirley, NY 11967, Tel: 516-345-3100, FAX: 516-345-3106; *Sls. Mgr.:* C. Liptman

MODULAR DEVICES, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967, Tel: 516-345-3100, FAX: 516-345-3106; FSC No.: 52202; Empl.: 65; *Sls. Mgr.:* C. Liptman ..... **D•1918-1919, 2235**

Local Sales Offices & Reps

AZ Tempe, Piper Sls. Co., Inc. 602-949-0048
CA Huntington Beach, MIL-COM Sls., Inc. 714-840-2424
KS Leewood, Thunderbird Tech. Sls. 913-642-7220
KS Wichita, Thunderbird Tech. Sls. 316-636-5777
MD Linthicum, Advanced Technlg. Sls., Inc. 301-789-9360
MO Maryland Heights, Thunderbird Tech. Sls. 314-298-8940
NM Albuquerque, Piper Sls. Co., Inc. 505-883-9090
NY Great Neck, F & F Metro Inc. 516-482-4080
NY Williamsville, RPN Elctrl. Assoc. 716-881-2121
TX Dallas, M-Rep Co. 214-484-5711
UT Salt Lake City, Piper Sls. Co., Inc. 801-466-9336

MODULAR DEVICES INC., 4115 Spencer St., Torrance, CA 90503, Tel: 213-542-8561, FAX: 213-371-6331; Empl.: 140; *Sls. Mgr.:* A. C. Augusta

MODULAR SYSTEMS, INC., 905 Albemarle St., Charlottesville, VA 22901, Tel: 804-295-7882; Empl.: 5; *Sls. Mgr.:* H. N. Patel

MODUTEC, 920 Candia Rd., Manchester, NH 03103, Tel: 603-669-5121, TELEX: 710-366-0005, FAX: 603-622-2690; Empl.: 300

MOISTURE REGISTER PRODUCTS DIV., Aqua Measure Instrument Co., 2583 Pomona Blvd., Pomona, CA 91768-3267, Tel: 714-594-5545, TELEX: 6503137369 MRP, FAX: 714-595-1218; Empl.: 25; *Sls. Mgr.:* G. Dean Curd

MOLDCON DIV. OF CONTEX ELECTRONICS, 221 Interstate Dr., W. Springfield, MA 01089, Tel: 413-736-0371, FAX: 413-736-9716; Empl.: 200; *Sls. Mgr.:* Robert Krzynowek

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MOLECU-WIRE, P.O. Box 495, Farmingdale, NJ 07727, Tel: 201-938-9473, TWX: 710-723-6943; Empl.: 125 ..... **C•1875-1879**

Local Sales Offices & Reps

CA Montrose, Roger D. Dahl 213-245-3817
CT Orange, KLS Sls. 203-795-6210
MO Independence, Hi Tech Cen. 816-796-6684
KY Louisville, Waddle & Assocs. 502-897-6419
NC Charlotte, QED 704-525-3053
PA Ligonier, Patterson Elec. 412-238-6238
WA Seattle, Comptronics 206-284-4842
WI Mequon, Robco 414-241-3348

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FAX: 312-969-1352

MOLEX, INC., 2222 Wellington Ct., Lisle, IL 60532, Tel: 312-969-4550, TELEX: 25-4069; Empl.: 6,200; *Sls. Mgr.:* Ed Parkinson; *Dist. Mgr.:* Dave Root ..... **B•1814-1815; C•1450-1451, 1880-1881**

Local Sales Offices & Reps

CA Laguna Hills, Molex 714-586-0950
CA Milpitas, Molex 408-946-4700
CO Englewood, Molex 303-779-8321
GA Atlanta, Molex 404-396-6120
IL Lisle, Molex 312-969-4550
IN Indianapolis, Molex 317-299-0099
KY Louisville, Molex 502-245-8337
MA Woburn, Molex 617-935-8983
MI Troy, Molex 313-879-7400
TX Dallas, Molex 214-931-0999

Local Distributors

AL Huntsville, Hamilton/Avnet 205-837-7210
AL Huntsville, Time Elctrns. 205-721-1133
AZ Chandler, Hamilton Avnet 602-961-6400
AZ Phoenix, Force Elctrns. 602-437-1060
AZ Tempe, Harper S.I.D. 602-967-1464
AZ Tempe, Time Elctrns. 602-967-2000
AR Ft. Smith, Carlton Bates 501-646-8201
AR Little Rock, Carlton Bates 501-562-9100
AR Pine Buff, Carlton Bates 501-535-1354
AR Springdale, Carlton Bates 501-756-5012
CA Anaheim, Time Elctrns. 714-937-0911
CA Chatsworth, Hamilton Avnet 818-700-1222
CA Chatsworth, Time Elctrns. 818-998-7200
CA Compton, Harper S.I.D. ... 800-253-5527,213-979-5090
CA Costa Mesa, Avnet Elctrns. 714-754-6111
CA Costa Mesa, Hamilton Electro Sls. 714-641-4110
CA Culver City, Hamilton Avnet 213-558-2143
CA El Segundo, Force Elctrns. 213-772-1324, 714-522-1324
CA Garden Grove, Richey Impact Elctrns. Ltd. 800-227-0060,714-895-0060
CA Gardena, Hamilton Avnet 213-217-6700
CA Ontario, Hamilton Avnet 714-989-4602
CA S. San Francisco, Peters-de Laet 415-873-9595
CA Sacramento, Hamilton Avnet 916-920-3150
CA San Diego, Force Elctrns. 619-569-9661
CA San Diego, Hamilton Avnet 619-571-7510
CA San Diego, Harper S.I.D. 619-578-2500
CA San Diego, Richey Impact Elctrns. Ltd. 619-271-4511
CA San Diego, Time Elctrns. 619-586-1331
CA San Jose, Force Elctrns. 408-435-1324
CA San Jose, Harper S.I.D. 408-943-9490
CA San Jose, Richey Western Elctrns. Ltd. 408-432-7100
CA Sunnyvale, Hamilton Avnet 408-743-3000
CA Sunnyvale, Harper S.I.D. 408-747-0333
CA Sunnyvale, Time Elctrns. 408-734-9888
CA Torrance, Time Elctrns. 213-320-0880
CO Denver, Integrated Elctrns. 303-292-6121
CO Englewood, Hamilton Avent 303-799-7815
CO Englewood, Time Elctrns. 303-799-8851
CO Wheatridge, Bell Inds. 303-424-1985
CT Cheshire, Time Elctrns. 203-271-3200
CT Danbury, Hamilton Avnet 203-797-2800
CT Danbury, Heilind Elctrns. 203-797-8600
CT Wallingford, Sager Elec. Supp. Co. 203-265-4600
FL Ft. Lauderdale, Hamilton Avnet 305-971-2900
CA Ft. Lauderdale, Time Elctrns. 407-484-7784
FL Orlando, Time Elctrns. 407-841-6565
FL St. Petersburg, Hamilton Avnet 813-573-3930
FL Winter Park, Hamilton Avnet 407-628-3888
GA Atlanta, Electro Air Corp. 404-351-3545
GA Norcross, Hamilton Avnet 404-447-7523
GA Norcross, Time Elctrns. 404-448-4448
IL Bensenville, Hamilton/Avnet 312-860-7700
IL Bensenville, Magnuson Elctrns. 312-595-7575
IL Chicago, Waldom Elctrns. Inc. 312-585-1212
IL Crystal Lake, Sub-Sem, Inc. 312-782-3954
IL Wood Dale, Time Elctrns. 312-350-0610
IN Carmel, Hamilton Avnet 317-844-9333
IN Indianapolis, Gateway Megatech 317-844-3906
IA Cedar Rapids, Hamilton Avnet 319-362-4757
KS Overland Pk., Hamilton Avnet 913-888-8900
KY Lexington, Hamilton Avnet 606-259-1475
LA Shreveport, Carlton Bates 318-636-9975
MD Baltimore, Hamilton Avnet 301-995-3500
MD Columbus, Time Elctrns. 301-964-3090
MD Jessup, Gateway 301-792-7527
MA Canton, Richey/Impact Elctrns. Ltd. ... 617-821-1500
MA Hingham, Sager Elec. Supp. Co. 617-749-6700
MA Peabody, Hamilton Avnet 508-532-3701
MA Peabody, Time Elctrns. 508-532-6200
MA Wilmington, Heilind Elctrns. 617-657-4870
MI Ann Arbor, Gateway Megatech 313-761-2980
MI Grand Rapids, Gateway Megatech 616-243-8805
MI Livonia, Gateway Megatech 313-522-4700
MI Troy, Empire Elctrns. 313-585-8130
MN Bloomington, Time Elctrns. 612-944-9192
MN Minneapolis, ICI/Sterling 612-831-2666
MN Minnetonka, Hamilton Avnet 612-932-0600
MO Earth City, Hamilton Avnet 314-344-1200
MO St. Charles, Lectronix ... 800-325-3348,314-946-6424
MO St. Louis, Time Elctrns. 314-391-6444
NH Manchester, Hamilton Avnet 603-624-9400
NH Salem, Sager Elec. Supp. Co. 603-898-1348
NJ Camden, Gen. Radio 609-964-8560
NJ Cherry Hill, Hamilton Avnet 609-424-0100
NJ Clifton, JMAR Elctrns. 201-772-6400
NJ Fairfield, Hamilton Avnet 201-575-3390
NJ Lake Hiawatha, Time Elctrns. 201-316-8644
NM Albuquerque, Hamilton Avnet 505-765-1500
NY Buffalo, Summit Dists. 716-887-2800
NY E. Syracuse, Time Elctrns. 315-432-0355
NY Hauppauge, Sager Elctrns. 516-348-1300
NY Hauppauge, Time Elctrns. 516-273-0100
NY Rochester, Hamilton Avnet 716-475-9130
NY Syracuse, Hamilton Avnet 315-437-2641/2541
NC Charlotte, Time Elctrns. 704-522-7600
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OH Cleveland, Hamilton Avnet 216-831-3500
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OH Willoughby, Gateway Megatech 800-MEGATECH
OK Oklahoma City, Carlton Bates 405-691-4446
OK Tulsa, Carlton Bates 918-250-1626
OK Tulsa, Hamilton Avnet 918-252-7297
OR Lake Oswego, Hamilton Avnet 503-635-8157
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MA Marlborough 617-481-8100
MA Woburn 617-932-9700
MI Detroit/Westland 313-261-6200
MN Minneapolis 612-941-6800
MO St. Louis 314-872-7681
NJ Hackensack 201-488-1200
NY Fairport 716-425-4000
NY Hauppauge 516-361-7000
NY Poughkeepsie/Fishkill 914-473-8102
NC Raleigh 919-876-6025
OH Cleveland 216-349-3100
OH Columbus/Worthington 614-846-9460
OH Dayton 513-294-2231
OH Tulsa 513-436-6800
OK Portland 918-664-5233
PA Philadelphia/Horsham 215-443-9400
TN Knoxville 615-690-5593
TX Austin 512-452-7673
TX Houston 713-783-6402
TX Irving 214-550-0770
TX Richardson 214-699-3900
VA Charlottesville 804-977-3691
WA Bellevue 206-454-4160
WA Seattle 206-622-9960
WI Milwaukee/Brookfield 414-792-0122
Can Montreal, Que. 514-731-6881
Can Ottawa, Ont. 613-226-3491
Can Toronto, Ont. 416-497-8181
Can Vancouver, BC 604-434-9134
Can Winnipeg, Manitoba 204-783-3388

Motorola Component Representatives

NV Reno, Galena Technology Grp. 702-786-5030
NM Albuquerque, S & S Technologies, Inc. 505-255-5599
WA Spokane, Doug Kenley 509-924-2322

Hybrid Components Resellers

CA Elmo Semiconductor Corp. 818-768-7400
CA Semi Dice 213-594-4631
MA Massachusetts Components Inc. 617-535-7270
MA Sertech Labs Inc. 617-531-8673
TX Minco Technology Labs Inc. 512-339-3436

MOTOR TECHNOLOGY, INC., 2798 Culver Ave., Dayton, OH 45429, Tel: 513-294-1041, FAX: 513-294-8336; Empl.: 35 .... **B•1284-1287**

Local Sales Offices & Reps

OH Dayton, Motor Technology, Inc. 513-294-1041

MOTOR-TRONICS, INC., 2142 Industrial Ct., Bldg. 'F', Vista, CA 92083, Tel: 619-727-7430; *Sls. Mgr.:* Bill Linko

Distributor

MOUSER ELECTRONICS, 11433 Woodside Ave., Santee, CA 92071, Tel: 619-449-2222, TWX: 910-331-1175; Empl.: 200; *Sls. Mgr.:* J. L. Kahler

MOUSER ELECTRONICS, 2401 Hwy. 287 North, Mansfield, TX 76063, Tel: 800-346-6873, FAX: 817-483-0931; Empl.: 200; *Sls. Mgr.:* J. Treadway

MOXNESS PRODUCTS, INC., Versa Technologies, 1914 Indiana St., Racine, WI 53405, Tel: 414-554-5050, 800-558-5706, FAX: 414-554-2321; Empl.: 300; *Sls. Mgr.:* Ronald M. Buono; *Dist. Mgr.:* Ronald M. Buono

MPB CORP., Miniature Precision Bearings Div., Precision Park, Keene, NH 03431, Tel: 603-352-0310, TWX: 710-366-1801; Empl.: 1600; *Dist. Mgr.:* R. F. Chartier

M P C, 150 S. Harbor Blvd. Unit J, Santa Ana, CA 92704, Tel: 714-775-0211, FAX: 714-775-1674; Empl.: 25; *Sls. Mgr.:* Sam Granat

MPC, Div. of Consulting Systems, 638 Main St., Danville, NH 03819, Tel: 603-642-5913, FAX: 603-642-5913; *Sls. Mgr.:* W. Morse ..... **D•1921**

Local Distributors

TN	Knoxville, Indl. Elctrns.	615-573-7135

MRL, Missouri Research Labs., 3800 West Clay, St. Charles, MO 63301, Tel: 314-946-6900, 1-800-325-0223, FAX: 314-946-2860; Empl.: 100; *Sls. Mgr.:* Virgil Beer

MSC TECHNOLOGIES, INC., 2600 San Tomas Expressway, Santa Clara, CA 95051, Tel: 408-988-0211, TELEX: 467848; *Sls. Mgr.:* David Witkowski; *Dist. Mgr.:* Alan Pettit

MSI ELECTRONICS, INC., 34-32 57th St., Woodside, NY 11377, Tel: 718-672-6500, TELEX: 426407, FAX: 718-397-0972; FSC No.: 18518; Empl.: 22; *Sls. Mgr.:* A. Lederman

Local Sales Offices & Reps

AL	Huntsville, Murcota	205-539-8476
AZ	Mesa, Fetty/Schoenduve	602-241-9009
CA	San Diego, Fetty/Schoenduve	619-292-5136
CA	El Segundo, Fetty/Schoenduve	213-322-4991
CA	Palo Alto, Tri-Rep	415-965-1822
FL	Brandon, R. C. Simon & Co.	813-689-6524
FL	Lighthouse Pt., R. C. Simon & Co.	305-941-2757
IL	Arlington Hgts., Phoenix Elctrns.	312-394-4422
IN	Ft. Wayne, Menze Sls. Inc.	219-747-5616
MD	Laurel, CSDS Inc.	301-792-9850
MA	Framingham, Stone Comp. Sls.	508-875-3266
MO	Grandview, R.R. Burton & Assoc.	816-763-5385
NC	Winston-Salem, Murcota	919-722-9445
TX	Richardson, Eagle Mktg. Inc.	214-238-5383
WA	Bellevue, Caruso & Co.	206-455-8811
Can	St. Laurent, Que., Componetics Ltd.	514-334-1464

MTE CORP., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, Tel: 414-358-5300; *Sls. Mgr.:* T. Kettner

MTI TECHNOLOGY CORPORATION, 6385 Rose Lane, Carpinteria, CA 93013, Tel: 805-684-6676, FAX: 805-684-6319; *Sls. Mgr.:* William Henrikson

FAX: 605-665-1709

M-TRON INDUSTRIES, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, Tel: 605-665-9321, TWX: 910-668-3603; FSC No.: 23875; Empl.: 150; *Sls. Mgr.:* S. D. Sinkler ..... **A•1438-1439**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
AZ	Phoenix, Howe & Howe Sls., Inc.	602-264-7971
CA	Santa Clara, Electec Sls. Inc.	408-496-0706
CA	Thousand Oaks, SC Cubed	805-496-7307
CA	Tustin, SC Cubed	714-731-9206
CO	Littleton, Simpson Assoc.	303-794-8381
CT	Broad Brook, Comptech	203-623-8014
FL	Ft. Lauderdale, QXI of Florida	305-978-0120
FL	Orlando, QXI of FL	407-423-3682
FL	St. Petersburg, QXI of Florida	813-894-4556
GA	Norcross, Hughes Assocs.	404-662-1587
IL	Arlington Hgts., KMA Sls.	312-398-5300
IN	Ft. Wayne, Alpha Tech, Inc.	219-447-0040
IA	West Des Moines, SPS Assoc.	515-225-0607
KS	Olathe, SPS Assoc.	913-764-4460
KS	Wichita, SPS Assocs.	316-733-4415
MD	Hunt Valley, Eagle Sls.	301-666-3930
MA	Tyngsboro, Comptech, Inc.	508-649-3030
MI	Farmington Hills, Tritech Sls., Inc.	313-553-3370
MN	Eden Prairie, Com-Tek Sls.	612-941-7181
MS	Corinth, Hughes Assocs. Inc.	601-287-2915
MO	Earth City, SPS Assoc.	314-291-0520
NE	Panama, SPS Assoc.	913-764-4460
NJ	E. Brunswick, Winch Sls. Assocs.	201-613-1515
NJ	Marlton, Naudain Assoc., Inc.	609-983-5300
NM	Albuquerque, Syntech	505-266-7951
NY	Pittsford, James E. Zimmerman Sls.	716-381-3186
NY	Plainview, Winch Sls. Assocs.	516-681-3163
NC	Raleigh, Blue Ridge Sls.	919-876-1883
OH	Dayton, Lyons Corp.	513-278-0714
OH	Richfield, Lyons Corp.	216-659-9224
OH	Westerville, Lyons Corp.	614-895-1447
TN	Jonesboro, Hughes Assocs.	205-533-9108
TX	Austin, Texoma Tech. Sls.	512-441-1771
TX	Freeport, Texoma Tech. Sls.	409-233-8192
TX	Houston, Texoma Tech. Sls.	713-462-1432
TX	Richardson, Texoma Tech. Sls.	214-238-8127
UT	Midvale, Simpson Assoc.	801-566-3691
WA	Redmond, Quadra Sls.	206-883-3550
WI	Milwaukee, KMA Sls.	414-259-1771
Can	Mississaqua, Ontario, John Weiss Co.	416-673-0011
Can	Ottawa, Ont., John Weiss Co.	613-825-0545
Can	St. Laurent, Quebec, John Weiss Co.	514-377-5022
Can	Vancouver, B. C., John Weiss Co.	604-873-1112

Local Distributors

AL	Huntsville, Bell Inds.	205-837-1074
AL	Huntsville, Pioneer Elctrns.	205-837-9300
AZ	Phoenix, Sterling Elect.	602-268-2121
AZ	Phoenix, Wyle Distr. Grp.	602-437-2088
AZ	Tempe, Bell Inds.	602-966-7800
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Agoura Hills, Western Micro	818-707-0377
CA	Calabasas, Wyle Labs.	818-880-9000
CA	Chatsworth, Image Elctrns.	818-407-8850
CA	El Segundo, Wyle Labs.	213-322-8100
CA	Fullerton, Pyramid Elctrns.	714-773-0781
CA	Garden Grove, Bell Inds.	714-895-7801
CA	Gardena, Bell Inds.	213-515-1800
CA	Irvine, Wyle	714-863-9953
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Orange, Western Micro	714-637-0200
CA	Rancho Cordova, Wyle	916-638-5282
CA	Roseville, Bell Inds.	916-652-0414
CA	San Diego, Bell Inds.	619-268-1277
CA	San Diego, Image Elctrns.	619-271-6555
CA	San Diego, Western Micro	619-453-8430
CA	San Diego, Wyle	619-565-9171
CA	San Jose, Compass Comps.	408-432-7525
CA	Santa Clara, Pyramid	408-727-9810
CA	Santa Clara, Wyle Distr. Grp.	408-727-2500
CA	Stanton, Inductive Comp/Crystal	714-828-3420
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Thousand Oaks, Bell Inds.	805-499-6821
CA	Tustin, Image Elctrns.	714-259-0900
CO	Englewood, Sterling Elctrns.	303-792-3939
CO	Thornton, Wyle Distr. Grp.	303-457-9953
CO	Wheatridge, Bell Inds.	303-424-1985
CT	E. Haven, J. V. Elctrns.	203-469-2321
CT	Norwalk, Pioneer Elctrns.	203-853-1515
FL	Altamonte Springs, Pioneer	407-834-9090
FL	Deerfield Bch., Bell Inds.	305-421-1997
FL	Deerfield Beach, Pioneer Elctrns.	305-428-8877
FL	Largo, Bell Inds.	813-541-4434
GA	Norcross, Bell Inds.	404-662-0923
GA	Norcross, Pioneer Elctrns.	404-448-1711
IL	Addison, Pioneer Elctrns.	312-495-9680
IL	Elk Grove Vl., Bell Inds.	312-640-1910
IL	Rosemont, Advent Elctrns.	312-297-6200
IL	Urbana, Bell Inds.	217-328-1077
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Advent	317-872-4910
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Pioneer Elctrns.	317-849-7300
IA	Cedar Rapids, Advent	319-363-0221
IA	Cedar Rapids, Bell Inds.	319-395-0730
KS	Lenexa, Pioneer Elctrns.	913-492-0500
MD	Baltimore, Resco Washington	301-529-0500
MD	Beltsville, Resco/Wash.	301-937-9100
MD	Gaithersburg, Pioneer	301-921-0660
MA	Billerica, A. W. Mayer Co. Inc.	508-229-2255
MA	Lexington, Pioneer Elctrns.	617-861-9200
MA	Wilmington, J.V. Elctrns.	508-657-6523
MA	Winchester, Bell Inds.	617-729-5800
MI	Ann Arbor, Bell Inds.	313-971-9093
MI	Farmington Hills, Advent Elec.	313-477-1650
MI	Grand Rapids, Pioneer Elctrns.	616-698-1800
MI	Livonia, Pioneer Elctrns.	313-525-1800
MN	Bloomington, All American	612-884-2220
MN	Eden Prairie, Pioneer	612-944-3355
MN	Hibbing, Minntech Elctrns.	218-262-5228
MN	Minneapolis, Stark Elec.	612-332-1325
MO	St Louis, Ric-tronics	314-576-9816
NH	Hudson, Bell Inds.	603-882-1133
NH	Nashua, Brevan Elctrns.	603-889-7230
NJ	Berlin, GCI	609-768-6767
NJ	Mt. Laurel, P.A.C. Elctrns.	609-234-1940
NJ	Pinebrook, Pioneer Elctrns.	201-575-3510
NM	Albuquerque, Bell Inds.	505-292-2700
NM	Albuquerque, Sterling Elect.	505-884-1900
NY	Binghamton, Pioneer Elctrns.	607-722-9300
NY	Bohemia, Key Comps. Inc.	516-567-7500
NY	Fairport, Pioneer	716-381-7070
NY	Farmingdale, Bell Inds.	516-752-9303
NY	Ronkonkoma, M-Tron Comps.	516-467-5100
NY	Stony Brook, Dove Elctrns.	516-689-7733
NY	Woodbury, Pioneer Elctrns.	516-921-8700
NC	Charlotte, Pioneer Elctrns.	704-527-8188
NC	Durham, Pioneer Elctrns.	919-544-5400
NC	Raleigh, Century Elctrns.	919-782-2116
NC	Raleigh, QC Southeast Inc.	919-876-7767
OH	Cleveland, Pioneer Elctrns.	216-587-3600
OH	Dayton, Bell Inds. (Industrial)	513-435-8660
OH	Dayton, Bell Inds. (Military)	513-434-8231
OH	Dayton, Pioneer Elctrns.	513-236-9900
OK	Oklahoma City, Radio Inc.	405-789-0741
OK	Tulsa, Altair	918-252-5781
OK	Tulsa, Radio Inc.	918-587-9123
OR	Hillsboro, Wyle Distr. Grp.	503-640-6000
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Horsham, Pioneer Elctrns.	215-674-4000
PA	Norristown, Century Elec.	215-631-5400
PA	Pittsburgh, Pioneer Elctrns.	412-782-2300
TN	Nashville, Bell Inds.	615-367-4400
TX	Austin, Altair	512-837-4970
TX	Austin, Pioneer	512-835-4000
TX	Austin, Wyle Distr.	512-834-9957
TX	Dallas, Pioneer Elctrns.	214-386-7300
TX	Houston, Altair	713-462-3029
TX	Houston, Pioneer	713-988-5555
TX	Houston, Wyle Laboratories	713-879-9953
TX	Richardson, Altair	214-231-5166
TX	Richardson, Bell Inds.	214-690-0466
TX	Richardson, Wyle Electric	214-235-9953
UT	Salt Lake City, Bell Inds.	801-255-9611
UT	Salt Lake City, Standard Supp.	801-486-3371
UT	Salt Lake City, Wyle Distr. Grp.	801-974-9953
VA	Herndon, Sterling Elctrns.	703-742-8400
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Bell Inds.	206-885-9963
WA	Kent, Pyramid Elec.	206-872-5800
WA	Redmond, Priebe Elctrns.	206-881-2363
WA	Redmond, Wyle Distr. Grp.	206-881-1150
WI	Milwaukee, Marsh Elect.	414-475-6000
WI	Waukesha, Bell Inds.	414-547-8879
Can	Brampton, Ont., Zentronics	416-451-9600
Can	Burnaby, BC, R A E Ltd.	604-291-8866
Can	Calgary, AB, Cardinal Elec. Ltd.	306-934-3443
Can	Calgary, AB, R-A-E Ltd.	403-253-8575
Can	Calgary, AB, Saynor Varah	403-255-9550
Can	Calgary, AB, Zentronics	403-295-8838
Can	Concord, Ont., R A E Ltd.	416-736-1144
Can	Dartmouth, NS, R A E Ltd.	902-465-2350
Can	Don Mills, Ont., Saynor Varah	416-445-0723
Can	Edmonton, AB, R A E Ltd.	403-451-4001
Can	Edmonton, AB, Zentronics	403-484-1669
Can	Edmonton, ALB., Cardinal Elec.	403-483-6266
Can	Moncton, NB, R A E Ltd.	506-857-8011
Can	Montreal, Que., Versatech	514-481-0196
Can	Nepean, Ont., R-A-E- Ltd.	613-226-7406
Can	Nepean, Ont., Zentronics	613-226-8840
Can	Richmond, B.C., Saynor Varah	884-273-2911
Can	Richmond, B.C., Zentronics	604-273-5575
Can	Saskatoon, SK, Cardinal Elec. Ltd.	306-934-3443
Can	Saskatoon, SK, R A E Ltd.	306-933-2888
Can	St. Laurent, QB, R-A-E Ltd.	514-335-7697
Can	Willowdale, Ontario, Electro Sonic	416-494-1666
Can	Winnepeg, MB, Zentronics	204-694-1957
Can	Winnepeg, MN, Saynor Varah	204-783-3105
Can	Winnipeg, MN, R A E Ltd.	204-786-8401

MTS SYSTEMS, Box 24012, Minneapolis, MN 55424, Tel: 612-937-4000, TELEX: 163548 MULAM DL, FAX: 214-333-3533; Empl.: 1300; *Sls. Mgr.:* Ted Beaudoin

FAX: 216-771-3068

MUELLER ELEC. CO., 1583 E. 31st St., Cleveland, OH 44114, Tel: 216-771-5225; Empl.: 156; *Sls. Mgr.:* J. E. Wisneski ..... **C•1452-1459**

Local Sales Offices & Reps

AZ	Phoenix, The Heath Grp.	602-248-9091
CA	Gardena, Ungar Sls. Assocs.	213-532-6837
CA	Mountainview, Del Bucchia/Onken	415-965-8045
GA	Buckhead, Mfg. Sls. & Mktg.	404-342-3503

IL Bensenville, Heighway Tech. Sls. 312-860-7900
IN Indianapolis, M & L Elctrns. 317-359-4742
MD Randallstown, Chesapeake Inds. 301-653-0476
MA Adams, Richard W. Bieniek Assocs. ... 413-743-4164
MA Lynnfield, Keene Sls. Co. 617-245-9400
MA Springfield, Keene Sls. Co. 413-525-1049
MI Royal Oak, Hilltronics 313-435-0920
MN Minneapolis, Boerger & Assocs. 612-561-2819
MS Hattiesburg, Mfg. Sls. & Mktg. 601-264-4755
MO St. Louis, Thomas L. Dowell & Assoc. 314-849-4234
NJ Clifton, R.O.I. Sls. Co. 201-340-1515
NJ Medford, Champion Elctrns. 609-983-0932
NY Rochester, Richard W. Bieniek 716-342-3098
OR Portland, Jud Lebrun Co. 503-244-6805
PA Pittsburgh, F. P. Yarussi Co. 412-221-1717
SC Ft. Lawn, Electronic Specialists Co. ... 803-872-4454
TN Memphis, Mfg. Sls. & Mktg. 901-377-5382
TX Austin, SW Mktg. Assocs. 512-225-8010
TX Dallas, SW Mktg. Assocs. 214-341-8631
TX Houston, SW Mktg. Assocs. 713-537-8166
Can Markham, Ont., Birde Mktg. Inc. 416-477-7722

Local Distributors

AL Lafayette, Ralph's Elctrns. 318-233-0105
AZ Tucson, Electronic City 602-622-1173
AR Little Rock, Carlton Bates Co. 501-562-9100
CA Covina, Selecta-Switch 800-722-6445
CO Denver, Ryall Elec. 303-629-7721
FL Orlando, EMSCO/Hammond 407-849-6060
IL Bensenville, Ohio Test Equip. 312-860-7900
IA Cedar Rapids, Dee Elctrns. 319-365-7551
MD Rockville, Capitol Radio Wholesale ... 301-881-2270
MA Hingham, Sager Elctrl. Supp. 617-749-6700
MI Livonia, Chelsea Inds. 313-525-1155
MN Minneapolis, Stark Elctrn. Supp. Co. ... 612-332-1325
MO Maryland Hgts., Chelsea Inds. 314-997-7709
NE Lincoln, Scott Elctrn. Supp. Corp. 402-466-8221
NJ South Hackensack, Nassor Elec. Supp. Co. 201-641-3737
NY Rochester, Masline Elec. 716-546-5373
OH Dayton, Carver Supp. 513-461-9673
PA York, York Elctrl. Supp. 717-843-9991
SC Charleston, Cameron & Barkley Co. 803-554-9550
TX Ft. Worth, Allied Elctrns. 817-265-9341
UT Salt Lake City, Kimball Elctrns. 801-328-2075
WA Seattle, Radar Elec. Co. 206-282-2511
WV Huntington, State Elec. Supp. 304-523-7491
WI Milwaukee, Marsh Elctrns. 414-475-6000
Can Downsview, Ont., Westburn Indl. Entprs. Ltd. 416-635-2950

MULTI-AMP CORP., TBG, 4271 Bronze Way, Dallas, TX 75237, Tel: 214-333-3201, TELEX: 163548 MULAM DL, FAX: 214-333-3533; Empl.: 350; *Sls. Mgr.:* Robert D. Libbey

MULTICOMP., INC., 3005 S.W. 154th No. 3, Beaverton, OR 97006, Tel: 503-626-4200, FAX: 503-643-4889; Empl.: 150 ..... **A•1125, 2362; D•1923**

MULTI-CONTACT USA, 616 Davis St, Santa Rosa, CA 95401, Tel: 707-575-7575, FAX: 707-575-7573; *Sls. Mgr.:* Walter Roberts; *Dist. Mgr.:* Walter Roberts ..... **C•1460-1462**

MULTICORE SOLDERS, Cantiague Rock Rd., Westbury, NY 11590, Tel: 516-334-7997, TWX: 510-222-5185, FAX: 516-334-7098; Empl.: 1000

MULTIPOWER, INC., MultiComp., Inc., 3005 S.W. 154th Terrace No. 1, Beaverton, OR 97006, Tel: 503-646-4700, FAX: 503-643-4889; FSC No.: 75498; Empl.: 24 ..... **A•1125, 2362; D•1923**

Local Sales Offices & Reps

OR Beaverton, MultiPower, Inc. 503-646-4700

MULTI PRODUCTS INTERNATIONAL, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, Tel: 201-239-8183, TELEX: 219289, FAX: 201-239-8449; Empl.: 25; *Sls. Mgr.:* LeRoy Gray ..... **A•1134, 2363; D•1924**

Local Sales Offices & Reps

CA Santa Clara, Nova Tronix 408-727-9530
CA Westminster, West Elctrn. Sls. 714-898-0120,
UT Ogden, Taylor Mktg. 801-546-9570,
FL Longwood, Elctrn. Mfgs. Agt. 305-682-1202,
GA Lawrenceville, Tek Rep Mktg. 404-963-1600
IL Des Plaines, Esco Assocs. 312-298-5310
IN Frankfort, C-S Elctrns. Sls. 317-659-1874
KS Overland Park, Electri-Rep 913-649-2168
MD Ellicott City, Eastern Tech. Corp. 301-461-7720
MA Norwood, Mac Innis Co. 617-762-8090
MI Lathrup Vl., R. C. Nordstrom & Co. 313-559-7373
MN St. Paul, Proud Inds. 612-646-9428
NJ Cedar Grove, Legtonics Assocs. 201-239-4098
NY Fairport, Hi Tec Sls. 716-223-5922,
OH Dayton, K.W. Elctrn. 513-890-2150
TX Dallas, MGR Elctrns. 214-238-5246
WA Bellevue, Eltech 206-643-4330
Can Lachine, Bytewide Mktg. 514-636-4121

MULTI-TECH SYSTEMS, INC., 2205 Woodale Dr., Mounds View, MN 55112, Tel: 612-785-3500, 800-328-9717, FAX: 612-785-9874; Empl.: 170; *Sls. Mgr.:* Thomas Heimerman; *Dist. Mgr.:* Peter Hanlon/Jan Hubbard/Jim Stackiie

MULTIWIRE DIVISION, Kollmorgen Corp., 250 Miller Place, Hicksville, NY 11801, Tel: 516-933-8300, TWX: 510-223-0639; Empl.: 500; *Sls. Mgr.:* Frank Melaccio

MUPAC CORP., Carlo Gavazzi Co., 10 Mupac Dr., Brockton, MA 02401, Tel: 508-588-6110, FAX: 508-588-0498; Empl.: 130; *Sls. Mgr.:* James L. Gallagher ..... **C•1060-1061, 1716-1717**

Local Sales Offices & Reps

AL Huntsville, Elec. Man. Assocs. 205-830-4030
AZ Tempe, Piper Sls. 602-949-0048
CA Burbank, Gemini Assocs. 818-846-2633
CA Los Alamitas, Gemini Assocs. 213-594-9618
CA San Diego, Hadden Assocs. Inc. 619-565-9444
CA Santa Clara, Interconnect Sls. Grp. 408-980-1166
CA Sepulveda, Gemini Assocs. 818-891-1000
CA Sunnyvale, Computer Modules 408-737-7727
CA Tustin, Gemini Assocs. 714-838-1675
CA West Covina, Mupac - West Coast Off. 213-960-3042
CO Longmont, Piper Sls. Co. 303-443-5337
FL Jupiter, Southern Elctrns. Sls. Co. 305-744-0028
FL Melbourne, Southern Elctrn. Sls. 407-242-9661
GA Norcross, Macro Mktg. Assocs. 404-662-5580
IL Hoffman Estates, Micro-Tex 312-382-3001
IL Hoffman Estates, Micro-Tex, Inc. 312-382-3001
IN Batesville, Applied Data Mgt. 317-257-8949
MD Baltimore, Rep-Tron 301-799-7490
MA Brockton, Mupac Corp. 508-588-6110
MI Whitmore Lake, Applied Data Mgt. 313-965-5859
MN Minneapolis, L. F. Green Assoc. 612-571-6666
MO Grandview, Digital Sys. Sls. 816-765-3337
NM Albuquerque, Piper Sls. Co. 505-883-9090
NY Great Neck, F & F Metro, Inc. 516-482-4080
NY Syracuse, Labtronics 315-455-7314
OH Cincinnati, Applied Data Mgt. 513-579-8108
OK Tulsa, Milco Mktg., Inc. 214-783-2716
OR Milwaukie, Comtec 503-654-6626
PA Norristown, RJI 215-631-1414
PA Pittsburgh, Applied Data Mgt. 412-642-4202
TX Houston, Lear Assoc. 713-488-7893
TX Richardson, Lear Assocs. 214-231-5388
TX Richardson, Milco Mktg. 214-783-2716
TX Seagoville, Delta Comps. 214-287-6333
UT Salt Lake City, Piper Sls. 801-466-9336
WA Bellevue, Comtec 206-453-1188
WI Waukesha, Micro-Tex, Inc. 414-542-5352
Can Ontario, Indl. Computer Prods. 416-849-1681

MURATA ERIE NORTH AMERICA, INC., 2200 Lake Park Dr., Smyrna, GA 30080, Tel: 404-436-1300, TELEX: 54-2329, TWX: 810-766-1531, FAX: 404-436-3030; Empl.: 1800; *Sls. Mgr.:* Jack Driscoll; *Dist. Mgr.:* Kenneth O'Connor ..... **A•1135-1139, 1440-1441, 1708-1709, 1852, 1998-1999, 2135-2137; B•1967; D•1044-1046**

Local Sales Offices & Reps

AL Madison, Jack Harvey & Assoc., Inc. .. 205-461-8591
AZ Scottsdale, Thom Luke Sls. 602-941-1901
CA Chatsworth, Murata Erie 818-701-9702
CA El Toro, English/Damco Sls. Co. 714-837-3801
CA Los Altos, Recht Assocs. 415-964-6321
CA San Diego, Harvey King, Inc. 619-587-9300
CA Tustin, Murata Erie 714-832-9972
CO Boulder, Front Range Mktg. 303-443-4780
FL Clearwater, Glen White Assocs. 813-726-0577
FL Ft. Lauderdale, Glen White Assocs. 305-977-5885
FL Maitland, Murata Erie 407-644-0954
GA Norcross, Jack Harvey & Assocs. 404-449-4643
IL Park Ridge, Metcom Assoc. Corp. 312-696-1490
IN Indianapolis, Jack Harvey & Assocs., Inc. 317-872-1031
IN Kokomo, Jack Harvey & Assoc., Inc. .. 317-453-4260
IA Cedar Rapids, C-Tron, Inc. 319-373-2029
KS Olathe, C-Tron, Inc. 913-829-0073
KY Prospect, Jack Harvey & Assoc., Inc. .. 502-228-4100
MD Baltimore, Glen White 301-321-7235
MD Baltimore, Murata Erie 301-494-0405
MD Columbia, Murata Erie 301-992-6612
MA North Adams, Jack Harvey & Assoc., Inc. 413-664-9993
MA Wakefield, Murata Erie 617-245-7880
MA Westwood, Apex Assocs. 617-326-5042
MI Allendale, Jack Harvey & Assoc., Inc. 616-895-5605
MI W. Bloomfield, Jack Harvey & Assoc., Inc. 313-737-9122
MN Minneapolis, Stan Clothier Co., Inc. 612-944-3456
MO St. Charles, C-Tron, Inc. 314-928-8078
NJ Springfield, Radix, Inc. 201-467-4970
NY Fairport, Technology Sls., Inc. 716-223-7500
NC Raleigh, Glen White Assoc. 919-848-1931
OH Dayton, KW Electrn. Sls., Inc. 513-890-2150
OH Shaker Hgts., KW Elctrn. Sls., Inc. 216-491-9177
OR Beaverton, Murata Erie 503-646-4973
PA Allison Park, KW Elctrn., Inc. 412-487-4300
TN Knoxville, Jack Harvey & Assoc., Inc. 615-524-7057
TX Austin, RAM Elec. Sls., Inc. 512-345-2982
TX Richardson, RAM Elec. Sls., Inc. 214-669-9911
UT Midvale, Front Range Mktg. 801-566-2500
VA Lynchburg, Glen White Assocs. 804-385-6110
WA Kirkland, Murata Erie 206-827-8282
WI West Allis, Metcom Assoc. Corp. 414-476-1300
PR Hato Rey, Semtronic Assocs., Inc. 809-766-0700

Local Distributors

AL Huntsville, Time Elctrns. 205-721-1133
AZ Phoenix, Future Elctrns. 602-968-7140
AZ Phoenix, Sterling Elctrns. 602-268-2121
AZ Tempe, Acacia Sls./Deanco 602-894-2874, 602-882-9054
AZ Tempe, Time Elctrns. 602-967-2000
CA Agoura Hills, Time Elctrns. 818-707-2890
CA Amarillo, Milgray Elctrns. 805-484-4055
CA Anaheim, Time Elctrns. 714-937-0911
CA Chatsworth, Future Elctrns. 818-772-6240
CA Chatsworth, Passive Technlg. 818-882-2277
CA Chatsworth, Time Elctrns. 818-998-7200
CA Garden Grove, Natl. Elctrns. Corp. 714-892-7749
CA Inglewood, Newark Elctrns., Inc. 213-671-7377
CA Irvine, Acacia Sls./Deanco 213-971-2428, 714-660-0834
CA Irvine, Future Elctrns. 714-250-4141
CA San Diego, Acacia Sls./Deanco 619-565-4365
CA San Diego, Future Elctrns. 619-278-5020
CA San Diego, Time Elctrns. 619-586-1331
CA San Jose, Future Elctrns. 408-434-1122
CA San Jose, Future Elctrns. 408-434-1114
CA San Jose, Passive Technlg. 408-435-5566
CA Sunnyvale, Acacia Sls./Deanco 408-745-7200, 916-442-5300
CA Sunnyvale, Capsco Sls., Inc. 408-734-3020
CA Sunnyvale, Time Elctrns. 408-734-9888
CA Torrance, Time Elctrns. 213-320-0880
CO Denver, Newark Elctrns. 303-757-3351
CO Englewood, Sterling Elctrns. 303-792-3939
CO Englewood, Time Elctrns. 303-799-8851
CO Lakewood, Acacia Sls./Deanco 303-232-2882
CO Westminister, Future Elctrns. 303-421-0123
CT Cheshire, Time Elctrns. 203-271-3200
CT Milford, Milgray Elctrns. 203-878-5538
CT Wallingford, Cronin Elctrns. 203-265-3134
FL Ft. Lauderdale, Time Elctrns. 305-484-7778
FL Orlando, Time Elctrns. 407-841-6565
FL Winter Park, Milgray Elctrns. 407-647-5747
GA Norcross, Milgray Elctrns. 404-446-9777
GA Norcross, Spectrum Elctrns. 404-448-1516
GA Norcross, Time Elctrns. 404-448-4448
IL Arlington Hgts., Milgray Elctrns. 312-253-1212
IL Chicago, Newark Elctrns. 312-784-5100
IL Elk Grove Village, Gould Elctrns. Corp. 312-860-7171
IL Rosemont, Advent Elctrns., Inc. 312-297-6200
IL Wooddale, Time Elctrns. 312-350-0610
IN Indianapolis, Advent Elctrns. 317-872-4910
IA Cedar Rapids, Advent Elctrns. 319-363-0221
KS Lenexa, Sterling Elctrns. 913-492-5406
KS Overland Park, Milgray Elctrns. 913-236-8800
MD Beltsville, Resco(Washington) 301-937-9100
MD Columbia, Milgray Elctrns. 301-621-8169
MD Columbia, Time Elctrns. 301-964-3090
MD White Marsh, Resco(Baltimore) 301-529-0500
MA Hopkinton, Interface Elctrns. Corp. 508-435-6858
MA Needham, Cronin Elctrns. 617-449-5000
MA Peabody, Time Elctrns. 508-532-9757
MA Wilmington, Milgray Elctrns. 617-657-5900
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Oak Park, Newark Elctrns. 313-967-0600
MN Edina, Time Elctrns. 612-835-1250
MN Minneapolis, Newark Elctrns. 612-331-6350
MN Minneapolis, Sterling/I.C.I. 612-831-2666
MO St. Louis, Time Elctrns. 314-391-6444
NH Manchester, Cronin Elctrns. 603-624-0105
NJ Mariton, Milgray Elctrns. 609-983-5010
NJ Morganville, Varitech Elctrns. 201-591-8801
NJ Parsippany, Milgray Elctrns. 201-335-1766
NJ Pine Brook, Time Elctrns. 201-882-4611
NJ Rockaway, Tonar Inds. 201-586-9000
NM Albuquerque, Sterling Elctrns. 505-884-1900
NY Airport, Time Elctrns. 516-383-8853
NY E. Syracuse, Time Elctrns. 315-432-0355
NY Hauppauge, Time Elctrns. 516-273-0100
NY Rochester, Milgray Elctrns. 716-235-0830
NC Charlotte, Elctrn. Mktg. Corp. 704-394-6195
NC Charlotte, Time Elctrns. 704-522-7600

NC Oxford, Time Elctrns. 919-693-5166
OH Cleveland, Milgray Elctrns. 216-447-1520
OH Columbus, Elctrn. Mktg. Corp. 614-299-4161
OH Dublin, Time Elctrns. 614-761-1100
OH Highland Hgts., Elctrn. Mktg. Corp. 216-442-3441
OH Highland Hts., Elctrn. Mktg. Corp. 216-442-3441
OH Kettering, Elctrn. Mktg. Corp. 513-439-4711
OH Valleyview, Newark Elctrns. 216-447-8860
OK Tulsa, Sterling Elctrns. 918-663-2410
OR Beaverton, Acacia Sls./Deanco 503-646-3377
OR Beaverton, Future Elctrns. 503-645-9454
OR Portland, Time Elctrns. 503-684-3780
OR Tualatin, Moore Elctrns. 503-692-5333
PA King of Prussia, Time Elctrns. 215-337-0900
TX Austin, Sterling Elctrns. 512-836-1341
TX Austin, Time Elctrns. 512-339-3051
TX Carrollton, Time Elctrns. 214-241-7441
TX Dallas, Milgray Elctrns. 214-248-1603
TX Dallas, Sterling Elctrns. 214-243-1600
TX Garland, Newark Elctrns. 214-487-8144
TX Houston, Newark Elctrns. 713-270-4800
TX Houston, Sterling Elctrns. 713-623-6600
UT Salt Lake City, Future Elctrns. 801-972-8489
UT Salt Lake City, Milgray Elctrns. 801-272-4999
UT Salt Lake City, Time Elctrns. 801-973-8181
WA Redmond, Future Elctrns. 206-881-8199
WA Redmond, Time Elctrns. 206-882-1600
WI Mequon, Taylor Elec. Co., Inc. 414-241-4321
Can Downsview, Ont., Future Elctrns. 416-638-4771
Can Kawata, Ont., Prelco 613-592-3636
Can Kawata, Ont., Time Elctrns. 416-672-5300
Can Montreal, PQ, Prelco 514-389-8051
Can Montreal, PQ, Tonar Inds. 514-286-4061
Can Montreal,PQ, Future Elctrns. 514-694-7710
Can Nepean, Ont., Carsten 613-726-9250
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Scarborough, Carsten 416-495-9999
Can St. Laurent, PQ, Carsten 514-334-8321
Can Vancouver, BC, Future Elctrns. 604-294-1166
Can Willowdale, Ont., Milgray Elctrns./Toronto 416-756-4481

MURATA MANUFACTURING CO., LTD., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, Japan 617, Tel: 075-951-9111, TELEX: J64270, FAX: 075-955-0526; Empl.: 3,047; *Sls. Mgr.:* O. Otaka

MUSHIELD PRODUCTS, Div. Bomco Inc., Route 128, Blachburn Cir., Gloucester, MA 01930, Tel: 508-283-9000, TELEX: 95-5439, FAX: 508-283-2882; FSC No.: 22780; Empl.: 10; *Sls. Mgr.:* David Grilli; *Dist. Mgr.:* Mark L. Standley ..... **C•1746**

MWS
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FAX: 818-706-0911

MWS WIRE INDUSTRIES, 31200 Cedar Valley Dr., Westlake Village, CA 91362, Tel: 818-991-8553; FSC No.: 51668; Empl.: 65; *Sls. Mgr.:* Greg Fancon ..... **C•1882-1885**

H. WM. MYERS & ASSOCS., 361 Virginia St., Crystal Lake, IL 60014, Tel: 815-459-0100; Empl.: 5; *Sls. Mgr.:* L. Peter Baenziger

NAMCO CONTROLS, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060, Tel: 216-946-9900, TELEX: 24-1566, FAX: 216-946-1228; Empl.: 200; *Sls. Mgr.:* Jon Slayburgh, VP & G/M, Elctrn. Bus.

NAMIKI PRECISION JEWEL CO., LTD., 15 Warren Street, Hackensack, NJ 07601, Tel: 201-343-3080, TWX: 710-990-1273, FAX: 201-343-3172; FSC No.: 201-343-3172

NANO PULSE INDUSTRIES, 440 Nibus St., Brea, CA 92670, Tel: 714-529-2600, FAX: 714-671-7919; FSC No.: 57222; *Sls. Mgr.:* Michael J. Schubert

NARDA MICROWAVE CORP., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788, Tel: 516-231-1700, TWX: 510-221-1867, FAX: 516-231-1711

NATEL

FAX: 805-584-4357

NATEL ENGINEERING CO., INC., 4550 Runway St., Simi Valley, CA 93063, Tel: 805-581-3950, TWX: 910-494-1959; Empl.: 150; *Sls. Mgr.:* Anthony Carbone ..... **D•1194-1195**

Local Sales Offices & Reps
AL Huntsville, Saber Assocs. 800-327-0853
CA San Diego, McMillen & Assocs. 619-484-3402
CO Parker, Howard Assocs. 303-841-5755
FL Melbourne, Saber Assocs. 800-432-6288
GA Norcross, Saber Assocs. 800-327-0853
IL Glendale Hgts., Beta Technlg. Sls., Inc. 312-790-9886
IA Cedar Rapids, Midwest Tech. Sls., Inc. 319-365-4011
KS Lenexa, Midwest Tech. Sls., Inc. 913-888-5100
KS Wichita, Midwest Tech. Sls., Inc. 316-393-6705
MO St. Charles, Midwest Tech. Sls., Inc. 314-441-1012
NY N. Syracuse, Advanced Comps. Corp. 315-699-2671
NC Clayton, Saber Assocs. 800-327-0853
OH Dayton, Rixan Assocs., Inc. 513-222-0011
PA Morrisville, Nexus Technlg. Sls. Inc. 215-295-6549
TX Richardson, Lear Assocs. 214-231-5388
WA Mercer Island, Eagle Entprs., Inc. 206-232-7401
WI Milwaukee, Beta Technlg. Sls., Inc. 414-543-6609

NATIONAL ELECTRONICS CORP., 11731 Markon Dr., Garden Grove, CA 92641, Tel: 714-892-7749, 800-854-2451, TWX: 910-596-1316, FAX: 714-898-6769; Empl.: 50

NATIONAL CONTROLS CORP., 1725 Western Dr., W. Chicago, IL 60185, Tel: 312-231-5900, FAX: 312-231-1377; Empl.: 250; *Dist. Mgr.:* Cy Pfeifer

NATIONAL INFORMATION SYSTEMS, INC., 1190 Saratoga Avenue, San Jose, CA 95129, Tel: 408-985-7100, TELEX: 750031, FAX: 408-246-3127; Empl.: 50

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NATIONAL INSTRUMENTS, 12109 Technology Blvd., Austin, TX 78727-6204, Tel: 512-250-9119; Empl.: 2; *Sls. Mgr.:* Don Nadon, VP Sls. ..... **D•1131, 1178-1179, 1272-1273**

Local Sales Offices & Reps
GA Atlanta, Natl. Instrs. 404-728-9119
IL Chicago, Natl. Instrs. 312-574-0050
MN Minneapolis, Natl. Instrs. 612-482-9930
OH Columbus, Natl. Instrs. 614-442-5740
TX Dallas, Natl. Instrs. 214-699-7474

Local Distributors
CA Mtn. View, Thorson West 415-964-9300
CA Riverside, Cal Tech Prods. 714-682-8506
CO Englewood, Odyssey 1 303-773-8176
MD Linthicum, KD Assocs. 301-859-5151
MA Reading, Scheinfein Assocs. 617-944-2304
NJ Manalapan, Beta Lambda 201-446-1100
NM Albuquerque, Odyssey 1 505-265-6645
UT Salt Lake City, Odyssey 1 801-485-4728
WA Woodenville, Team, Inc. 206-485-1111
Can Mississauga, Ont., Allan Crawford Assocs. 416-890-2010

NATIONAL MICRONETICS, 71 Smith Ave., Kingston, NY 12401, Tel: 914-338-0333, TWX: 510-247-8046, FAX: 914-338-0377; Empl.: 700; *Sls. Mgr.:* Richard Carlton

NATIONAL POWER TECHNLG., See Intelligence Power Technology

NATIONAL SEMICONDUCTOR, Memory Division, 2900 Semiconductor Dr., Santa Clara, CA 95052, Tel: 408-721-5724, FAX: 408-245-6340; *Sls. Mgr.:* George Saul; *Dist. Mgr.:* Jo Craven

NATIONAL SEMICONDUCTORS, LTD., See Silonex Inc.

NATIONAL-STANDARD CO., 601 N. 8th, Niles, MI 49120, Tel: 616-683-8100, TELEX: 295187, FAX: 616-683-6249; Empl.: 3100; *Sls. Mgr.:* D. M. Wedsworth; *Dist. Mgr.:* D. M. Wedsworth

NATIONAL TELEPHONE & ELECTRONICS INC., 2350 N.W. 96 Avenue, Miami, FL 33172, Tel: 305-592-0551, FAX: 305-599-0948; Empl.: 50

NATIONAL TEL-TRONICS, State Road Hill, Meadville, PA 16335, Tel: 814-724-6440, FAX: 814-333-3675; Empl.: 250; *Dist. Mgr.:* D. R. Booth

FAX: 213-225-4630

NATIONAL WIRE & CABLE CORP., 136 San Fernando Rd., Los Angeles, CA 90031-1780, Tel: 213-225-5611, TELEX: 181409, TWX: 910-321-4155; FSC No.: 04569; Empl.: 225 ..... **C•1886-1906**

Local Sales Offices & Reps
AZ Mesa, System Sls. 602-464-9989
AR Cotter, P.M.I. Sls. Co. 501-430-5525
CA Redwood City, National Wire & Cable 415-365-1952
CA San Diego, McKinley Elctrn. Sls. 619-271-7221
CA Santa Clara, Ross Mktg. 408-988-8111
CO Arvada, Arrowhead/CSI Sls. 303-423-5556
FL Altamonte Springs, Gugel-Tuttle Assocs. 305-788-0845
FL Orlando, National Wire & Cable 305-898-3801
GA Lawrenceville, Tek-Rep Mktg. 404-963-1600
HI Hilo, Kirco Corp. 808-959-3888
IL Northfield, H. S. Tollaksen 312-441-6644
MD Glen Burnie, Faion Lott 301-744-4611
MA Norwood, Tom Maguire Assocs., Inc. 617-551-0500
MI Livonia, Luebbe Sls. 313-477-3131
MN Bloomington, Electro Smith Inc. 612-854-8775
MO St. Louis, P.M.I. Sls. Co. 314-353-4709
NJ Wayne, GT Assoc. 201-694-6040
NY Sodus, W. T. Woolard 315-655-8145
OH Cincinnati, Luebbe Sls. 513-530-0600
OH Cleveland, Luebbe Sls. 216-333-0425
OH Columbus, Luebbe Sls. Co. 614-431-0474
OH Dayton, Luebbe Sls. 513-294-0426
PA Hatboro, Jacobsen Assocs. 215-674-2937
PA Pittsburgh, Luebbe Sls. Co. 412-364-0490
TX Ft. Worth, Tesco, Inc. 214-553-1200
WA Redmond, Halbar Assocs. 206-882-0990
WA Vancouver, Halbar Assocs. 206-696-0170

NATIONWIDE ELECTRONIC SYSTEMS, See NES, Inc.

NAUGLER ENGINEERING, INC., Off Dunham Rd., Beverly, MA 01915, Tel: 617-922-5634, FAX: 617-468-1272; FSC No.: 05222; Empl.: 10; *Sls. Mgr.:* Kristen N. Bonnette

NAZ-DAR/K.C., Thrall Enterprises, 1087 N. Branch St., Chicago, IL 60622, Tel: 312-943-8338, FAX: 312-943-8215; Empl.: 53; *Sls. Mgr.:* Kent Schnese; *Dist. Mgr.:* Kent Schnese

NCE:NATIONAL CUSTOM ENTERPRISES, INC., 400 Gateway Blvd., Burnsville, MN 55337, Tel: 612-890-1360, FAX: 612-894-3899; FSC No.: 1FS75; Empl.: **00;** *Sls. Mgr.:* J. A. Carlson

NCR COMTEN, INC., NCR Corp., 2700 Snelling Avenue N., St. Paul, MN 55113, Tel: 612-638-8685, TELEX: 6879018 Comten, TWX: 910-563-3661, FAX: 612-638-8573; FSC No.: 7025-0010; Empl.: 2300; *Sls. Mgr.:* Edward J. Clark; *Dist. Mgr.:* James Woller

NCR MICROELECTRONICS, NCR Corporation, 1635 Aeroplaza Dr., Colorado Springs, CO 80916, Tel: 303-596-5795, 800-543-5618, TELEX: 241669 NCR NVMEM MSBG; FSC No.: 60924; *Sls. Mgr.:* Ted Lunacek; *Dist. Mgr.:* Mike Shapiro

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FAX: 408-725-0369

NDK AMERICA, INC., 20300 Stevens Creek Blvd., Ste. 400, Cupertino, CA 95014, Tel: 408-255-0831, TELEX: 352057; Empl.: 28; *Sls. Mgr.:* Mike Kurihara, GM; *Dist. Mgr.:* Glenn Kawahara ..... **A•1338, 1443-1453**

Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
AZ	Scottsdale, Harris & Croy	602-951-9121
AZ	Tucson, Harris & Croy	602-882-8642
TX	Dallas, SW Tech.	214-369-0977
CA	Calabasas, Quad-Rep Cen., Inc.	818-887-3711
CA	Irvine, Quad-Rep South, Inc.	714-727-4222
CA	Orangevalle, I Square, Inc.	916-989-0843
CA	San Diego, Quad-Rep.	619-560-8330
CA	Santa Clara, I Square, Inc.	408-988-3400
CO	Englewood, Thorson Rocky Mtn. Inc.	303-799-3435
CT	Woodbury, Anacon	203-266-0707
DE	Medford, Jack McCoy	609-953-0770
FL	Largo, TMA	813-536-3796
FL	Melbourne, TMA	305-676-3776
FL	Orlando, TMA	305-857-3760
FL	Pompano Bch., TMA	305-977-9006
GA	Atlanta, L & D, Inc.	404-395-7079
ID	Boise, Intermountain Tech.	208-888-6071
IL	Chicago, M. Gottlieb & Assocs.	312-775-1151
IN	Carmel, Fred A. Dorsey & Assocs.	317-844-4842
IA	Davenport, Rush & West Assocs.	319-388-9494
KS	Olathe, Rush & West Assocs.	913-764-2700
MD	Annapolis, E.E.S Assoc.	301-269-4234
MA	Burlington, Anacon Sls. Assocs., Inc.	617-272-9080
MI	Grand Rapids, Miltimore Sls.	616-942-9721
MI	Novi, Miltimore Sls.	313-349-0260
MO	St. Louis, Rush & West Assocs.	314-965-3322
MT	Boise, Inter-Mtn. Tech.	208-888-6071
NE	Davenport, Rush & West	319-388-9494
NV	Santa Clara, I Squared	408-988-3400
NV	Scottsdale, Harris & McCoy	602-951-9121
NJ	Fairfield, Tech. Applications & Mktg.	201-575-4130
NJ	Medford, Jack McCoy, Inc.	609-953-0770
NM	Albuquerque, Nelco Elctrns.	505-292-3657
NY	Fairfield, TAM	201-575-4130
NC	Raleigh, L & D Inc.	919-876-5301
OH	Cincinnati, Makin Assocs.	513-871-2424
OH	Columbus, Makin Assocs.	614-848-5424
OH	Solon, Makin Assocs.	216-248-7370
OR	Tigard, Comps. West	503-684-1671
PA	Medford, Jack McCoy, Inc.	609-953-0770
PA	Solon, Makin Assocs.	216-248-7370
TN	Bristol, L & D, Inc.	615-878-2266
TX	Austin, Southwestern Tech. Sls.	512-440-0499
TX	Dallas, Southwestern Tech. Sls.	214-369-0977
TX	Houston, Southwestern Tech. Sls.	713-440-9200
UT	Arvada, Gemini Elctrns.	303-428-5600
VT	Wilmington, Anacon	617-270-3712
VA	Front Royal, Eltron Sls.	703-635-7201
WA	Redmond, Comps. West	206-885-5880
WA	Spokane, Comps. West	509-922-2412
WI	Chicago, M. Gottlieb Assocs.	312-775-1151
Can	Burnaby, Vitel Elctrns.	604-439-1136
Can	Kanata, Ont., Vitel Elctrns.	613-592-0090
Can	Mississauga, Ont., Vitel Elctrns.	416-676-9720
Can	St. Laurent, Que., Vitel Elctrns.	514-331-7393

Local Distributors

AL	Huntsville, Schweber Elec.	205-895-0480
AL	Huntsville, Time Elctrns.	205-721-1133
AZ	Phoenix, Schweber Elec.	602-431-0030
AZ	Phoenix, Sterling Elctrns.	602-268-2121
AZ	Tempe, Acacia Sls.	602-894-2874
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Calabassas, Schweber Elec.	818-999-4702
CA	Chatsworth, Sterling	818-407-8850
CA	Chatsworth, Time Elctrns.	818-988-7200
CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	Irvine, Acacia Sls.	714-660-0834
CA	Irvine, Schweber Elec.	714-863-0200
CA	Sacramento, Schweber Elec.	916-364-0222
CA	San Diego, Acacia Sls.	619-565-4365
CA	San Diego, Schweber Elec.	619-450-0454
CA	San Diego, Time Elctrns.	619-586-1331
CA	San Jose, Acacia Sls.	408-745-7200
CA	San Jose, Eric Elctrns.	408-432-1111
CA	San Jose, Schweber Elec.	408-432-7171
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CA	Tustin, Sterling	714-259-0900
CO	Englewood, Schweber Elec.	303-799-0258
CO	Englewood, Sterling Elctrns.	303-792-3939
CO	Englewood, Time Elctrns.	303-799-8851
CO	Lakewood, Acacia Sls.	303-232-2882
CT	Cheshire, Time Elctrns.	203-271-3200
CT	Danbury, Schweber Elec.	203-748-7080
CT	Wallingford, Sterling Elctrns.	203-265-9535
FL	Altamonte Springs, Schweber Elec.	305-331-7555
FL	Ft. Lauderdale, Time Elctrns.	305-484-7778
FL	Pompano Bch., Schweber Elec.	305-977-7511
GA	Norcross, Hammond Elctrns.	404-449-1996
GA	Norcross, Schweber Elec.	404-449-9170
GA	Norcross, Time Elctrns.	404-448-4488
IL	Elk Grove Vl, Schweber Elec.	312-364-3750
IL	Lisle, Comps., Inc.	312-852-7707
IL	Wood Dale, Time Elctrns.	312-350-0610
IA	Cedar Rapids, Schweber Elec.	319-373-1417
KS	Overland Park, Sterling Elctrns.	913-492-5406
KS	Overland Pk., Schweber Elec.	913-492-2922
LA	Westwego, Sterling Elctrns.	504-436-1418
MD	Columbia, Time Elctrns.	301-964-3090
MD	Columbia, Vantage Comps., Inc.	301-720-5100
MD	Gaithersburg, Schweber Elec.	301-840-5900
MA	Bedford, Schweber Elec.	617-275-5100
MA	Peabody, Time Elctrns.	508-532-6200
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MI	Livonia, Schweber Elec.	313-525-8100
MN	Bloomington, Time Elctrns.	612-835-1250
MN	Edina, Schweber Elec.	612-941-5280
MN	Minneapolis, Sterling	612-831-3043
MO	Earth City, Schweber Elec.	314-739-0526
MO	St. Louis, Time Elctrns.	314-391-6444
NH	Manchester, Schweber Elec.	603-625-2250
NJ	Clifton, Vantage Comps., Inc.	201-777-4100
NJ	Pinebrook, Schweber Elec.	201-227-7880
NJ	Pinebrook, Time Elctrns.	201-882-4611
NJ	S. Plainfield, Sterling Elctrns.	201-769-7000
NM	Albuquerque, Sterling Elctrns.	505-884-1900
NY	E. Syracuse, Time Elctrns.	315-432-0355
NY	Hauppauge, Scheber Elec.	516-231-0500
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Rochester, Schweber Elec.	716-424-2222
NY	Rochester, Time Elctrns.	716-383-8853
NY	Smithtown, Vantage Comps., Inc.	516-543-2000
NY	Westbury, Schweber Elec.	516-334-7474
NC	Charlotte, Time Elctrns.	704-522-7600
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Schweber Elec.	919-876-0000
OH	Beachwood, Schweber Elec.	216-464-2970
OH	Dayton, Schweber Elec.	513-439-1800
OH	Dublin, Time Elctrns.	614-761-1100
OK	Tulsa, Schweber Elec.	918-622-8000
OK	Tulsa, Sterling Elctrns.	918-663-2410
OR	Beaverton, Acacia	503-646-3377
OR	Portland, Time Elctrns.	503-684-3780
PA	Export, Advacom	412-733-5400
PA	Horsham, Schweber Elec.	215-441-0600
PA	King of Prussia, Time Elctrns.	215-337-0900
PA	McKean, Advacom	814-496-7774
PA	Pittsburgh, Schweber Elec.	412-963-6804
SC	Greenville, Hammond Elctrns.	803-233-4121
TX	Austin, Schweber Elec.	512-339-0088
TX	Austin, Sterling Elctrns.	512-836-1341
TX	Austin, Time Elctrns.	512-339-3051
TX	Carrollton, Time Elctrns.	214-241-7441
TX	Dallas, Schweber Elec.	214-661-5010
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Schweber Elec.	713-784-3600
TX	Houston, Sterling Elctrns.	713-623-6600
UT	Salt Lake City, Time Elctrns.	801-973-8181
VA	Richmond, Sterling Elctrns.	804-226-2190
VA	Sterling, Sterling Elctrns.	703-450-2373
WA	Redmond, Time Elctrns.	206-882-1600
WI	New Berlin, Schweber Elec.	414-784-9020
Can	Ontario, Time Elctrns.	416-672-5300

NEC

FAX: 415-965-6130

NEC ELECTRONICS, INC., 401 Ellis Street, P.O. Box 7241, Mountain View, CA 94039, Tel: 415-960-6000, TWX: 910-379-6985; Empl.: 1200; *Sls. Mgr.:* Mike Despotes; *Dist. Mgr.:* Michael Kelly ..... **A•1140-1143; B•1092-1093, 1324-1332, 1586-1591**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-533-9281
AZ	Phoenix, Oasis Sls., Inc.	602-277-2714
CA	Cardiff, Mission Technlg.	619-753-5092
CA	Mtn. View, NEC Elctrns.	415-965-6200
CA	San Jose, Exis	408-433-3947
CA	Santa Ana, NEC Elctrns.	714-546-0501
CO	Aurora, NEC Elctrns.	303-755-6353
CO	Boulder, Promotional Technlg.	303-530-4774
CO	Parker, Promotional Technlg.	303-841-4664
CT	Cheshire, Datatrack Engrg., Inc.	203-271-1311
FL	Altamonte Springs, V.G. Sls., Inc.	407-831-8688
FL	Ft. Lauderdale, NEC Elctrns.	305-776-0682
FL	Largo, V.G. Sls. Co., Inc.	813-536-7787
FL	Maitland, NEC Elctrns.	407-875-1145
FL	Pompano Bch., V.G. Sls. Co., Inc.	305-971-0900
GA	Norcross, NEC Elctrns.	404-447-4409
GA	Norcross, 20th Century Mktg. Inc.	404-446-1999
IL	Arlington Hgts., NEC Elctrns.	312-577-9090
IL	Schaumburg, Martan Inc.	312-303-5660
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Technlg. Mktg. Corp.	219-432-5553
IA	Cedar Rapids, Stan Clothier Co.	319-365-1717
KS	Overland Pk., AME Sls.	913-262-3971
KY	Louisville, Technlg. Mktg. Corp.	502-893-1377
MD	Glen Burnie, TRI-MARK Inc.	301-761-6000
MA	Natick, NEC Elctrns.	508-655-8833
MA	Woburn, Compass Technlg.	617-933-3336
MI	Grand Rapids, Miltimore Sls.	616-942-9721
MI	Novi, Miltimore Sls.	313-349-0260
MI	Troy, NEC Elctrns.	313-680-0506
MN	Bloomington, NEC Elctrns.	612-854-4443
MN	Minneapolis, Stan Clothier Co.	612-944-3456
MO	St. Charles, AME Sls.	314-947-0333
NJ	Bellmawr, TAI Corp.	609-933-2600
NJ	Saddle Brook, Metro Logic Corp.	201-797-8844
NY	Fairport, NEC Elctrns.	716-425-4590
NY	Jericho, NEC Elctrns.	516-932-5700
NY	Pittsford, Elcom Sls.	716-385-1400
NY	Poughkeepsie, NEC Elctrns.	914-452-4747
NY	Skaneateles, Elcom Sls.	315-685-8245
NC	Charlotte, Quantum Mktg. Inc.	704-523-8822
NC	Durham, NEC Elctrns.	919-544-4132
NC	Raleigh, Quantum Mktg. Inc.	919-846-5728
OH	Columbus, NEC Elctrns.	614-436-1778
OR	Portland, NEC Elctrns.	503-245-1600
OR	Portland, Venture Elctrns.	503-624-0617
PA	Trevose, NEC Elctrns.	215-638-8989
TX	Austin, NEC Elctrns.	512-346-9280
TX	Austin, TL Mktg., Inc.	512-453-4586
TX	Dallas, NEC Elctrns.	214-931-0641
TX	Dallas, TL Mktg., Inc.	214-484-6800
TX	Houston, TL Mktg., Inc.	713-589-2763
UT	Midvale, Promotional Technlg. Corp.	801-566-8919
WA	Bellevue, Venture Elctrns.	206-454-4594
WI	Mequon, Martan Inc.	414-241-4955
PR	Bonneville, Dynamic Sls./V.G. Sls.	809-746-1091
PR	Caguas, V. G. Sls. Co., Inc.	809-744-5568
Can	Concord, Ont., Kaytronics	416-669-2262
Can	Kanata, Ont., Kaytronics	613-592-6606
Can	Surrey, BC, Kaytronics Western	604-581-5005
Can	Ville St.-Laurent, Que., Kaytronics	514-745-5800

Local Distributors

AL	Huntsville, Marshall Inds.	205-881-9253
AZ	Phoenix, Marshall Inds.	602-496-0290
AZ	Phoenix, Sterling Elctrns.	602-268-2121
AZ	Tempe, Insight Elec.	602-829-1800
CA	Agoura, Insight Elctrns.	818-707-2100
CA	Agoura Hills, Western Microtechnology	818-707-0377
CA	Camarillo, Milgray Elctrns.	805-484-4055
CA	Chatsworth, Marshall Inds.	818-407-4100
CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	Costa Mesa, Insight Elctrns.	714-556-6890
CA	El Monte, Marshall Inds.	818-459-5558
CA	Fountain Valley, Bell Microproducts	714-963-0667
CA	Irvine, Marshall Inds.	714-859-5050
CA	Milpitas, Bell Microproducts	408-434-1150
CA	Milpitas, Marshall Inds.	408-942-4600
CA	Orange, Western Microtechnology	714-637-0200
CA	Rancho Cordova, Marshall Inds.	916-635-9700
CA	Sacramento, IEC	916-424-5297
CA	San Diego, Insight Elctrns.	619-587-0471
CA	San Diego, Marshall Inds.	619-578-9600
CA	San Diego, Western Microtechnology	619-453-8430
CA	San Jose, Eric Elctrns.	408-432-1111
CA	San Jose, IEC	408-435-1000
CA	San Jose, Merit Elctrns.	408-434-0800
CA	Santee, Mouser Elctrns.	619-449-2222
CA	Saratoga, Western Microtechnology	408-725-1660
Can	Saskatoon,Que., ITT Multicomponents/RAE Elctrns.	306-933-2888
CO	Denver, IEC	303-292-6121
CO	Englewood, Sterling Elctrns.	303-792-3939
CO	Thornton, Marshall Inds.	303-451-8383
CT	Milford, Milgray Elctrns.	203-878-5538
CT	Wallingford, Cronin Elctrns.	203-265-3134
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Altamonte Springs, Marshall Inds.	407-767-8585
FL	Ft. Lauderdale, Marshall Inds.	305-977-4880

FL Ft. Lauderdale, Reptron Elctrns. 305-735-1112
FL St. Petersburg, Marshall Inds. 813-573-1399
FL Tampa, Reptron Elctrns. 813-855-4656
FL Winter Park, Milgray Elctrns. 407-647-5747
GA Norcross, Marshall Inds. 404-923-5750
GA Norcross, Milgray Elctrns. 404-446-9777
GA Norcross, Reptron Elctrns. 404-446-1300
IL Bensenville, Milgray Elctrns. 312-350-0490
IL Hoffman Estates, IEC 312-843-2040
IL Schaumburg, Marshall Inds. 312-490-0155
IL Schaumburg, Reptron Elctrns. 312-882-1700
IL Schaumburg, Reptron Elctrns. 317-882-1700
IN Indianapolis, Marshall Inds. 317-297-0483
KS Lenexa, Marshall Inds. 913-492-3121
KS Lenexa, Sterling Elctrns. 913-492-5406
KS Overland Park, Milgray Elctrns. 913-236-8800
MD Columbia, Milgray Elctrns. 301-995-6169
MD Jessup, Almo Elctrns. 301-953-2566
MD Silver Spring, Marshall Inds. 301-622-1118
MA Burlington, Western Microtechnology 617-273-2800
MA Hopkinton, Interface Elctrns. 508-435-6858
MA Wilmington, Marshall Inds. 508-658-0810
MA Wilmington, Milgray Elctrns. 508-657-5900
MA Woburn, Sterling Elctrns. 617-938-6200
MI Livonia, Marshall Inds. 313-525-5850
MI Livonia, Reptron Elctrns. 313-525-2700
MN Minneapolis, Sterling Elctrns. 612-831-2666
MN Minnetonka, Reptron Elctrns. 612-938-0000
MN Plymouth, Marshall Inds. 612-559-2211
MO Bridgeton, Marshall Inds. 314-291-8795
NJ Clifton, Vantage Comps. 201-777-4100
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Marlton, Milgray Elctrns. 609-983-5010
NJ Mt. Laurel, Marshall Inds. 609-234-9100
NJ Parsippany, Milgray Elctrns. 201-335-1766
NJ Randolph, Mouser Elctrns. 201-328-3322
NJ South Plainfield, Sterling Elctrns. 201-769-7000
NM Albuquerque, Sterling Elctrns. 505-884-1900
NY Farmingdale, Milgray Elctrns. 516-420-9800
NY Hauppauge, Marshall Inds. 516-273-2424
NY Holbrook, Micro Genesis 516-472-6000
NY Johnson City, Marshall Inds. 607-798-1611
NY Rochester, Marshall Inds. 716-235-7620
Can Rochester, Milgray Elctrns. 716-235-0830
NC Charlotte, Electronic Mktg. Corp. 704-394-6195
NC Raleigh, Marshall Inds. 919-878-9882
NC Raleigh, Resco 919-781-5700
OH Columbus, Electronic Mktg. 614-299-4161
OH Dayton, Marshall Inds. 513-898-4480
OH Highland Hgts., Electronic Mktg. 216-442-3441
OH Independence, Milgray Elctrns. 216-447-1520
OH Solon, Marshall Inds. 216-248-1788
OH Solon, Reptron Elctrns. 216-349-1415
OH Worthington, Reptron Elctrns. 614-436-6675
OK Tulsa, Sterling Elctrns. 918-663-2410
OR Beaverton, IEC 503-641-1690
OR Beaverton, Marshall Inds. 503-644-5050
PA Philadelphia, Almo Elctrns. 215-698-4000
OR Beaverton, Western Microtechnology 503-629-2082
TX Austin, Marshall Inds. 512-837-1991
TX Austin, Sterling Elctrns. 512-836-1341
TX Carrollton, Marshall Inds. 214-233-5200
TX Dallas, Milgray Elctrns. 214-248-1603
TX Dallas, Sterling Elctrns. 214-243-1600
TX El Paso, Marshall Inds. 915-593-0706
TX Houston, Marshall Inds. 713-895-9200,1-800-392-2416
TX Houston, Sterling Elctrns. 713-627-9800
TX Mansfield, Mouser Elctrns. 817-483-0165
TX Richardson, Insight Elctrns. 214-783-0800
UT N.Salt Lake City, IEC 801-298-1869
UT Salt Lake City, Marshall Inds. 801-485-1551
UT Salt Lake City, Milgray Elctrns. 801-272-4999
VA Herndon, Sterling Elctrns. 703-742-8400
VA Richmond, Sterling Elctrns. 804-226-2190
WA Bellevue, IEC 206-455-2727
WA Bellevue, Marshall Inds. 206-486-5747
WA Redmond, Western Microtechnology .. 206-881-6737
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI Waukesha, Marshall Inds. 414-797-8400
Can Burnaby,BC, ITT Multicomponents/RAE Elctrns. 604-291-8866
Can Calgary,Alberta, ITT Multicomponents/RAE Elctrns. 403-253-8575
Can Calgary,Alberta, MEMCO 403-258-3399
Can Concord, Ont., ITT Multicomponents/RAE Elctrns. 416-736-1144
Can Dartmouth,Nova Scotia, ITT Multicomponents/RAE Elctrns. 902-456-2350
Can Edmonton, Alberta, MEMCO 1-800-661-9536
Can Edmonton,Alberta, ITT Multicomponents/RAE Elctrns. 403-451-4001
CA Irvine, IEC 714-837-9960
Can Moncton,New Brunswick, ITT Multicomponents/RAE Elctrns. 506-857-8011
Can Nepean,Ont, ITT Multicomponents/RAE Elctrns. 613-226-7406
Can Nepean,Ont., Carsten Elctrns. LTD. 613-726-9250
Can Saskatoon,Que., MEMCO 1-800-661-9536
Can Scarborough,Ont., Carsten Elctrns. LTD. 416-495-9999
Can Surrey, BC, MEMCO 604-590-1553
Can Victoria,BC, MEMCO 604-383-2400
Can Ville St. Laurent, Que., ITT Multicomponents/RAE Elctrns. 514-335-7697
Can Ville St. Laurent,Que., Carsten Elctrns. LTD. 514-334-8321
Can Willowdale,Ont., Milgray Elctrns. 416-491-4481
Can Winnipeg, Manitoba, MEMCO 1-800-661-9536
Can Winnipeg,Manitoba, ITT Multicomponents/RAE Elctrns. 204-786-8401

NEC INFORMATION SYSTEMS, INC., 1414 Massachusetts Ave., Boxborough, MA 01719, Tel: 617-264-8000, TELEX: 92-3434; Empl.: 1500; *Sls. Mgr.:* Richard Gilbert/Robert Henderson; *Dist. Mgr.:* Richard Gilbert/John Bruni

NEDAP N.V., P.O. Box 6, Groenlo, Holland 7140 AA, Tel: ò31-5440-71111, TELEX: 44253, FAX: ò31.5440.62745; Empl.: 360; *Sls. Mgr.:* W. Bonnemeier

N.E.D. CABLE CO., Div. of Electro-Prep, Inc., 16 Proctor St, Salem, MA 01970, Tel: 617-745-9911; Empl.: 10; *Sls. Mgr.:* R. M. Sullivan

NEDCO ELECTRONICS, INC., 8246 LeHigh, Morton Grove, IL 60053, Tel: 312-967-0500, FAX: 312-967-0505; Empl.: 10

NEFF INSTR., 700 S. Myrtle Ave., Monrovia, CA 91016, Tel: 818-357-2281, TWX: 910-585-1833, FAX: 818-303-2286; Empl.: 125; *Sls. Mgr.:* James L. Taylor

NEI
Ferranti-Packard

FAX: 416-625-6197

NEI FERRANTI-PACKARD ELECTRONICS, 6030 Ambler Dr., Mississauga, Ont., Canada L4W 2P1, Tel: 416-624-3020, TELEX: 06-961437; Empl.: 225; *Sls. Mgr.:* Paul A. Manuel ..... **B•1095-1097**

Local Sales Offices & Reps

IL Chicago, NEI Svc. 800-263-4346
MA Hopkinton, FP Displays, Inc. 617-742-2335
NH Nashua, Bell Controls Inc. 603-882-6984
PA Paoli, Tyler Griffin Co. 215-647-1550
TX Dallas, NEI Svc. 800-263-4346
Can Mississauga, Ont., NEI Ferranti-Packard Elctrns. 416-624-3020

NEL FREQUENCY CONTROLS, INC., 357 Beloit St., Burlington, WI 53105, Tel: 414-763-3591, TWX: 910-278-2450, FAX: 414-763-2881; FSC No.: 00815; Empl.: 225; *Sls. Mgr.:* Dick Griebel, VP Sls. & Mktg.; *Dist. Mgr.:* Lyann Jung ..... **A•1455-1457**

Local Sales Offices & Reps

AL Huntsville, 20th Century Mktg. 205-533-9281
AZ Tempe, A5 Co. 602-968-4923
CA Burlingame, Wm. J. Purdy Co. 415-347-7701
CA Huntington Beach, Mil-Com Sls. 714-840-2424
CO Parker, A5 Co. 303-841-3651
FL Orlando, Richmar Elctrns. 407-352-3755
GA Norcross, 20th Century Mktg. 404-446-1999
IL Downers Grove, Richmar Elctrns. 312-968-0118
IN Indianapolis, Richmar Elctrns. 317-577-9950
IA Iowa City, Richmar Elctrns. 319-354-8894
MI Adrian, Elctrn. Salesmasters 517-263-2500
MN Minneapolis, Holmgren Assocs. 612-786-7641
NH Nashua, Bell Controls 603-882-6984
NJ Hopelawn, Kamco Indl. Sls. 201-422-6252
NJ Medford, Champion 800-234-2426
NC Cary, 20th Century Mktg. 919-481-3370
OH Beechwood, Elctrn. Salesmasters 216-831-9555
OR Lake Oswego, RTS, Inc. 503-244-4123
TN Knoxville, 20th Century Mktg. 615-966-2099
TX Plano, Richmar Elctrns. 214-424-8388
WA Vashon, RTS, Inc. 206-285-1363
WI Butler, Richmar Elctrns. 414-781-1730
EXP San Juan, Puerto Rico, Elctrn. Tech. Sls. 809-798-1300

Local Distributors

CA Agoura Hills, Pacesetter 818-991-3984
CA Anaheim, Pacesetter 714-779-5855
CA Canoga Park, Tim-Co 818-992-5040
CA Fountain Valley, Components Ctr. 714-979-0433
CA Irvine, Integrated Elctrns. 714-837-9960
CA Sacramento, Integrated Elctrns. 916-424-5297
CA San Jose, All American 408-943-1200
CA San Jose, Integrated Elctrns. 408-435-1000
CA San Jose, Pacesetter 408-436-8822
CA San Jose, Sierra West 408-435-7477
CA Santa Clara, Components Ctr. 408-988-3751
CA Torrence, All American 800-664-8300
CO Denver, Integrated Elctrns. 303-292-6121
FL Miami, All American 305-621-8282
IL Hoffman Estates, Integrated Elctrns. .. 312-843-2040
IL Northbrook, Classic Comps. 312-272-9650
IL Rosemont, Advent 800-323-1270
IN Indianapolis, Advent 317-872-4910
IA Cedar Rapids, Advent 319-363-0221
MD Jessup, Treeko Elctrns. 301-792-0112
MD Rockville, All American 800-426-0420
MA Billerica, Mayer Elctrns. 617-229-2255
MA Middleboro, Glynn Elctrns. 800-225-8684
MA Wakefield, All American 800-874-2834
MI Farmington Hills, Advent 313-477-1650
MN Eden Prairie, All American 612-944-2151
MN Minneapolis, Bergquist 612-835-2322
NY Buffalo, Genesee Indl. 716-873-9661
NY Rochester, Masline Elctrns. 716-546-5373
NY Ronkonkoma, All American 800-874-2830
NY Stony Brook, Dove Elctrns. 516-689-7733
OH Englewood, Argent 513-836-8633
OH Solon, Repco Elctrns. 216-248-8900
OK Tulsa, Altair 918-252-5781
OR Beaverton, Integrated Elctrns. 503-641-1690
RI Richardson, All American 800-541-1435
TX Austin, Altair Co. 512-837-4970
TX Dallas, MP Sys. 214-385-8885
TX Dallas, Off The Shelf 214-247-0052
TX Houston, Altair Co. 713-462-3029
TX Richardson, Altair Co. 214-231-5166
TX Richardson, Off The Shelf 214-238-0808
UT Salt Lake City, Integrated Elctrns. 801-298-1869
WA Bellevue, Integrated Elctrns. 206-455-2727
WI Mequon, Taylor Elec. 800-242-8914
WI New Berlin, Classic Comps. 800-242-7408
Can Calgary, Alberta, Memco 403-258-3399
Can Surrey, B.C., Memco 604-590-1553

NEPENTHE, INC., 2471 E. Bayshore Road, Palo Alto, CA 94303, Tel: 415-856-9332, 800-NEPENTHE, TWX: 910-373-2060; FSC No.: 415.856 8650; Empl.: 50; *Sls. Mgr.:* Mark Urban

NESCO BATTERY SYSTEMS, National Electro-Sales Corp., 7110 Gerald Ave., Van Nuys, CA 91406-7840, Tel: 818-781-0505, FAX: 818-786-2758

NESHAMINY TRANSFORMER, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925, Tel: 215-794-7411; *Sls. Mgr.:* Philip Klein

NES Slimline – A Systems-Oriented Panel Meter

FAX: 312-426-6630

NES, INC. (NATIONWIDE ELECTRONIC SYSTEMS), 3003 Wakefield, Carpentersville, IL 60110, Tel: 312-426-5900; Empl.: 54; *Sls. Mgr.:* Jerry Bestler; *Dist. Mgr.:* Jerry Bestler ..... **B•1098; D•1153, 1406-1411**

Local Sales Offices & Reps

WA Bellevue, Al Smith Co. 206-746-6770

Local Distributors

IL Bridgeview (Chicago), Norman Equip. Co. 312-430-4000
IL Mt. Prospect, Feed Controls 312-253-3898
WI Appleton, G.W.S. Supp. 414-739-6066
Can Montreal, Que., Mod-tronic Instr. Ltd. .. 514-848-7205

NETCOM, INC, 3000 Commerical Ave.,P.O.Box 3025, Northbrook, IL 60065-3025, Tel: 312-564-5100, FAX: 312-564-2279; FSC No.: 57193; Empl.: 105; *Sls. Mgr.:* Wayne Roeder

NETWORKS INTERNATIONAL CORPORATION, 13924 W. 108th St., Lenexa, KS 66215, Tel: 913-469-6494, FAX: 913-469-6495; Empl.: 15; *Sls. Mgr.:* Abhay Bisarya; *Dist. Mgr.:* Abhay Bisarya

NEURON

FAX: 213-375-6145

NEURON ELECTRONICS, INC., 24050 Madison St, Torrance, CA 90505, Tel: 213-375-5407, 213-375-5333; Empl.: 4; *Sls. Mgr.:* Steve Stone ..... **D•1101**

NEUTRIK PRODUCTS, See Kulka Smith

NEW ENGLAND SMELTING WORKS, INC., 502 Union St, Box 29, W. Springfield, MA 01090, Tel: 413-734-6491; FSC No.: 3439; Empl.: 40; *Sls. Mgr.:* David R. Saffer

NEW HAMPSHIRE BALL BEARINGS, INC., NMB (USA), Inc., Rte. 202, Peterborough, NH 03458, Tel: 603-924-3311, TWX: 710-364-1805; Empl.: 1500

NEWMAN, M. M., CORP., Heli-Tube Div., P.O. Box 615, Marblehead, MA 01945, Tel: 617-631-7100, FAX: 617-631-8887; FSC No.: 09106; *Sls. Mgr.:* C. Loutrel; *Dist. Mgr.:* C. Loutrel ..... **C•1874**

NEW MEDIA GRAPHICS CORP., Matrix Corp., 780 Boston Rd., Billerica, MA 01821, Tel: 508-663-0666, FAX: 508-663-6678; Empl.: 50

NEWPORT

FAX: 714-546-3022

NEWPORT ELECTRONICS, 2229 S.Yale St, Santa Ana, CA 92704-4426, Tel: 714-540-4914, TWX: 910-595-1787; Empl.: 160; *Sls. Mgr.:* Jim Way ..... **D•1412-1413**

Local Sales Offices & Reps

AL	Birmingham, Richardson Co.	205-979-0550
AZ	Phoenix, CPS Assocs.	602-246-1097
CA	Milpitas, IFM, Inc.	408-945-5920
CA	Orange, Electramation	714-997-8420
CO	Denver, AKI Entprs.	303-388-4488
FL	Orlando, Datarep, Inc.	305-843-5224
IL	Arlington Hgts., Brainard-Wilson	312-437-2700
IN	Ft. Wayne, Walter M. Bierberich Inc.	219-432-2537
IA	Des Moines, H & H Vega Sls. Assocs.	515-280-8088
KS	Shawnee Mission, H & H Vega Sls.	316-722-7856
MD	Joppa, Electra-Tech	301-877-0344
MA	Billerica, Eastronix, Inc.	617-670-2400
MI	Livonia, Amtech Reps.	313-474-8300
MN	Eden Prairie, Rockmore Sls. Corp.	612-941-1390
MO	St. Charles, Power Transmission Sys.	314-928-1750
NJ	Parlin, JMR Sls.	201-254-8484
NY	Wading River, JMR Sls., Inc.	516-929-5756
NC	Charlotte, SPK Instrmn.	704-535-2345
OH	Dayton, Dolfuss-Root & Co.	513-433-6776
OH	Strongsville, Dolfuss-Root & Co.	216-238-0300
PA	Bridgeville, Dolfuss-Root & Co.	412-221-4420
PA	Valley Forge, J. E. Cuesta & Co., Inc.	215-935-0400
SC	Greenville, SPK Instrmn.	803-297-4133
TN	Memphis, Southeastern Marketing	901-529-9818
TX	Addison, Associated Dyn., Inc.	214-387-3800
VA	Dumfries, Electra-Tech	703-670-6962
WA	Redmond, Sls. & Engrg. Assocs.	206-883-4999
WI	Waukesha, Brainard-Wilson	414-797-7940

Local Distributors

AL	Birmingham, Brownell Instrs.	205-332-3374
AZ	Tempe, Metermaster	602-431-0015
AR	Little Rock, Brownell Instrs.	501-562-2061
CA	Costa Mesa, FLW, Inc	714-751-7512
CA	Foster City, Therm-X	415-571-1166
CA	Fremont, FLW, Inc.	415-651-6511
CA	Los Angeles, EIL Instrs., Inc.	213-685-7020
CA	S. San Francisco, Steven Engrg.	415-588-9200
CA	San Leandro, Coast Instr.	415-483-3774
CA	Yorba Linda, Metermaster	714-921-2101
CO	Aurora, R & R Instrmn.	303-340-8728
CT	Middletown, EIL Instrs., Inc.	203-346-6646
FL	Orlando, FLW, Inc.	407-894-1100
GA	Atlanta, Sesco, Inc.	404-458-6423
GA	Atlanta (Hapeville), Brownell Electro	404-762-5181
GA	Marietta, FLW Southeast	404-424-1731
HI	Kailua, FLW, Inc.	808-945-1030
IL	Chicago, Data Elctrns. Co.	312-283-0300
IL	Countryside, Pacific Indicator	312-352-3500
IL	Glendale Heights, Crompton Metermaster	312-351-4554
IN	Evansville, Electro-Lab Svcs.	812-423-5211
IA	Davenport, Universal Precision Instr.	319-326-5757
KS	Kansas City, Process Measurement	913-384-2064
KY	Louisville, P. L Burkes Co.	502-589-3960
LA	Slidell, Process & Engrg. Prod.	504-641-0652
MD	Sparks, EIL Instr.	301-771-4800
MA	Waltham, Calibron Instrs.	617-894-6440
MI	Royal Oak, George Instr.	313-280-1111
MN	Minneapolis, Instrmn. Svcs.	612-544-8916
MN	Minneapolis, Process Meas.	612-544-4035
MO	Kansas City, ISL Corp.	816-587-5400
MO	Manchester, Universal Precision Inst.	314-394-4693
NE	Omaha, Interstate Indl.	402-331-3535
NJ	Newfoundland, Hosica Labs.	201-697-6111
NY	Buffalo, EIL/Trott Elctrns.	716-634-8500
NY	Buffalo, KOM Lamb	716-874-3530
NY	Farmingdale, Brownell Electro	516-420-5990
NC	Charlotte, EIL/Trott Elctrns.	704-376-2237
OH	Cincinnati, Schlemmer	513-522-8340
OH	Cleveland, Pioneer Instr.	216-587-3600
OH	Cleveland, Weschler Elec.	216-238-2550
OH	Dayton, Pioneer Instr.	513-236-9900
OH	Toledo, Girkins Elec.	419-478-5600
OK	Tulsa, Inotek	918-627-1500
OR	Portland, EIL Instruments	503-221-1123
OR	Portland, Westcon	503-283-0132
PA	Philadelphia, Sunshine Scientific	215-673-5600
PA	York, Trola Inds.	717-848-3700
SC	Columbia, Brownell Instrs.	803-772-6111
TN	Knoxville, Brownell	615-966-3441
TX	Dallas, Dallas Meter Tek	214-349-6044
TX	Dallas, Inotek	214-243-7000
TX	Houston, American Analog	713-941-7265
UT	N. Salt Lake, Western Controls	801-292-5900
VA	Richmond, Metermetrics	804-275-1431
WA	Seattle, Branom Instrs.	206-762-6050
WA	Seattle, EIL Instruments	201-882-3222
WI	Milwaukee, E-M Instrs.	414-272-7799

NEW WAVE INSTRUMENTS, 128 W 3100 N., Provo, UT 84604, Tel: 801-373-4909, TWX: 510-601-2474, ESYLNK: 62925379; *Sls. Mgr.:* Larry Christensen

THE J. M. NEY COMPANY, Ney Industrial Park, Bloomfield, CT 06002, Tel: 203-242-2281, TELEX: 9-9238, FAX: 203-242-5688; *Sls. Mgr.:* Hal Poschmann ..... **C•1463, 1619; D•2241**

Local Sales Offices & Reps

CA	San Diego, The J.M. Ney Co.	619-462-4214
CT	Hartford, The J.M.Ney Co.	203-242-2281
IL	Chicago, The J.M.Ney Co.	312-724-0431
MA	Springfield, The J.M.Ney Co.	413-566-5542
MI	Detroit, The J.M.Ney Co.	313-477-8774
NJ	Newark, The J.M.Ney Co.	201-968-4218

NGK BERYLCO, NGK Metals Corporation, P.O. Box 13367, Reading, PA 19612-3367, Tel: 215-921-5000, TWX: 510-651-0677; Empl.: 600; *Sls. Mgr.:* Robert E. Strock

NH RESEARCH, INCORPORATED, Instrumentation Products Division, 16601 Hale Ave., Irvine, CA 92714, Tel: 714-474-3900, TELEX: 67-8377, FAX: 714-474-7062; Empl.: 120; *Sls. Mgr.:* Fred Sabatine

NH RESEARCH, Powertest Automatic Power Supply Test Systems, 16601 Hale Avenue, Irvine, CA 92714, Tel: 714-474-3900, TELEX: 67-8377, FAX: 714-474-7062; FSC No.: 24862; Empl.: 125; *Sls. Mgr.:* Sam Duran

NIC COMPONENTS CORP., 6000 New Horizons Blvd., N. Amityville, NY 11701, Tel: 516-226-7500, TELEX: 221-228, FAX: 516-226-6262; Empl.: 50; *Sls. Mgr.:* Robert Schatz; *Dist. Mgr.:* Nancy Lamendola ..... **A•1144-1145, 2000**

Local Sales Offices & Reps

CA		
CA	San Diego, Eagle Sls.	619-743-6550
CT	Bloomfield, F.S.I.	203-243-3122
IL	Lisle, W. G. Controls	312-963-5954
IN	Indianapolis, Elctrn. Rep. Inc.	317-894-1414
KS	Overland Park, Thomas L. Dowell & Assocs.	913-648-7373
LA	Hammond, Design Mktg.	504-294-3076
MA	Glouchester, F.S.I.	617-281-3864
MI	Grand Rapids, Burcaw Co.	313-573-4605
MI	Wyoming, Burcaw Co.	313-573-4605
MO	St. Louis, Thomas L. Dowell & Assocs.	314-849-4234
NY	Hicksville, J-Square Mktg. Inc.	516-935-3200
TX	Irving, Design Mktg.	214-607-0611
TX	Round Rock, Design Mktg.	512-255-9896

Local Distributors

AZ	Tempe, Acacia Sls.	602-894-2874
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Garden Grove, Bell Inds.	714-895-7801
CA	San Diego, Western Microtechnology	619-453-8430
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Tustin, Projections Unlimited	714-544-2700
CO	Wheatridge, Bell Inds.	303-424-1985
CT	Danbury, Pilgrim Elctrns.	203-792-7274
CT	Wallingford, Mid-State Elctrns.	203-265-9900
FL	Clearwater, Future Elctrns.	813-578-2770
FL	Largo, Bell inds.	813-541-4434
FL	Orlando, Hammond Elctrns.	407-841-1010
GA	Norcross, Bell Inds.	404-662-0923
GA	Norcross, Hammond Elctrns.	404-449-1996
IL	Addison, Belford Elctrns.	312-691-1100
IL	Elk Grove VL, Bell Inds.	312-640-1910
IL	Schaumburg, QPS	312-884-6620
IN	Ft. Wayne, Bell Inds./Graham Div.	219-423-3422
IN	Indianapolis, Meunier	317-635-3511
KY	Louisville, Peerless Elctrns.	502-637-7674
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Chelmsford, TLC Inc.	508-250-9666
MI	Grand Rapids, SF Elctrns.	616-459-0216
MI	Livonia, RS Elctrns.	313-525-1155
MN	New Brighton, Chris Elctrns.	612-631-2647
MO	St. Louis, Future Elctrns.	314-469-6805
MO	St. Louis, Van Sickle Radio	314-621-5000
NH	Nashua, Brevan Elctrns.	603-889-7230
NJ	Rockaway, Tonar Inds.	201-586-9000
NJ	South River, M-Tronics	201-613-8390
NY	Farmingdale, Bell Inds.	516-752-9303
NY	Liverpool, Future Elctrns.	315-451-2371
OH	Dayton, Bell Inds./Graham Div.	513-435-8660
OH	Dayton, Stotts Friedman Inc.	513-298-5555
OK	Oklahoma City, Carlton-Bates Co.	918-250-1620
OR	Beaverton, Acacia Sls.	503-646-3377
PA	McKean, Advacom Inc.	814-476-7774
TN	Hixson, Techni-tronics	615-842-0514
TX	Richardson, Bell Inds.	214-690-0466
TX	Richardson, Future Elctrns.	214-437-2437
UT	Salt Lake City, Bell Inds.	801-972-6969
WA	Kirkland, Priebe Elctrns.	206-821-4695
Can	Pointe Claire, Future Elctrns.	514-694-7710

NICHICON (AMERICA) CORP., 927 E. State Pkwy., Schaumburg, IL 60173, Tel: 312-843-7500, TELEX: 20-6577, FAX: 312-843-2798/7125; *Sls. Mgr.:* Russ Edwards; *Dist. Mgr.:* Buddy Black

NICHIFU AMERICA, INC., 60 Robinson St, Pottstown, PA 19464, Tel: 215-323-7120, FAX: 215-970-2096; *Sls. Mgr.:* Roy Allen

NICOLET INSTRUMENT CORP., Test Instrument Division, 5225 Verona Rd., P.O. Box 4288, Madison, WI 53711, Tel: 608-271-3333, TELEX: 608-273-5061, TWX: 910-286-2737; Empl.: 700; *Sls. Mgr.:* Jeffry Shahan

NICOLET COMPUTER GRAPHICS DIV., See Bruning Computer Graphics

NIDEC CORPORATION, 100 Franklin Drive, Torrington, CT 06790, Tel: 203-482-4422, TELEX: 643963; Empl.: 350; *Sls. Mgr.:* Robert Murphy; *Dist. Mgr.:* Rich Brache

NITTANY PIEZO CERAMICS, See Piezo Kinetics, Inc.

NJE
POWER SUPPLIES

FAX: 201-329-6185

NJE CORPORATION, 329 Culver Rd, P.O. Box 669, Dayton, NJ 08810-0669, Tel: 201-329-4611, TWX: 710-480-5674; FSC No.: 98380; Empl.: 105; *Sls. Mgr.:* John Slavik ..... **D•1925-1928**

Local Sales Offices & Reps

NJ	Dayton, NJE Corp.	201-329-4611

nkk switches
OF AMERICA INC.

FAX: 602-998-1435

NKK SWITCHES OF AMERICA, INC., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260, Tel: 602-991-0942; FSC No.: 63426; Empl.: 473; *Sls. Mgr.:* Joseph Nessim; *Dist. Mgr.:* Joseph Nessim ..... **B•1816-1821**

Local Sales Offices & Reps

AL Huntsville, Over & Over 205-837-7105
AZ Phoenix, C.T. Carlberg & Assocs. 602-468-0750
AZ Scottsdale, NKK Switches 602-991-0942
CA Santa Clara, Caltron Components Corp. 408-980-0181
CA Torrance, O'Donnell Assocs. Inc. 213-539-9664
CO Wheatridge, Cluff & Assocs. Inc. 303-425-6604
FL Altamonte Springs, Over & Over, Inc. 407-332-1222
FL Coral Springs, Over & Over Inc. 305-753-7050
FL Tampa, Over & Over Inc. 813-626-9100
GA Norcross, Over & Over, Inc. 404-449-6205
ID Boise, Bob Sickler Sls. Co. 208-344-9588
IL Mt. Prospect, The Dombrow Co., Inc. .. 312-253-3326
IN Carmel, Frank E. Kahsar Sls. 317-844-9353
IA Cedar Rapids, Midwest Tech. Sls. 319-365-4011
KS Goddard, Midwest Tech. Sls. 316-794-8565
KS Lenexa, Midwest Tech. Sls. 913-888-5100
MD Baltimore, Eastern Comp. Sls. 301-788-7050
MA Millis, Schumacher & Yarrington, Inc. 617-376-2411
MI Ann Arbor, Frank E. Kahsar Sls. 313-769-0131
MN Minnetonka, J. P. & Assocs. 612-935-7930
MO St. Charles, Midwest Tech. Sls. 314-441-1012
NH Nashua, Schumacher & Yarrington, Inc. 603-882-2664
NM Albuquerque, C. T. Carlberg & Assocs. 505-836-1448
NY Clifton Pk., NET Sls. Co. 518-371-6864
NY Cortland, NET Sls. Co. 607-756-6592
NY De Ruyter, NET Sls. Co. 315-662-7996
NY Melville, Comtronic Assocs., Inc. 516-249-0505
NY Victor, NET Sls. Co. 716-924-1844
NC Charlotte, Over & Over Inc. 704-542-9111
NC Raleigh, Over & Over Inc. 919-782-9111
OH Cincinnati, Frank E. Kahsar Sls. 513-922-3133
OH Columbus, Frank E. Kahsar Sls. 614-252-4009
OH Mentor, Frank E. Kahsar Sls. 216-257-1166
OR Beaverton, JHS J. Backer Co. 503-627-0775
PA Sewickley, Frank E. Kahsar Sls. 412-741-4155
PA West Conshohocken, Eastern Comps. Sls. 215-825-8610
RI Warwick, Schumacher & Yarrington, Inc. 401-884-5671
TX Dallas, Rem Air Components Corp. ... 214-234-1069
UT Salt Lake City, Cluff & Assocs. 801-486-7297
WA Seattle, James J. Backer Co. 206-285-1300
Can Mississauga, Ont., John G. Weiss Co., Ltd. 416-673-0011
Can Nepean, Ont., John G. Weiss Co., Ltd. 613-825-0545
Can St. Laurent, Que., John G. Weiss Co., Ltd. 514-337-5022
Can Vancouver, B.C., John G. Weiss Co., Ltd. 604-873-1112
Can Winnipeg, Manitoba, John G. Weiss Co., Ltd. 204-949-1877

Local Distributors

AL Huntsville, Allied Elctrns. 205-721-3500
AL Huntsville, Powell Elctrns. 205-539-2731
AZ Phoenix, Dalis Elctrn. Supp. 602-275-2885
AZ Phoenix, Powell Elctrns. 602-938-5552
AZ Tempe, L Comp. Inc. 602-730-1633
AZ Tucson, Dalis Elctrn. Supp. 602-889-5301
AR Ft. Smith, Radio, Inc. 501-646-5200
AR Little Rock, Bluff City Elctrns. 501-376-7044
CA Costa Mesa, Eric Elctrns. 714-751-1185
CA Costa Mesa, Powell Elctrns. 714-754-1717
CA Fountain Valley, Components Ctr. 714-979-0433
CA Fremont, Allied Elctrns. 415-770-0590
CA Irvine, ITT Multicomps. 714-727-4001
CA Los Angeles, Electric Switches, Inc. ... 213-660-1310
CA Milpitas, Zack Elctrns. 415-326-5482
CA Monterey, Zack Elctrns. 408-375-3144
CA Sacramento, Zack Elctrns. 916-446-3131
CA San Diego, Mock III Sls. Co., Inc. 619-560-0515
CA San Diego, Shanks & Wright 619-239-0176
CA San Diego, Southland Comps. 619-578-6630
CA San Francisco, Zack Elctrns. 415-626-1444
CA San Jose, Eric Elctrns. 408-432-1111
CA San Jose, ITT Multicomps. 408-279-0685
CA San Jose, Powell Elctrns. 408-943-9020
CA San Jose, Rose Elctrn. Dist. Co. 408-943-0200
CA Santa Clara, Components Ctr. 408-988-3751
CA Torrance, Allied Elctrns. 213-373-6547
CA Tustin, Allied Elctrns. 714-669-4190
CA Tustin, Western Switches & Controls 714-259-8144
CA Vallejo, Zack Elctrns. 707-644-6676
CO Arvada, Denver Beta 303-431-7161
CO Aurora, Jet Elctrns. Supp. Co. 303-364-1000
CO Colorado Springs, Kimball Elctrns. 303-528-7066
CO Englewood, Allied Elctrns. 303-790-1664
CO Englewood, NEP Elctrns. 303-799-9898
CT Cheshire, Allied Elctrns. 203-272-7730
CT Danbury, Pilgrim Elctrns., Inc. 203-792-7274
CT Wallingford, Greene Shaw 203-265-3333
CT Wallingford, Midstate Elctrns. 203-265-9900
DE Milford, Harco Elctrns. 302-442-3105
DE Wilmington, Wholesale Elctrns. 302-652-3221
FL Altamonte Springs, Control Des. Supp., Inc. 305-788-3220
FL Bradenton, Dow Elctrns. 813-756-9571
FL Ft. Lauderdale, Bros. Elctrns. 305-561-6700
FL Ft. Lauderdale, Powell Elctrns. 305-484-8377
FL Ft. Meyers, Dow Elctrns. 813-334-6577
FL Gainesville, Dow Elctrns. 904-376-3231
FL Jacksonville, Dow Elctrns. 904-356-8426
FL Lakeland, Dow Elctrns. 813-686-8193
FL Largo, Allied Elctrns. 813-541-4660
FL Longwood, RM Elctrns. 407-862-9191
FL Maitland, Elctrn. Equip. 407-539-0888
FL Melbourne, Greene Shaw 407-951-3636
FL Miami, Electronic Equip. Co. 305-871-3500
FL Orlando, Dow Elctrns. 407-299-2771
FL Orlando, Wallace 407-841-0400
FL Pompano Bch., Allied Elctrns. 305-978-3008
FL Pompano Beach, Dow Elctrns. 305-975-5550
FL St. Petersburg, Dow Elctrns. 813-525-1131
FL Tampa, Dow Elctrns. 813-626-5191
FL Tampa, Dow Elctrns. 813-870-3315
FL Tampa, Elctrn. Equip. Co., Inc. 813-988-0810
FL West Palm Beach, Nurmi Elctrn. Supp., Inc. 305-686-8553
GA Albany, Dow Elctrns. 912-435-1711
GA Atlanta, Dow Elctrns. 404-446-3140
GA Augusta, Dixie Elctrns., Inc. 404-772-2055
GA Augusta, Dow Elctrns. 404-722-1526
GA Macon, Dow Elctrns. 912-743-5421
GA Marietta, Dow Elctrns. 404-422-4333
GA Norcross, Allied Elctrns. 404-446-8595
GA Norcross, Applied Power, Inc. 404-263-0421
GA Norcross, Dow Elctrns. 404-448-4004
GA Norcross, Spectrum Elctrns. 404-448-1516
GA Norcross, Whitehead Elctrns. 404-923-6667
GA Savannah, Dow Elctrns. 912-234-1684
ID Boise, Kimball Elctrns., Inc. 208-342-3559
ID Pocatello, Kimball Elctrns., Inc. 208-232-2201
IL Addison, Belford Elctrns. 312-691-1100
IL Addison, L Comp, Inc. 312-628-1400
IL Bensenville, Goold Elctrns. 312-860-7171
IL Chicago, Leeds Electro Comps. 312-625-3800
IL Des Plaines, Allied Elctrns. 312-803-1040
IL Elgin, Allied Elctrns. 312-697-8200
IL Geneva, Melvin Elctrns., Inc. 312-232-7300
IL Villa Park, Melvin Elctrns., Inc. 312-279-5015
IL Wheeling, Hawk Elctrns., Inc. 312-459-4030
IL Wood Dale, Nep Elctrns. 312-595-8500
IN Indianapolis, Allied Elctrns. 317-875-0448
IN Indianapolis, MAR Elctrns. 317-633-6699
IN Indianapolis, RM Elctrns. 317-291-7110
IA Sioux City, Molstad Distrbg. 712-255-8023
KS Great Bend, RSC Elctrns., Inc. 316-793-3507
KS Salina, RSC Elctrns., Inc. 913-823-6353
KS Wichita, Airtechnics, Inc. 316-267-2849
KS Wichita, L-Comp 316-265-5100
KS Wichita, Radio Inc. 316-264-2798
KS Wichita, RSC Elctrns., Inc. 316-267-5213
KY Florence, URI Elctrns., Inc. 606-371-4423
LA New Orleans, Southern Radio Supp. Co. 504-524-2343
MD Aberdeen, Harco Elctrns. 301-838-7990
MD Columbia, Allied Elctrns. 301-381-1560
MD Columbia, Powell Elctrns. 301-995-6410
MD Gaithersburg, Axis Elctrns., Inc. 301-840-9640
MD Kensington, Marine Air Supply Co. 301-949-9560
MD Marlow Hgts., Allied Elctrns. 301-423-0161
MA Avon, Controller Svc. & Sls. 617-584-9010
MA Billerica, Allied Elctrns. 508-667-8624
MA Boston, Controller Svc. & Sls. 617-269-1375
MA Newton, Greene Shaw 617-969-8900
MA Westborough, Powell Elctrns. 617-366-6100
MI Ann Arbor, Wedemeyer Elctrn. Supp. .. 313-665-8611
MI Grand Rapids, RM Elctrns. 616-531-9300
MI Lansing, Wedemeyer Elctrn. Supp. 517-484-9009
MI Livonia, Allied Elctrns. 313-462-0190
MI Novi, Belford Elctrns. 313-349-6842
MI St. Clair Shores, Spemco Switches ... 313-771-2700
MN Burnsville, Cassidy Elctrns. 612-895-9026
MN Eden Prairie, Allied Elctrns. 612-829-7554
MN Minneapolis, Stark Elctrns. Supp., Inc. 612-332-1325
MN Minneapolis, Tor Tec 612-866-3662
MS Columbus, Bluff City Elctrns. 601-328-6212
MS Tupelo, Bluff City Elctrns. 601-842-6832
MO Kansas City, L Comp., Inc. 816-221-2400
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CA Carson, Tritek Solutions, Inc. 213-515-1590
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NOVA TRAN, Union Carbide Corp., 100 Deposition Dr., Clear Lake, WI 54005, Tel: 800-554-1697, FAX: 715-263-3189; *Sls. Mgr.:* Paul McGuire

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NTK

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TX	Dallas, NTK Tech. Ceramic	214-404-1173
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NT.T/WAVECONN, State Rd. Hill, Meadville, PA 16335, Tel: 800-535-3162, 914-591-4173, FAX: 914-591-7783; Empl.: 100; *Sls. Mgr.:* Sigmund Jay Silberstein

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NU-METRICS INC., Cedar Valley Bldg., Box 471, Vanderbilt, PA 15486, Tel: 412-628-6370, 800-346-2025, FAX: 412-628-8875; Empl.: 12; *Sls. Mgr.:* Bernie Ames

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NYTRONICS COMPONENTS GRP., INC., 700 Orange St., Darlington, SC 29532, Tel: 803-393-5421, TWX: 810-665-2182; FSC No.: 83125; Empl.: 502; *Sls. Mgr.:* Mack W. Windham ..... **A•1148-1161, 1196, 1254-1275, 1604-1610, 2001; B•1024**

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CA	Los Angeles, MG Sls.	213-476-3113
CA	Sunnyvale, W.W. Posey	408-746-0771
CO	Englewood, Component Sls.	303-779-8060
CT	Bloomfield, FSI	203-243-3122
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KS	Lenexa, Mid-Tec Assoc.	913-541-0505
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MN	Edina, Dunlop Consits.	612-933-9070
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NJ	W. Caldwell, Grimm, Siegel	201-575-9300
NJ	West Orange, National Atlantic	201-731-0730
NY	Pittsford, W.A. Franklin Sls.	716-248-8251
OH	Cincinnati, Kahsar Sls., Inc.	513-922-3133
OH	Columbus, Kahsar Sls., Inc.	614-252-4009
OR	Tigard, Eltech, Inc.	503-684-3458
PA	Narberth, Bresson Assocs.	215-664-6460
TX	Houston, Texoma	713-462-1432
TX	Richardson, Texoma	214-238-8127
UT	Salt Lake City, Component Sls.	801-268-8440
VA	Forest, Bresson Assocs.	804-525-7445
WA	Bellevue, Eltec	206-643-4330
WI	Milwaukee, Beta	414-543-6609
Can	Nepean, Ont., Dynasty Elctrns.	613-723-0725

Local Distributors

CA	Garden Grove, Inductive Prods.	714-891-2572
CA	Gardena, Bell Inds.	213-515-1800
CA	San Diego, Mock III	619-560-0515
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	Santa Clara, Cypress	408-980-2500
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Thousand Oaks, Bell	805-499-6821
CA	Walnut, A. C. I.	818-331-0735
CO	Englewood, Industrial Elctrns.	303-694-9444
CO	Wheatridge, Bell Inds.	303-424-1985
IL	Chicago, Bell Inds.	312-982-9210
IL	Chicago, Newark Elect.	312-638-4411
IN	Indianapolis, Bell Inds.	317-634-8202
MD	Beltsville, Newark Elec.	301-937-5085
MD	White Marsh, RESCO/Baltimore	301-529-0500
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Woburn, Sterling Elec.	617-938-6200
MN	Minneapolis, Joel Co.	612-545-5669
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hauppauge, Fairmont Elctrns.	516-231-3313
NY	Hauppauge, Jaco Elect.	516-273-5500
NY	Plainview, ACI Elect.	516-293-6630
NY	Rome, Rome Elect.	315-337-5400
NC	Raleigh, Radio Elec. Svc.	919-781-5700
OH	Centerville, C.V. Clark	513-435-3000
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Montgomeryville, Pyttronic Inds.	215-643-2850
PA	Philadelphia, Herback Rademan	215-426-1700
PA	Philadelphia, PEI	215-568-7400
PA	York, E. C. I.	717-843-8971
TX	Dallas, Wholesale Elect.	214-824-3001
WA	Bellevue, Bell Inds.	206-747-1515

OAK Switch Systems Inc.

FAX: 815-459-5000 (x2218)

OAK SWITCH SYSTEMS, 100 S. Main St., Crystal Lake, IL 60014, Tel: 815-459-5000; FSC No.: 76854; Empl.: 500; *Dist. Mgr.:* Gary LeMaire ..... **B•1822, 1880**

Local Sales Offices & Reps

AL	Huntsville, Electramark, Inc.	205-830-4400
AZ	Scottsdale, Harris & Croy	602-951-9121
CA	Granada Hills, C & N & Assocs., Inc.	805-254-5844
CA	Walnut Creek, Tech-Rep Assocs.	415-934-8028
FL	Clearwater, Tech-Rep Associates	813-572-9900
FL	Winter Springs, Tech Rep Associates	407-699-4010
GA	Norcross, Electramark, Inc.	404-446-7915
IL	Crystal Lake, Oak Switch Sys. Inc.	815-459-5000
IL	Palatine, Golbeck/Milota	312-705-0602
IA	Cedar Rapids, Pattison Sls.	319-395-9866
KS	Olathe, C-Tron, Inc.	913-829-0073
MA	Acton, Boston Elctrns. Assocs.	508-264-4456
MI	White Pigeon, Oak Switch Sys. Inc.	616-483-7179
MN	Bloomington, Horizon Technologies	612-884-6515
MO	St. Charles, C-Tron	314-928-8078
NV	Las Vegas, Harris & Croy Inc.	702-876-5022
NJ	Cherry Hill, Eastern Elctrns.	609-662-2113
NJ	Mountainside, Henry G. Richter	201-233-4615
NM	Albuquerque, Harris & Croy Inc.	505-275-9103
NY	Fayetteville, Henry G. Richter	315-637-6713
NC	Raleigh, Eastern Elctrns.	919-876-7591
OH	Cincinnati, JMK Elctrns.	513-271-3860
OH	Cleveland, JMK Elctrns.	216-886-7100
OR	Tigard, Matrix Sls. & Mktg.	503-639-0325
PA	Phoenixville, Henry G. Richter	215-495-6176
TX	Dallas, Dal/Tex Rep., Inc.	214-991-7799
WA	Seattle, Rep-West	206-283-8351
Can	Don Mills, Ont., R. D. Assocs.	416-444-0959

Local Distributors

AL	Huntsville, Component Distr.	205-883-7501
AL	Huntsville, Marshall Elctrns.	205-881-9235
AZ	Phoenix, Marshall Elctrns.	602-496-0290
AZ	Scottsdale, Harper SID	800-442-7737
CA	Chatsworth, Marshall Elctrns.	818-407-4100
CA	Compton, Harper SID	213-979-5090
CA	Inglewood, Newark Elctrns.	213-671-7066
CA	Irvine, Marshall Elctrns.	714-859-5050
CA	Milpitas, Marshall Elctrns.	408-943-4600
CA	Mountain View, I/O Sls. Inc.	415-968-1080
CA	Rancho Cordova, Marshall Elctrns.	916-635-9700
CA	Sacramento, Zack Electronics	916-446-3131
CA	San Diego, Harper SID	619-578-2500
CA	San Diego, Marshall Elctrns.	619-578-9600
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	Sunnyvale, Bell Ind.	408-734-8570
CO	Denver, CSID	303-292-9594
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Component Distrs.	303-799-4916
CO	Thornton, Marshall Elctrns.	303-451-8383
CT	Wallingford, Marshall Elctrns.	203-265-3822
FL	Altamonte Springs, Marshall Elctrns.	305-767-8585
FL	Ft. Lauderdale, Marshall Elctrns.	305-977-4880
FL	Melbourne, Component Distr.	305-724-9910
FL	W. Palm Bch., Wings Electro Sls. Co.	407-798-6606
GA	Norcross, Component Distr.	404-441-3320
GA	Norcross, Marshall Elctrns.	404-923-5750
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Crystal Lake, Sub-Sem, Inc.	815-459-4139
IL	Palatine, Ohm/Elctrns.	312-359-5500
IL	Rosemont, Advent Elctrns.	312-297-6200
IL	Schaumburg, Marshall Elctrns.	312-490-0155
IL	Urbana, Bell Ind.	217-328-1077
IN	Indianapolis, Advent Elctrns.	317-874-2190
IN	Indianapolis, Bell Ind.	317-875-8200
IN	Indianapolis, Marshall Elctrns.	317-297-0483
KS	Edwardsville, C. Tennant Co.	913-441-1801
KS	Lenexa, Marshall Elctrns.	913-492-3121
MD	Silver Spring, Marshall Elctrns.	301-622-1118
MA	Canton, Impact Sls.	617-821-1500
MA	Westborough, In-Stock Prods.	508-870-5750
MA	Wilmington, Marshall Elctrns.	508-658-0810
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Livonia, Marshall Elctrns.	313-525-5850
MI	Oak Park, Newark Elctrns.	313-967-0600
MN	Minneapolis, Berquist	800-328-3882
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Plymouth, Marshall Elctrns.	612-559-2211
MO	Maryland Hts., Olive Elctrns.	314-997-7709
NJ	Fairfield, Marshall Elctrns.	201-882-0320
NJ	Mt. Laurel, Marshall Elctrns.	609-234-9100
NJ	Springfield, Route Elctrns.	201-379-7710
NM	Albuquerque, Walker Radio	505-883-2992
NY	East Syracuse, Add/ Modutek	315-437-1852
NY	Hauppauge, Fairmont Elec.	516-231-3313
NY	Hauppauge, Marshall Elctrns.	516-273-2424
NY	Jamaica, Calson Co.	718-525-5900
NY	Johnson City, Marshall Elctrns.	607-798-1611
NY	Northport, Coke-el Aerospace Co.	516-754-2233
NY	Rochester, Marshall Elctrns.	716-235-7620
NC	Raleigh, Component Distr.	919-787-7311
NC	Raleigh, Marshall Elctrns.	919-878-9882
OH	Centerville, IPD	513-435-2086
OH	Dayton, Marshall Elctrns.	513-898-4480
OH	Solon, Marshall Elctrns.	216-248-1788
OH	Westerville, Marshall Elctrns.	614-891-7580

OR	Beaverton, Marshall Elctrns.	503-644-5050
OR	Portland, Radar Elec.	503-232-3404
PA	Pittsburgh, Marshall Elctrns.	412-963-0441
TX	Austin, Marshall Elctrns.	512-837-1991
TX	Carrollton, Marshall Elctrns.	214-233-5200
TX	Dallas, Component Distr.	214-644-0373
TX	El Paso, Ideal Indl. Elect.	915-779-6647
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Marshall Elctrns.	713-895-9200
TX	Irving, Harper S. I. D.	214-621-0500
UT	Salt Lake City, Marshall Elctrns.	801-485-1551
WA	Bothell, Marshall Elctrns.	206-486-5747
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	Waukesha, Marshall Elctrns.	414-797-8400
Can	Burnaby, B.C., Semad Elctrn. Dist.	604-438-2515
Can	Calgary, Alberta, Semad Elctrn. Dist.	403-252-5664
Can	Downsview, Ont., Westburne Elctrns.	416-635-2980
Can	Markham, Ont., Semad Elctrn. Dist.	416-475-3922
Can	Ottawa, Ont., Semad Elctrn. Dist.	613-727-8325
Can	Ottawa, Ont., Westburne Elctrns.	613-737-5570
Can	Pointe Claire,Quebec, Semad Elctrn. Dist.	514-694-0860
Can	Winnipeg, Manitoba, Westburne Industrial Ent.	204-786-4451
AZ	Tucson, Harris & Croy Inc.	602-882-8642

OAKTRON MANUFACTURING, INC., 704 30th St, Monroe, WI 53566, Tel: 608-328-5560, TELEX: 260-266, FAX: 608-328-5575; FSC No.: 07109; Empl.: 100; *Sls. Mgr.:* J. F. Disch

OAL ASSOCIATES, INC., P.O. Box J, Escondido, CA 92025, Tel: 619-743-7143, FAX: 619-743-2460; Empl.: 18; *Sls. Mgr.:* Mark Lohkemper

OAS INC., See Optimum Applied Systems

OCEAN MARINE INSTRUMENT, P. O. Box 3963, Tustin, CA 92680, Tel: 714-832-4627

OCEAN STATE THERMOTICS, INC., 27 Thurber Blvd, Smithfield, RI 02917, Tel: 401-231-4640, FAX: 401-231-4641; Empl.: 50; *Sls. Mgr.:* Stephen R. Hecht; *Dist. Mgr.:* Stephen R. Hecht

OCTAGON SYSTEMS, 6510 W. 91st Ave., Westminster, CO 80030, Tel: 303-426-8540, TELEX: 4931919

OCULAR INC., 1701 N. Collins Ste. 330, Richardson, TX 75080, Tel: 214-437-2561, FAX: 214-437-2562; Empl.: 80; *Sls. Mgr.:* Ben Kwong ..... **B•1099-1101**

Local Sales Offices & Reps

NJ	Wayne, Breen Assocs.	201-696-8683
RI	Warren, William Poisson & Assocs.	401-245-0260
TX	Dallas, Component Technlg.	214-783-8831
WA	Federal Way, K.R. Jensen Sls. Co.	206-874-2772

ODELL, M. P., CO., 1620 Chesapeake Dr., Hoffman Estates, IL 60195, Tel: 312-991-2828; *Sls. Mgr.:* Maria McClurkin

OECO CORP., 4607 S.E. International Way, Milwaukie, OR 97222, Tel: 503-659-7932, TELEX: 36-0350, FAX: 503-653-6310; FSC No.: 95266; *Sls. Mgr.:* Dave Fuller, VP Sls.

OGALLALA ELCTRNS., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153, Tel: 308-284-4093, FAX: 308-284-4093 (ext 29); Empl.: 39; *Sls. Mgr.:* H. L. Harrington

BRILL ELECTRONICS
(415) 834-5888
610 E. 10th St., Oakland, CA 94606
OHMITE
(213) 452-8002
1220 Olympic Bl., Santa Monica, CA 90404

OSI

FAX: 614-486-0743

OHIO SEMITRONICS, INC., 1205 Chesapeake Ave, Columbus, OH 43212, Tel: 614-486-9561; FSC No.: 12066; Empl.: 47; *Sls. Mgr.:* G. Clagett .. **B•1968-1986; D•1330**

Local Sales Offices & Reps

AZ	Tucson, Sheldon Equip.	602-722-1452
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Fremont, FLW, Inc.	415-651-6511
CT	Wallingford, Pat Jenks Assocs.	203-265-9939
FL	Orlando, Datarep	407-843-5224
GA	Marietta, FLW	404-424-1731
IL	Park Ridge, Elctrn. Instr. Assocs.	312-298-2290
IL	Waterloo, R.L. Weisheimer & Assocs.	314-487-7328
MD	Baltimore, Electra-Tech, Inc.	301-877-8344
MA	Beverly, Pat Jenks Assocs.	508-921-4600
MI	Milford, TMS	313-360-1514
MN	Minneapolis, The Mark Co.	612-933-3026
NJ	Garwood, E.R. Mertz, Inc.	201-232-4643
NY	Latham, L-Tron Corp.	518-785-5032
NC	Charlotte, Zelco Assocs.	704-541-6122
OH	Dayton, Mohawk Intronics	513-434-8873
OH	No. Ridgeville, TMS, Inc.	216-327-3527
OR	Portland, Topp Engrg. Sls. Corp.	503-244-7265
PA	Frazier, FLW, PA, Inc.	215-251-9700
PA	Monroeville, TMS	412-776-1666
TN	Memphis, Jordan/Marlar/Hale, Inc.	901-452-7441
TX	Houston, Scientific Sls. Co.	713-645-6218
TX	Richardson, Scientific Sls. Co.	214-231-6541
UT	Salt Lake City, MC Squared, Inc.	801-298-3388
WA	Bellevue, Topp Engrg. Sls. Corp.	206-747-5400

FAX: 312-675-1505

OHMITE MANUFACTURING CO., 3601 W. Howard St, Skokie, IL 60076, Tel: 312-675-2600, TELEX: 72-4433, TWX: 910-223-0805; FSC No.: 44655 ..... **A•2003-2019, 2138-2139**

ohmtek
... a VISHAY Company

FAX: 716-283-5932

OHMTEK INC., Vishay, 2160 Liberty Dr., Niagara Falls, NY 14304, Tel: 716-283-4025; FSC No.: 57489; Empl.: 175; *Sls. Mgr.:* William Cuviello ..... **A•2020-2025**

Local Sales Offices & Reps

AZ	Scottsdale, Semper Fi Sls., Inc.	602-991-4601
CA	Chatsworth, Raltech	818-700-0933
CA	Del Mar, Chapman & Chapman	619-755-0412
CA	Glendale, Mission Mktg. Grp.	818-247-9110
CA	Santa Clara, I Square, Inc.	408-988-3400
CO	Denver, West, Inc.	303-477-8180
FL	St. Petersburg, J.C.J. Assocs.	813-343-2679
IL	Downers Grove, Richmar Elctrns.	312-968-0118
IN	Ft. Wayne, John F. Kilfoil Co.	219-436-7233
IA	Hiawatha, Ard Sls.	319-393-6392
MA	Sterling, Compatible Comps., Inc.	617-422-7641
MI	Jackson, T.P.S. & Assocs.	517-783-1722
MN	Minneapolis, Dunlop Consits.	612-544-1070
NJ	Piscataway, R. P. Luce & Co.	201-752-8750
NY	Chappaqua, Micrel, Inc.	914-238-4961
NY	New Hyde Pk., R. P. Luce & Co.	516-437-4550
NY	Rochester, Fritz Dasson	716-338-1699
OH	Wooster, T.P.S. & Assocs.	216-264-0971
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Wynnewood, Metz-Benham Assocs., Inc.	215-896-7300
TX	Richardson, Pro-Comp Sls. Co.	214-669-1500
UT	Salt Lake City, West, Inc.	801-466-5739
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
Can	Rexdale, Ont., Source Elctrns.	416-675-6235

Local Distributors

MA	Sterling, Compatible Comps. Dvcs.	617-422-7356

OK INDUSTRIES, INC., 4 Executive Plaza, Yonkers, NY 10701, Tel: 914-969-6800, TELEX: 12-5091; Empl.: 200; *Sls. Mgr.:* John Malboeuf

OKONITE CO., Box 340, Ramsey, NJ 07446, Tel: 201-825-0300, TWX: 710-988-1017; Empl.: 1700; *Sls. Mgr.:* F. R. Postma

OLEKTRON CORP., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570, Tel: 508-943-7440, TWX: 710-347-1602, FAX: 508-949-1804; FSC No.: 32252

OLFLEX WIRE & CABLE, INC., 30 Plymouth Street, Fairfield, NJ 07006, Tel: 201-575-1101, TELEX: 130-327, ESYLNK: 201-575-7178; Empl.: 25; *Sls. Mgr.:* Michael R. Picone

OLIVER ADVANCED ENGINEERING, 320 W. Arden St, Glendale, CA 91203, Tel: 818-240-0080, FAX: 818-240-6131; Empl.: 28; *Sls. Mgr.:* J. Gilberts

OLYMPIC WIRE & CABLE, 1 Madison Rd., Fairfield, NJ 07006, Tel: 201-227-7996, FAX: 201-227-1606; FSC No.: 63830; Empl.: 35; *Dist. Mgr.:* Yvette Archer

OMEGA ENGINEERING, INC.

OMEGA ENGINEERING, Box 4047, Stamford, CT 06907, Tel: 800-826-6342, TELEX: 99-6404; Empl.: 500; *Sls. Mgr.:* Peter Casiraghi & Nelson Hart ..... **B•1823, 1912-1913, 1988-1989; C•1907; D•1015, 1102, 1154, 1196, 1331, 1414-1415, 1442**

OMEGA PRECISION CORP., 1384 Pompton Ave., Cedar Grove, NJ 07009, Tel: 201-256-3422; FSC No.: 9Y506; Empl.: 16; *Sls. Mgr.:* Leon Komsa

OMNIBYTE CORP., 245 W. Roosevelt Rd., Bldg. 1-5, W. Chicago, IL 60185, Tel: 312-231-6880, 1-800-638-5022, FAX: 1-312-231-7042; Empl.: 38; *Sls. Mgr.:* Mike Hansen

OMNIPrint

FAX: 408-747-0358

OMNIPRINT, INC., 1188 Elko Drive, Sunnyvale, CA 94089, Tel: 408-745-6400; Empl.: 12 ..... **D•1103-1105**

Local Sales Offices & Reps

CA	Irvine, OBI Distrs.	714-250-9003
IL	Arlington Heights, Coombs Assoc., Inc.	312-439-9810
NJ	Fords, Marlin Data	201-738-7200

OMNI SWITCH USA, INC., 21630 N. 19th Ave., Ste. B-16, Phoenix, AZ 85027, Tel: 602-582-0629, FAX: 602-582-0665; Empl.: 100; *Sls. Mgr.:* Peggy Ann Wenzel, V.P.

OMRON ELECTRONICS, INC., Consumer & Commerical Div., 1 East Commerce Dr., Schaumburg, IL 60173, Tel: 312-843-7900, TELEX: 910-291-0426, FAX: 312-843-7787; Empl.: 200; *Sls. Mgr.:* Tony Tinaglia; *Dist. Mgr.:* Gary Myers ..... **B•1592-1596, 1672, 1824-1825**

Local Sales Offices & Reps

CA	Anaheim, Omron Elctrns., Inc.	714-978-3420
CA	Cupertino, Ormon Elctrns., Inc.	408-255-9231
CO	Aurora, Moss Mktg.	303-340-8535
FL	Clearwter, Dyne-A- Mark	813-441-4702
FL	Fort Lauderdale, Dyne -A- Mark	305-771-6501
FL	Orlando, Dyne-A-Mark	407-831-2822
GA	Atlanta, Omron Elctrns., Inc.	404-477-2115
IL	Hoffman Estates, Ormon Elctrns., Inc.	312-843-2780
IN	Greenwood, Valentine & Assocs.	317-888-2260
IN	Southbend, Valentine & Assoc.	219-288-7070
IA	Des Moines, SPS Assocs.	515-225-0607
KS	Olathe, Omron Electrns., Inc.	913-764-8426
KS	Olathe, SPS Assocs.	913-764-4460
MA	Danvers, Omron Elctrns., Inc.	508-774-6501
MI	Grand Rapids, Omron Elctrns., Inc.	616-949-9666
MN	Minneapolis, Omron Elctrns., Inc	612-933-4015
MO	Earth City, SPS Assocs.	314-291-0520
NE	Panama, SPS Assocs.	402-788-2536
NY	Rochester, Omron Elctrns.	716-342-0953

NY Oceanside, Bitten Assocs. 516-678-6222
NC Raleigh, Omron Elctrns. 919-833-8211
OH Columbus, Omron Elctrns. 614-847-8209
PA Philadelphia, Omron Elctrns.,Inc. 215-964-9376
TX Dallas, Omron Elctrns., Inc. 817-792-3539
UT Salt Lake City, Moss Mktg. 801-363-5875
Can Calgary, Alberta, Omron Canada, Inc. 403-278-1833
Can MOntreal, Ormon Canada, Inc. 514-694-6361
Can Toronto, Ont., Omron Canada, Inc. 416-298-9988

OMRON ELCTRNS., INC., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, Tel: 312-843-7900, TWX: 910-291-2494, FAX: 312-843-7787 (ext. 8568); Empl.: 250; *Sls. Mgr.:* F. Newburn

OMUTEC, Odetics, Inc., 1515 S. Manchester Ave., Anaheim, CA 92802, Tel: 714-758-0200, TWX: 910-594-1461; *Sls. Mgr.:* Robert Asher

ONAN POWER/ELECTRONICS, 4801 W. 81st St., Minneapolis, MN 55437, Tel: 612-921-5600, FAX: 612-921-5627; FSC No.: 3Z577; *Sls. Mgr.:* John R. Michael

ONEAC CORPORATION, 27944 N. Bradley Rd., Libertyville, IL 60048, Tel: 312-816-6000, 800-327-8801, TWX: 757024 ONEAC USA; Empl.: 170; *Sls. Mgr.:* John Jeter; *Dist. Mgr.:* John Jeter

ONSET COMPUTER CORP., 199 Main St., PO Box 1030, N. Falmouth, MA 02556, Tel: 508-563-2267, FAX: 508-563-9477; Empl.: 10; *Sls. Mgr.:* Lon Hocker

OPAMP LABS, INC., 1033 N. Sycamore Ave., Los Angeles, CA 90038, Tel: 213-934-3566, FAX: 213-464-0977; FSC No.: 24699; Empl.: 18 ..... **D•1016**

OPTEK

FAX: 214-542-1739

OPTEK TECHNOLOGY INC., 345 Industrial Blvd., McKinney, TX 75069, Tel: 214-542-9461, TWX: 910-860-5625; Empl.: 2000; *Sls. Mgr.:* Larry Major; *Dist. Mgr.:* Betty Renfro ..... **B•1333**

Local Sales Offices & Reps

AL Huntsville, R.O. Whitesell & Assoc. 205-883-5110
AZ Scottsdale, Earl & Haas Assoc. 602-994-3813
AZ Scottsdale, Pinnacle Comp. Sls. 602-994-0441
AZ Tucson, Pinnacle Comp. Sls. 602-886-1726
CA Calabasas, Quad Rep Southern 818-887-3711
CA Escondido, Uni Rep 714-746-5131
CA Escondido, Uni Rep Co. 619-746-5131
CA Irvine, Quad Rep Southern 714-727-4222
CA Mountain View, Marcon 415-964-8046
CA Santa Clara, Criterion 408-988-6300
CA Thousand Oaks, Sc Cubed 805-496-7307
CA Tustin, Sc Cubed 714-731-9206
CO Wheat Ridge, Waugaman Assoc. 303-423-1020
CO Wheatridge, Waugaman Assocs. 303-423-1020
CT Madison, Conti-Younger Assocs. 203-245-1136
CT Stratford, VISTAssociates 203-375-5456
FL Coral Springs, H A I 305-752-7520
FL Melborne, H A I 305-676-1639
FL Orlando, South Atlantic Comp. Sls. 407-857-3650
FL Tampa, HAI 813-963-0743
GA Norcross, South Atlantic Comp. Sls. ... 404-447-6154
IL Arlington Heights, KMA Sls. Co. 312-398-5300
IL Rolling Meadows, KMA Sales 312-398-5300
IN Ft. Wayne, R.O. Whitesell & Assoc. 219-432-5591
IN Indianapolis, J & W Sales 317-842-3740
IN Indianapolis, R.O. Whitesell & Assoc. .. 317-359-9283
IN Kokomo, R.O. Whitesell & Assoc. 317-457-9127
IA Cedar Rapids, C.H. Horn & Assoc. 319-393-8703
KY Pewee Valley, R.O. Whitesell & Assoc. 502-241-1441
MD Columbia, L.D. Lowery Inc. 301-381-0225
MA Burlington, Conti-Younger Assocs. 617-273-1582
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NY Clark Mills, KLM Garner 315-853-6126
NY Clark Mills, KLM/Garner 315-853-6126
NY Manhasset, Win-Cor Elec. 516-627-9474
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NY Pittsford, KLM/Garner 716-381-8350
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NC Raleigh, South Atlantic Comp. Sls. 919-852-4676
OH Cincinnati, R.O. Whitesell 513-521-2290
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TN Nashville, R.O. Whitesell & Assoc. 615-352-4760
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TX Austin, ProSales 512-467-9947
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CA Anaheim, Pacesetter 714-779-5855
CA Chatsworth, Anthem 818-700-1000
CA Compton, Harper-S.I.D. 213-979-5090
CA Culver City, Hamilton-Avnet 213-558-2000
CA East Irvine, Anthem 714-768-4444
CA Los Angeles, Bell Inds. 213-826-6778
CA San Diego, Anthem 619-453-9005
CA San Jose, Anthem 408-295-4000
CA Tustin, Added Value 714-259-8258
CA Tustin, AVED 714-259-8258
CO Englewood, Anthem 303-790-4500
IL Chicago, Newark Elctrns. 312-784-5100
IL Elk Grove Village, RM Elctrns. 312-364-6622
IL Palatine, Ohm Elctrns. 312-359-5500
IN Indianapolis, RM Elctrns. 317-291-7110
MD Gaithersburg, Pioneer-Technlg. 301-921-0660
MA Andover, R2 Elctrns. 617-470-3777
MA Newton, Greene Shaw 617-969-8900
MA Newton, Greene-Shaw Co. 917-969-8900
MA Norwood, Gerber Elctrns. 617-769-6000
MI Grand Rapids, RM Elctrns. 616-531-9300
MN Fridley, Voyager 612-571-7766
NJ West Berlin, General Comps., Inc. 609-768-6767
NY Melville, Arrow Elctrns. 516-391-1300
NY New York, Moneloa Elctrns. 212-764-3028
NC Greensboro, Golden Elctrns. 919-294-4653
WA Belleview, Bell Inds. 206-747-1515
WI Milwaukee, Taylor 414-241-4321
Can Pointe Claire, Que., Future Elctrns. 514-694-7710

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AZ	Scottsdale, Arcom Sls.	602-947-5745
CA	Brea, Masco Elctrns.	714-529-0866
CA	Santa Clara, Nova-Tronix	408-727-9530
CO	Lakewood, Candal, Inc.	303-935-7128
CT	Clinton, Selmark Associates	203-573-9088
FL	Oviedo, Conley & Assocs., Inc.	305-365-3283
GA	Roswell, AWREP Associates, Inc.	404-998-5008
IL	Itasca, Janus, Inc.	312-250-9650
IN	Indianapolis, STB & Associates,Inc.	317-844-9227
KS	Kansas City, BC Elctrn. Sls.	913-342-1211
MD	Randallstown, Beacon North	703-478-2480
MA	Millis, Selmark Assocs., Inc.	508-376-2914
MI	St. Clair Shores, DEM Electronic Sales	313-777-1750
MN	Minneapolis, Holmgren	612-786-7641
MO	Ferguson, BC Elctrn. Sls.	314-521-6683
NH	Hopkinton, Selmark Associates, Inc.	508-376-2914
NJ	Berkeley Heights, Cambridge Allen	201-464-0203
NY	Binghamton, Empire Tech. Assoc.	607-772-0651
NC	Raleigh, Zucker Associates	919-782-8433
OH	Cleveland, C. A. Robinson Co.	216-473-6044
OH	Dayton, C. A. Robinson Co.	513-278-7969
PA	Collegeville, Beacon North, Inc.	215-287-5479
TX	Austin, Matthews & Assocs.	512-346-2969
TX	Dallas, Matthews & Assocs.	214-248-7881
UT	Salt Lake City, Sierra Technical Sales	801-566-9719
VA	Sterling, Beacon North	703-478-2480
WA	Bellevue, MC & Associates	206-746-7780
WI	Waukesha, Janus, Inc.	414-542-7575

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CT	Clinton, Selmark Assocn.	203-573-9088
IN	Indianapolis, STB & Assocs.	317-844-9227

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MA	Needham, Ray Perron & Co.	617-449-6162
NH	Merrimack, Ray Perron & Co.	603-424-4423
WA	Eastsound, JB Assocs.	206-376-4766

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Optrex

FAX: 213-375-8565

OPTREX/SATORI, 23717 Hawthorne Blvd. Ste. 201, Torrance, CA 90505, Tel: 213-378-9478; Empl.: 12; *Sls. Mgr.:* Ken Yoshikawa; *Dist. Mgr.:* Ken Yoshikawa ..... **B•1102-1104**

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AZ	Scottsdale, E.T.S.	602-941-9137
AZ	Scottsdale, ETS	213-378-9478
CA	Santa Clara, Nova-Tronix	408-727-9530
CA	Torrance, Satori Elec.	213-378-9478
CO	Denver, Aki Entprs.	303-388-4488
CO	Denver, AKI Entprs.	303-388-4488
GA	Atlanta, Satori Elec.	404-320-8482
OR	Portland, Venture Elctrns.	503-624-0617
OR	Portland, Venture Elex	503-624-0617
WA	Seattle, Venture Elctrns.	206-454-4594
TX	Dallas, Satori Elec.	214-518-1946
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ORBIT INSTRUMENT CORP., 80 Cabot Ct., Hauppauge, NY 11788, Tel: 516-435-8300, TWX: 510-221-2122, FAX: 516-435-8458; FSC No.: 11263; *Sls. Mgr.:* Jeanne Szabodas ..... **B•1881; D•1155**

Local Sales Offices & Reps

CA	San Diego, Orbit Instr. Corp.	619-566-3437

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FAX: 714-527-7552

ORBIT INSTRUMENT OF CAL., 6431 Global Dr., Cypress, CA 90630, Tel: 714-527-0561, TWX: 510-221-2122; FSC No.: 11263; *Sls. Mgr.:* Graham Vernon ..... **B•1881; D•1155**

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MA	Tewksbury, Delcon Sls.	617-851-9911

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CA	Garden Grove, Advanced Digital Grp.	714-897-0319
CA	Santa Clara, Elcor Assocs.	408-980-8868
FL	Odessa, High Tech Support Grp.	813-920-7564
GA	Duluth, Electro-Cadd	404-446-7523
KS	Overland Park, Walker Engrg., Inc.	913-888-0089
MA	Wilmington, DGA Assocs., Inc.	617-935-3001
MI	Bloomfield Hills, MacKellar Assocs.	313-335-4440
MN	Minneapolis, Comstrand, Inc.	612-788-9234
NJ	Manalapan, Beta Lambda, Inc.	201-446-1100
NC	Raleigh, Tingen Techn. Sls., Inc.	919-870-6670
OH	Cincinnati, Frank J. Campisano, Co.	513-574-7111
OR	Beaverton, Integrated Automation	503-645-6628
TX	Houston, Abcor, Inc.	713-486-9251
WA	Bellevue, Seltech	206-746-7970
Can	Markham, Ont., Electralert, Ltd.	416-475-6730
Can	Vancouver, BC, Interworld Elctrns., Ltd.	604-984-4171

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CA	Santa Clara, Elcor Assocs.	408-980-8868
FL	Odessa, High Tech Support Grp.	813-920-7564
GA	Duluth, Electro-Cadd	404-446-7523
KS	Overland Park, Walker Engrg., Inc.	913-888-0089
MA	Wilmington, DGA Assocs., Inc.	617-935-3001
MI	Bloomfield Hills, MacKellar Assocs.	313-335-4440
MN	Minneapolis, Comstrand, Inc.	612-788-9234
NJ	Manalapan, Beta Lambda, Inc.	201-446-1100
NC	Raleigh, Tingen Techn. Sls., Inc.	919-870-6670
OH	Cincinnati, Frank J. Campisano, Co.	513-574-7111
OR	Beaverton, Integrated Automation	503-645-6628
TX	Houston, Abcor, Inc.	713-486-9251
WA	Bellevue, Seltech	206-746-7970
Can	Markham, Ont., Electralert, Ltd.	416-475-6730
Can	Vancouver, BC, Interworld Elctrns., Ltd.	604-984-4171

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OREGON MICRO SYSTEMS, INC., 1800 N.W. 169th Pl., A400, Beaverton, OR 97006, Tel: 503-644-4999, FAX: 503-629-0688; Empl.: 7; *Sls. Mgr.:* Wayne Hunter

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CA Santa Clara, Oriental Motor U.S.A. Corp. 408-988-2655
IL Rolling Meadows, Oriental Motor U.S.A. Corp. 312-577-0310
NJ Fairfield, Oriental Motor U.S.A. Corp. .. 201-882-0480

ORIGINAL ELECTRIC MFG. CO., INC., 123 Lincoln Blvd., Middlesex, NJ 08846, Tel: 201-271-5770, FAX: 201-271-5774

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ORION INSTRUMENTS, INC., 702 Marshall St., Redwood City, CA 94063, Tel: 415-361-8883, TELEX: 530942; *Sls. Mgr.:* Bob Reynolds ..... D•1332-1333, 1436

ORMEC SYSTEMS CORP., 19 Linden Park, Rochester, NY 14625, Tel: 716-385-3520, TELEX: 510-601-5941; Empl.: 50; *Sls. Mgr.:* Richard Morgan

ORTEL CORP., 2015 W. Chestnut St., Alhambra, CA 91803, Tel: 818-281-3636, TELEX: 752434, FAX: 818-281-8231; *Sls. Mgr.:* Bill Moore

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CA Palo Alto, Home Electro Sls. 415-494-6777
CO Aurora, Thorson Desert States 303-671-7344
FL Boca Raton, Beacon Elctrns. 305-997-4518
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FL Longwood, Beacon Elctrns. 305-332-1940
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KS Lenexa, Midwest Tech. Sls. 913-888-5100
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NM Albuquerque, Thorson Desert States 505-293-8555
NY Fairport, bbd Elctrns., Inc. 716-425-1112
NY Huntington, C. R. Mayer Co. Inc. 516-692-4221
NC Raleigh, Beacon Elctrns. 919-787-0330
OH Miamisburg (Dayton), Elctrn. Comps. Inc. 513-866-3340
OR Beaverton, Thorson Co. Northwest ... 503-644-5900
PA Southampton, Eastern Instrmn. of PA 215-355-7700
TX Dallas, McDonald Assocs. 214-239-7236
WA Bellevue, Thorson Co. Northwest 206-455-9180

OSCILLOQUARTZ, B & J Marketing, 17074 Dearborn St., Northridge, CA 91325, Tel: 818-993-0048, TELEX: 650 2068183, FAX: 818-993-5758; Empl.: 125; *Sls. Mgr.:* Alain Jendly

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CA Campbell, SMA Associates 408-370-6900
CA Tustin, Tauber-Dreyer Corp. 714-838-9846
Can Ottawa, A.I.M. Electronics 613-722-8286

OSHINO ELECTRIC LAMP WORKS, LTD., 5-2, Minami-Shinagawa 2-chome, Shinagawa-Ku, Tokyo, Japan, Tel: 03-471-8548, TELEX: 0242-2117, FAX: 03-450-3939; Empl.: 300; *Sls. Mgr.:* T. Koyama ..... B•1176-1177

OSLO CONTROLS, 328 Industrial Ave., Cheshire, CT 06410-1511, Tel: 203-272-2794, FAX: 203-272-3492; *Sls. Mgr.:* J. J. Martinez ..... B•1827

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AZ Scottsdale, BSE 602-483-0383
CA Brea, MASCO Elctrns., Inc. 714-529-0866
CA Cupertino, West-Comp., Inc. 408-245-3100
CO Englewood, CompuTech Mktg. 303-773-3981
CT Glastonbury, Pace Assocs. 203-659-2266
FL Deerfield Beach, Newelt Hynes 305-429-3207
GA Lawrenceville, R.L. Panyik & Assoc. ... 404-923-3703
IL Wheaton, Chadra-Schilke Assoc. 312-653-8126
IA Anamosa, WG Controls 319-462-3456
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MI Troy, C. B. Jensen 313-643-0506
MN Minneapolis, Jos-Co/Melius, Inc. 612-861-3343
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OH Highland Hieghts, Major Electronix 216-461-2100
PA Edgemont, White/Whiddett Co. 215-353-6343
TX Dallas, Glidden Electro Equip. 214-341-0610
WA Bellevue, MC Assocs. 206-746-7780
Can Scarborough, Ont., Banke Elctrns. 416-477-7722

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AZ Tempe, LComp., Inc. 602-730-1633
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CA Gardena, California Switch & Signal 1-800-421-2471
CA Los Angeles, Master Distrs. 213-452-1229
CA Redwood City, HdB 415-368-1388
CA San Diego, Deco Elctrns., Inc. 619-693-1595
CA San Jose, Spectra Elctrns. 408-452-1590
CA Tustin, Western Switches & Controls, Inc. 714-259-8144
CA Van Nuys, Wes Garde Components .. 213-873-4802
CO Aurora, Jet Elctrn. Supp., Co., Inc. 303-364-1000
CT Fair Haven, Control Comps. 203-865-0300
CT Waterbury, Century Elec. Supps., Inc. 203-755-0405
CT West Hartford, Wes Garde Components 203-527-7705
FL Lakeland, A A Elec. 800-237-8274
FL Lakeland, Wes Garde Components ... 813-644-7564
IL Addison, LComp., Inc. 312-628-1400
IL Carol Stream, Wes Garde Components 1-800-323-9431
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MN Minneapolis, Dot Elctrns. 612-861-4561
MN Minneapolis, Elctrn. Center, Inc. 612-371-5200
MO Maryland Hgts., LCOMP, Inc. 800-325-1393
MO St. Louis, Wes-Garde Comps. 314-567-7776
NJ Mt. Laurel, Wes Garde Components .. 609-778-8190
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NY Bohemia, Key Comps. 516-567-7500
NY Buffalo, Summit Dist. 716-887-2800
NY Johnson City, Help Elctrns. 607-729-3528
NY Woodside, Switches Unltd., Inc. 718-478-5000
OH Shandon, Cartessa Corp. 513-738-4477
OH Westerville, Wes Garde Components 614-885-0319
TX Dallas, GEECO Sls. Co. 214-341-0610
TX Dallas, Wes Garde Components 214-357-1768
WI Grafton, Lakeview Elctrns. 414-377-8250
WI Mequon, Taylor Elec. 414-241-4321
Can Downsview, Ont., Westburne Elctrns. 416-635-2950

OTTO® CONTROLS

FAX: 312-428-1956

OTTO CONTROLS, Otto Engineering, 2 E. Main St., Carpentersville, IL 60110, Tel: 312-428-7171, TELEX: 722426; FSC No.: 21649; Empl.: 200; *Sls. Mgr.:* R. E. Sparks ..... B•1828-1829

Local Sales Offices & Reps

AL Birmingham, Electro Sls. 205-681-4680
AZ Scottsdale, Advent Comps. Corp. 602-481-0044
CA Anaheim, Gabriel & Assocs. 714-666-0660
CA Cupertino, West Comp Inc. 408-245-3100
FL Deerfield Beach, Newell Hynes Assocs., Inc. 305-429-3207
GA Atlanta, Electro Sls., Inc. 404-394-1122
IL Downers Grove, Rockford Controls Co. 312-960-2046
IN Indianapolis, Rockford Controls Co. ... 317-248-2518
MD Gaithersburg, Naudain Assocs. Southern, Inc. 301-258-5040
MA Needhan Heights, Newscott 617-444-1923
MI Madison Heights, Pine Sls., Inc. 313-589-0350
MO Kansas City, Harris-Hanson Co. 816-763-6200
MO St. Louis, Harris-Hanson Co. 314-432-3611
NJ Marlton, Naudain Assocs., Inc. 609-983-5300
NY Great Neck, Tylinski Co. 516-466-9070
NC Kernersville, CCI South, Inc. 919-996-4814
OH Kettering, Electro-Com 513-299-0864
TN Chattanooga, Electro Sls. 615-267-4260
TX Dallas, Control Comps. Corp. 214-458-8877
WA Bellevue, James Findlay Co. 206-455-9597

Local Distributors

CA Gardena, Cal Switch 213-770-2330
CA Los Angeles, Electric Switches, Inc. ... 213-660-1310
MD Kensington, Marine Air Supp. 301-949-9560
MA Hingham, Sager Elec. Supp. 617-749-6700
NY Lynbrook, Peerless Radio Corp. 516-593-2121
TX Dallas, Associated Aircraft Supp. 214-331-4381

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OVENAIRE-AUDIO-CARPENTER, Oak Industries, 706 Forrest St., Charlottesville, VA 22901, Tel: 804-977-8050, TWX: 910-997-8053; FSC No.: 12020; Empl.: 190; *Sls. Mgr.:* Andy Bell ..... **A•1462-1463, 2026-2027**

Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
CA	EL toro, Marktronix	714-858-0632
CA	Los Angeles, Martronix	213-782-7826
CA	San Mateo, Melvin Sls.	415-349-7445
DC	Towson, Dickison Sales Co.	301-823-0923
FL	Longwood, D. Assocs.	407-830-8976
FL	Maitland, Ellis & Assocs.	407-645-11-1
GA	Atlanta, L & D Inc.	404-395-7079
KS	Lexena, MIDTEC Associates	913-541-0505
MD	Towson, Dickison Sls. Co.	301-823-0923
MA	Milton, Naton Assocs.	617-698-0670
NJ	Paramus, Eltech Sls.	201-967-1309
NY	Buffalo, Quality Comps.	716-837-5430
NC	Greensboro, L & D, Inc.	919-292-3201
NC	Raleigh, L&D Inc.	919-876-5301
TN	Bristol, L&D Inc.	615-878-2266
TX	Euless, W. Pat Fralia Co.	817-354-1144
WA	Seattle, Interconnect Tech.	206-462-9508
Can	Mississauga, Vitel Electronics	416-676-9720

OVEN INDUSTRIES, 207 Hempt Rd., P.O. Box 290, Mechanicsburg, PA 17055, Tel: 717-766-0721, FAX: 717-766-4786; FSC No.: 21302; Empl.: 60; *Sls. Mgr.:* T. M. Nolan

OXLEY, INC., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, Tel: 203-488-1033, TWX: 910-350-6660, FAX: 203-481-6971; FSC No.: 3R006; *Sls. Mgr.:* Carol Carr ..... **A•1715; B•1025, 1179; C•1465**

Local Sales Offices & Reps

CA	Fullerton, GRU Assocs.	714-738-0905
CA	Irvine, Balzer Wolfe Assocs.	714-261-6877
CA	San Jose, J. T. McFarland Assocs.	408-286-9333
FL	Longwood, Krebs Myton	305-788-9333
IL	Lincolnwood, Electro-Tech Mktg. Assocs.	312-676-3151
MA	Needham, Pay Parron Co., Inc.	1-800-225-4280
MN	St. Paul, Bonament Heyda Co.	612-484-8531
PA	Paoli, Stitzer Assocs.	215-644-5500
TX	Richardson, Eagle Marketing	214-238-5383

OYSTER TERMINALS, 1640 5th St., Suite 224, Santa Monica, CA 90401, Tel: 213-395-4774, TELEX: 65-2337 (BT Smedley SNM); *Sls. Mgr.:* Eric Sheppard; *Dist. Mgr.:* Christopher E. Thomson

PACCOM, 3928 148th NE, Redmond, WA 98052, Tel: 206-883-9200, 800-426-6254, TWX: 910-449-2973, FAX: 206-881-0508; Empl.: 16; *Sls. Mgr.:* B. Rudd

PACE INC., 9893 Brewers Ct., Laurel, MD 20707, Tel: 301-490-9860, TELEX: 198296, FAX: 301-498-3252; *Sls. Mgr.:* James K. Bausell

PACER INDUSTRIES, INC., 1450 First Ave., Chippewa Falls, WI 54729, Tel: 715-723-1141, TELEX: 284755, FAX: 715-723-7890; FSC No.: 60162; *Sls. Mgr.:* Patrick Brennan

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PACIFIC COAST CIRCUITS, INC., 189 Granada Dr., San Luis Obispo, CA 93401, Tel: 805-544-4881, FAX: 805-544-6475; FSC No.: 66107; Empl.: 18; *Sls. Mgr.:* Chris Cofer

PACIFIC COIL CO., Inductor Supp., Inc., 430 E. 19th St, Bakersfield, CA 93305-5495, Tel: 805-323-7714, 800-332-COIL, FAX: 805-325-9732; Empl.: 23

PACIFIC COMMUNICATIONS, 2041 S. Grand Ave., Santa Ana, CA 92705, Tel: 714-546-0147; Empl.: 60

PACIFIC ELECTRICORD, 747 W. Redondo Bch. Blvd., Gardena, CA 90247, Tel: 213-532-6600, TWX: 910-346-7619, FAX: 213-538-9479; Empl.: 850; *Sls. Mgr.:* Robert Huffman; *Dist. Mgr.:* Robert Huffman

PACIFIC ELECTRO DYNAMICS, INC., 11465 Willows Rd. N.E., Redmond, WA 98073-9745, Tel: 206-881-1700, TWX: 910-449-2977; Empl.: 350

PACIFIC INDUSTRIAL COMPONENTS CORP., See Altair Exchange Corp.

PACIFIC INSTRUMENTS INC., 215 Mason Circle, Concord, CA 94520, Tel: 415-827-9010, FAX: 415-827-9023; Empl.: 60; *Sls. Mgr.:* Don Seyk

PACIFIC MAGNETICS CORP., 2602 Transportation Ave., Ste. G, National City, CA 92050, Tel: 619-474-8216, FAX: 619-474-3979; *Sls. Mgr.:* Mary Hill

PACIFIC MICROCOMPUTERS, Signal Technology, 6730 Mesa Ridge Rd., San Diego, CA 92121, Tel: 619-453-8649, TELEX: 701-578; FSC No.: 701-578;;;408-433-1337; Empl.: 30; *Sls. Mgr.:* Walter Snell

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Local Sales Offices & Reps

AZ	Phoenix, Barnhill Assocs.	602-788-9596
CA	San Jose, Amasco Corp.	408-262-1500
CA	Torrance, Amasco Corp.	213-781-9494
CO	Englewood, Barnhill Assocs.	303-741-3844
CO	Grand Junction, Barnhill Assocs.	303-241-0039
FL	Ft. Lauderdale, W. A. Brown Instrs.	305-776-4055
FL	Melbourne, W.A. Instrs.	407-723-0766
FL	Orlando, W.A. Brown Instrs.	407-648-9660
GA	Norcross, W.A. Brown Instrs.	404-449-7160
IL	Arlington Hgts., Comtel Midwest	312-392-4040
IN	Indianapolis, Comtel Midwest	317-253-1681
KS	Shawnee Mission, Comtel Midwest Co.	913-268-0762
MA	Burlington, Intersell, Inc.	617-273-3844
MI	Plymouth, EQS Sys.	313-455-7924
MN	Minneapolis, Loren Green Assocs.	612-571-6666
MO	St. Louis, Comtel Midwest Co.	314-991-5363
NM	Albuquerque, Barnhill Assocs.	505-299-7658
NY	Liverpool, Northern Tech. Sls. Assocs., Inc.	315-451-1091
NY	Wantagh, Bytec Reps.	516-781-7400
NC	Cary, W.A. Brown Instrs.	919-460-1120
OH	Chesterland, EQS Sys.	216-729-2222
OH	Dayton, EQS Sys.	513-236-7676
OK	Tulsa, J. Wisdom & Assocs.	918-665-8899
NJ	Cherry Hill, Sci. Reps.,Inc.	609-662-5222
PA	Pittsburgh, EQS Sys.	412-261-2604
TX	Richardson, J. Wisdom & Assocs.	214-470-9093
TX	Round Rock, J. Wisdom & Assocs.	512-255-1167
UT	Orem, Barnhill Assocs.	801-226-1239
VA	Fairfax, Scientific Assocs.	703-385-0600
WA	Bellevue, Al Smith	206-746-6770
WA	Vancouver, Al Smith Co.	206-892-9912
WI	New Berlin, Comtel Midwest Co.	414-544-6042
Can	Markham, Ont., Multitest Elctrns.	416-470-2929
Can	St. Laurent, PQ, Multitest Elctrns.	514-337-0723

Local Distributors

EXP	Oxnard, CA, Trans World Trade	805-486-1818

PACIFIC RESISTOR CO., 18300 Oxnard St., Tarzana, CA 91356, Tel: 818-345-7811, TELEX: 06416; FSC No.: 06416; *Sls. Mgr.:* Douglas Trewhitt ..... **A•2028-2029**

Local Sales Offices & Reps

CA	San Jose, Comtech Mktg.	408-294-5448

Local Distributors

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PACIFIC SCIENTIFIC CO., 4301 Kishwaukee, Rockford, IL 61105, Tel: 815-226-3100, TELEX: 386743, FAX: 815-226-3122; Empl.: 400; *Dist. Mgr.:* Michael M. Mungor

PACIFIC SCIENTIFIC, Electro Kinetics Division, 402 E. Gutierrez St., Santa Barbara, CA 93101, Tel: 805-963-2055, TWX: 910-334-1177; Empl.: 210; *Sls. Mgr.:* Robert E. Lynch

PACIFIC TRANSDUCER CORP., 2301 Federal, Los Angeles, CA 90064, Tel: 213-478-1134, TELEX: 3781834 PTC, FAX: 213-312-0826; Empl.: 22; *Sls. Mgr.:* Thomas Lopez

PACTEC, LaFrance Corp., Enterprise & Executive Avenues, Philadelphia, PA 19153, Tel: 215-365-8400, TELEX: 506-082, FAX: 215-365-4420; Empl.: 503; *Sls. Mgr.:* J. Craig; *Dist. Mgr.:* T. DiSciascio ..... **C•1002, 1066-1074**

Local Sales Offices & Reps

AL	Huntsville, Scott Ray	205-883-2159
CA	Anaheim, Jonathan Winters	714-779-8092
CA	San Jose, Jeff A. Singer	408-943-1609
MO	St. Louis, Spectrum Sls.	314-731-5151
TX	Dallas, Tesco	214-553-1200
FL	Palm Harbor, Roger Hauck	813-784-7895
FL	Plantation, Kathy Hughes, Inc.	305-472-5323
IL	Lombard, Parke Van Brott	312-916-9377
KS	Overland Pk., Spectrum Sls.	913-648-6811
TX	Austin, Tesco	512-834-8374
MA	Woburn, Suzanne Erkert	617-933-1335
EXP	Philadelphia, PA, PacTec Export Sls. Dept.	215-365-8400
NJ	Merchantville, Bill Boucot	609-488-9086
NC	Thomasville, Keith Pierce	919-472-2030
OH	Perrysburg, Bruce Brown	419-874-1110
WA	Seattle, Mike Werttemberger	206-363-9899
WI	Appleton, Ed Sabish	414-731-7212

Local Distributors

AL	Birmingham, American Elctrns. Supp.	205-942-4656
AZ	Phoenix, Tri-Tek	602-371-0860
AZ	Tempe, Circut Specialists, Inc.	602-966-0764
AZ	Tucson, Anatech Corp.	602-881-2348
CA	Anaheim, A-Z Elctrns.	714-634-3620
CA	Anaheim, R&D Elctrns.	714-773-0240
CA	Burbank, Electronic City	213-842-5275
CA	Canoga Park, Sandy's Elctrns. Supp.	213-346-8353
CA	Carpenteria, Electronic Resources	805-684-5439
CA	Costa Mesa, Marvac	714-540-3280
CA	Cucamonga, Abletronics	714-987-7606
CA	El Segundo, Force Elctrns.	213-772-1324
CA	El Toro, R-Vac	714-586-1210
CA	Gardena, California Switch & Signal	213-538-9830
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	Monterey, Zackit (Monterey)	408-375-3144
NJ	Pennsauken, Jan Ind'l Elctrns.	609-663-4800
CA	Sacramento, Zackit/Sacramento	916-446-3131
CA	San Diego, Southland Comps.	619-578-6630
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Force Elctrns.	408-435-1324
CA	San Jose, Rose Elctrns.	408-943-0200
CA	Sunnyvale, Fry's Elctrns.	408-733-1770
FL	Tampa, Dow Elctrns., Inc.	813-870-3315
CA	Thousand Oaks, Sandy's Elctrns.	818-889-1209
CA	Vallejo, Zackit (Vallejo)	707-644-6676
CO	Aurora, Jet Elctrn. Supp.	303-364-1000
CO	Englewood, Indelco	303-694-9444
CT	Stratford, Utronics	203-378-4201
CT	Wallingford, Midstate Elctrns.	203-265-9900
CT	Wallingford, Sager Elctrl. Supp.	203-265-4600
DE	Wilmington, Wholesale Elctrns. Inc.	302-656-9988
FL	Largo, Electronic Precepts of FL	813-544-3636
FL	Longwood, Intertec Comps.	305-834-7777
FL	St. Petersburg, Knapp of Florida	813-392-0406
FL	Tampa, Dow Elctrns., Inc.	813-870-3315
FL	Tampa, Sunex Elctrns.	813-885-4074
FL	West Palm Beach, Nurmi Elctrns.	305-686-8553
GA	Atlanta, Ack Radio	404-351-6340
GA	Norcross, Dow Elctrns.	404-448-4004
GA	Norcross, Dow Elctrns., Inc.	404-448-4004
GA	Norcross, EMSCO	404-925-8366
HI	Honolulu, Precision Radio, Ltd.	808-537-5291
IL	Berwyn, BB & W Inc.	312-242-1533
IL	Champaign, Klaus Radio	217-356-1896
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Elk Grove, Martec Assocs.	312-956-8090
IL	Mt. Prospect, Tri State Elctrns.	312-255-0600

IL	Northbrook, Classic Comps.	312-291-0019
IL	Peoria, Klaus Radio	309-691-4840
IL	Rosemont, Advent Elctrns.	312-298-4210
IL	Villa Pk., Melvin Elctrns.	312-279-5015
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Iowa Radio Supply	319-393-4510
KS	Salina, Electronics, Inc.	913-827-7377
KY	Bowling Green, Randolph, Hale & Meredith	502-781-1460
KY	Louisville, Peerless Elctrns.	502-637-7674
MD	Beltsville, Mark Elctrns.	301-595-5040
MD	Beltsville, P.S.I.	301-937-4960
MD	Jessup, Almo Elctrns.	301-792-9197
MD	Jessup, Almo Elctrns. (MD)	301-792-9197
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Westborough, In-Stock Products Co.	617-870-5750
MI	Grand Rapids, S. F. Elctrns.	616-459-0216
MI	Livonia, RS Elctrns.	313-525-1155
MI	Taylor, Tel Van Elctrn. Supp.	313-291-3515
MN	Minneapolis, AEI Elctrn. Parts	612-338-4754
MN	Minneapolis, Berquist	612-835-2322
MN	New Brighton, Parts I	612-633-8079
MO	Kansas City, Walters Indl. Elctrns.	816-531-7015
MO	St. Louis, Franklin Elctrns.	314-993-5333
NE	Lincoln, Scott Elctrns.	402-466-8221
NH	Salem, Sager Elctrl. Supp.	603-898-1348
NJ	Frenchtown, Suntec/Aries	201-996-4093
NJ	Pennsauken, Jan Indl. Elctrns.	609-663-4800
NJ	Pine Brook, Parts Masters	201-227-7797
NJ	Rockaway, Tonar Inds., Inc.	201-586-9000
NM	Albuquerque, B B & W	505-344-3311
NM	Albuquerque, Walker Elctrns. Supp.	505-883-2992
NY	Buffalo, Summit Distr.	716-887-2800
NY	Farmingdale, Midway Indl. Electro	516-293-6800
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Freeport, KRP Elctrns.	516-623-3346
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Mamoroneck, Logicomp Elctrns., Inc.	914-698-9332
NY	Rochester, Masline Elctrns., Inc.	716-546-5373
NY	Rochester, Summit Distr.	716-334-8110
NC	Burlington, Womack Elctrns.	919-227-7486
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Sager Svc. Plus Elctrns.	919-850-9550
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cincinnati, R. S. Elctrns.	513-793-2450
OH	Cleveland, Roberts Elctrns.	216-238-1711
OH	Columbus, Hughes-Peters	614-294-5351
OK	Oklahoma City, She Elctrns.	405-843-5941
OK	Tulsa, Radio Inc.	918-587-9123
OR	Beaverton, Norvac Elctrns.	503-644-1025
OR	Beaverton, Rose Elctrns	503-629-9288
OR	Portland, Radar Elec.	503-232-3404
PA	Allentown, P. A. Peters	215-434-5237
PA	Exton, VSH Elctrns.	215-363-2250
PA	Marcus Hook, Lindwood Wholesale, Inc.	215-485-0777
PA	Philadelphia, Almo Grp.	215-698-4000
PA	York, Rosen Elctrns.	717-843-7881
TN	Chattanooga, Horizon Elctrns.	615-266-4729
TN	Chattanooga, Techni-Tronics	615-842-0514
TN	Columbia, Randolph & Williams, Inc.	615-388-7566
TN	Memphis, Bluff City	901-345-9500
TN	Nashville, Bluff City	615-242-8000
TN	Nashville, Randolph & Rice	615-255-5602
TX	Austin, Galtronics	512-837-7470
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Force Elctrns.	214-247-9955
TX	Dallas, Off-the-Shelf Comps.	214-247-0052
TX	Dallas, Wholesale Elctrns. Supp.	214-824-3001
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Ace Elctrns.	713-688-8114
TX	Houston, Force Elctrns.	713-561-8644
TX	Houston, Wofford Elctrns.	713-847-3583
TX	Richardson, Off-the-Shelf Comps.	214-238-0808
TX	San Antonio, Altex Elctrns.	512-828-0503
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Charlottesville, Virginia Elctrn. Comps.	804-296-4184
WA	Bellevue, Almac Elctrns. DKM Co.	206-643-9992
WA	Seattle, Radar Elec.	206-282-2511
WI	Milwaukee, Industrial Elctrns., Inc.	414-276-1212
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, Classic Comps. Supp., Inc.	414-786-5300
WI	Oshkosh, Electronic Inds., Inc.	414-235-8930
Can	Burnaby, BC, Intek Elctrns.	604-294-8100
Can	Mississauga, Ont., Rush Elctrns.	416-677-7280
Can	Pointe Claire, Que., Future Elctrns.	514-694-7710
Can	Vancouver, BC, Future Elctrns.	604-294-1206
Can	Victoria, BC, Queale Elctrns., Ltd.	604-388-6111

PAINE CORPORATION, 2401 S. Bayview St., Seattle, WA 98144, Tel: 206-329-8600, 800-426-0366, ESYLNK: 6294-5057, FAX: 206-329-1615; FSC No.: 13624; Empl.: 93; *Sls. Mgr.:* R. E. Helmick

PAKTRON, See ITW Paktron

PAK-TRONIC, See Tracor Paktronics

PALADIN CORP., 3543 Old Conejo Rd., Ste. 102, Newbury Park, CA 91320, Tel: 805-499-0318, FAX: 805-499-4006; Empl.: 20; *Sls. Mgr.:* Dennis Behling

PALOMAR ENGINEERS, Box 455, Escondido, CA 92025, Tel: 619-747-3343; Empl.: 9

PAMRAN INC., 1900 Williams St., Young Ind. Pk., Racine, WI 53404, Tel: 414-637-7999; Empl.: 28; *Sls. Mgr.:* R. C. Pfeil

PANAMETRICS, 221 Cresent St., Waltham, MA 02254, Tel: 617-899-2740, TELEX: 6817337, TWX: 951006, FAX: 617-899-1552; Empl.: 200; *Sls. Mgr.:* Bob Mel

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PANASONIC INDUSTRIAL CO., Battery Sls. Div., Box 1511, Secaucus, NJ 07096-1511, Tel: 201-348-5266; Empl.: 25 ..... **D•1502-1509**

Local Sales Offices & Reps

AZ	Scottsdale, Dar-C	602-948-2240
CA	Glendale, Halbar Assocs. Inc.	818-246-8263
CA	Pleasanton, Moulthrop Sls. Inc.	415-463-0450
CA	San Diego, Tauber & Assocs.	619-274-7242
FL	Deerfield Bch., S.E.C.	305-426-4601
IN	Indianapolis, Marketing Engs. Inc.	317-872-5665
KS	Overland Pk., Spectrum Sls.	913-648-6811
MA	Burlington, Conti-Younger Assocs. Inc.	617-273-1582
MN	Eden Prairie, Electro Mark Inc.	612-944-5850
OH	Beachwood, Elctrn. Salesmasters Inc.	216-831-9555
OR	Beaverton, Advanced Power Prods.	503-646-0994

Local Distributors

AL	Huntsville, Resistacap Inc.	205-883-4270
AZ	Scottsdale, Electro Mktg.	602-991-0110
CA	San Diego, Tauber Elctrns. Inc.	619-274-7242
CA	San Jose, Rose Elec. Distrbg. Co.	408-263-2934
CA	Santa Clara, Cypress Elctrns. Inc.	408-980-2500
CA	Van Nuys, NESCO	818-781-0505
CO	Englewood, Indelco/AVT	303-694-9444
CT	Woodbury, Cell Technlg.	203-266-4105
FL	Miami, Electronic Equip. Co.	305-526-6000
FL	St. Petersburg, Micro Precision	813-821-5504
GA	Norcross, Applied Power, Inc.	404-263-0421
IL	Morton Grove, Power Pak Inc.	312-966-6000
IL	Palatine, Ohm Elctrns.	312-359-5500
IN	Indianapolis, Bell Inds.	317-634-8202
MD	Aberdeen, Harco Elctrns.	301-575-6885
MD	Beltsville, Mark Elctrns.	301-792-0072
MA	Canton, Impact Sls. Co. Inc.	617-821-1500
MA	Danvers, Generation Elctrns. Inc.	617-777-4866
MI	Brighton, Applied Power Inc.	313-227-3604
MN	Thief River Falls, Digi-Key	800-346-5144
MO	St. Louis, Indl. Battery Prod. Inc.	314-423-7005
NJ	Camden, Gen. Radio	609-964-8560
NJ	Clifton, Engineered Assem.	201-340-0600
NC	Raleigh, Engrd. Assemblies Inc.	919-790-9700
NC	Winston Salem, Kirkman Elctrns.	800-334-0158
OH	Columbus, Elctrn. Mktg. Corp., Promark Div.	614-876-8885
OH	Columbus, Hughes-Peters	614-294-5351
OR	Beaverton, Micro Power	503-626-7086
PA	Bensalem, Avex Elctrns. Corp.	800-345-1295
TX	Dallas, Computer Comps. Corp.	214-239-0271
TX	Dallas, Norvell Elctrns. Inc.	214-233-0020
TX	Fort Worth, Allied Elctrns.	817-336-5401
WI	Mequon, Taylor Elec. Co.	414-241-4321

Panasonic

FAX: 201-392-4441

PANASONIC INDUSTRIAL COMPANY, Electronic Components Division, 1 Panasonic Way, Secaucus, NJ 07094, Tel: 201-392-4290/4264; *Sls. Mgr.:* J. Ambrose/E. Budenieks/K. Sasaki; *Dist. Mgr.:* Dick Robert ..... **D•1107, 1936-1937**

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Local Sales Offices & Reps

AL Huntsville, Rep, Inc. 205-830-0470
AZ Phoenix, O'Donnell Assts. 602-944-9542
CA Los Alamitos, Power Specialists 213-594-9418
CA Pleasanton, Moulthrop Sls., Inc. 415-463-0450
CO Englewood, Comp. Sls., Inc. 303-779-8060
GA Tucker, Rep, Inc. 404-938-4358
IL Palatine, Technlg. Sls. 312-991-6600
IN Indianapolis, Mktg. Engrs., Inc. 317-872-5665
MI Brighton, Elctrn. Sources, Inc. 313-227-3598
MN Eden Prairie, Electro-Mark, Inc. 612-944-5850
MO St. Louis, KKB & Co. 314-647-2400
NJ Fair Lawn, March Inds. 201-794-0088
NJ Medford, Jack McCoy, Inc. 609-953-0770
NJ Secaucus, Panasonic 201-392-4290
NM Albuquerque, O'Donnell Assts. 505-883-1030
NY Mendon, Tech-Mark, Inc. 716-624-3840
NC Morrisville, Rep., Inc. 919-469-9997
NC Raleigh, Rep, Inc. 919-851-3007
OH Dayton, Del Steffan & Assocs. 513-293-3145
OH Lexington, Del Steffan & Assocs. 419-884-2313
OR Tigard, Elctrn. Engrg. Sls. 503-639-3978
PA Carnegie, Del Steffan & Assocs. 412-276-7366
PA Exton, Jack McCoy, Inc. 215-363-0350
TN Jefferson City, Rep., Inc. 615-475-4105
TX Dallas, Erickson Sls., Inc. 214-739-5833
UT Salt Lake City, Comp. Sls., Inc. 801-268-8440
WA Redmond, Elctrn. Engrg. Sls. 206-883-3374
Can Concord, Ont., Astec Comps., Ltd. 416-669-4022

Local Distributors

CA Buena Pk., Cypress Elctrns., Inc. 213-744-0355
CA Santa Clara, Cypress Elctrns., Inc. 408-980-2500
CT E. Haven, J.V. Elctrns. 203-469-2321
MI Livonia, RS Elctrns. 313-525-1155
MN Minneapolis, Indl. Comps., Inc. 612-831-2666
TX Dallas, Computer Comps. Corp. 214-239-0271
WI Milwaukee, Taylor Elec. Co. 414-241-4321

PANAVISE PRODS., 2850 E. 29th St., Long Beach, CA 90806, Tel: 213-595-7621, FAX: 213-595-9539; Empl.: 25; *Sls. Mgr.:* Gary Richter; *Dist. Mgr.:* Kathy DePorter

PANDUIT CORP., 17301 Ridgeland Ave., Tinley Park, IL 60477-0981, Tel: 800-777-3300, TELEX: 25-4560, FAX: 312-532-1811; FSC No.: ;06383; Empl.: 1200 ..... **C•1466-1468, 1908-1909**

Local Sales Offices & Reps

AL Birmingham, Frank Parker & Assocs. 205-655-4801
AL Mobile, Frank Parker & Assocs. 205-457-3896
AK Anchorage, Bar Elec. Agt. 907-345-7281
AZ Phoenix, Panduit Corp. 602-271-0167
AR Little Rock, Byron Carson Co. 501-663-6870
CA Anaheim, Panduit Corp. 714-978-2299
CA Los Altos, Ewing-Foley, Inc. 415-941-4525
CA Sacramento, Ewing-Foley, Inc. 916-885-6591
CA San Diego, Tak Sls. Co. 619-287-6141
CO Denver, Panduit Corp. 303-985-1900
CT Glastonbury, Panduit Corp. 203-657-4105
FL Ft. Lauderdale, Panduit Corp. 800-282-9209
FL Lakeland, Panduit Corp. 800-282-9209
FL Orlando, Panduit Corp. 800-282-9209
GA Atlanta, Panduit Corp. 404-256-5940
HI Honolulu, Pacific Power Prods. 808-836-0265
IL Burr Ridge, Panduit Corp. 312-887-1100
IN Indianapolis, Panduit Corp. 800-777-3300
KS Kansas City, Panduit Corp. 800-777-3300
KY Louisville, A. L. Pickens Co. 502-491-4215
LA Baton Rouge, Wells-Keown & Assocs. 504-292-6553
LA New Orleans, Wells- Keown & Assocs. 504-733-0301

MD Baltimore, Agency Group, Inc. 301-793-0023
MA N. Andover, Panduit Corp. 508-681-0451
MI Fraser, Panduit Corp. 313-791-1700
MI Grand Rapids, Panduit Corp. 800-777-3300
MN Minneapolis, Electric Comp. Sls. 612-933-2594
MO St. Louis, Panduit Corp. 314-894-7800
NE Omaha, Panduit Corp. 402-391-0452
NV Las Vegas, G & F Sls. Co. 702-367-0885
NJ Leonia, Panduit Corp. 201-461-7790
NM Albuquerque, F P Sls. 505-345-5553
NY Buffalo, Panduit Corp. 800-777-3300
NY Rochester, Panduit Corp. 800-777-3300
NY Schenectady, Panduit Corp. 800-777-3300
NY Syracuse, Panduit Corp. 800-777-3300
NC Raleigh, L. G. White Southern 919-872-6049
NC Winston-Salem, L. G. White Southern 919-725-3612
OH Cincinnati, Panduit Corp. 800-777-3300
OH Cleveland, Panduit Corp. 800-777-3300
OH Columbus, Panduit Corp. 614-888-6224
OK Oklahoma City, Elctrl. Prods. of Okla. 405-235-8041
OR Portland, Panduit Corp. 503-654-9455
PA Philadelphia, Kunz, Powell & Assoc. 215-296-9490
PA Pittsburgh, Cody Assocs., Inc. 412-787-5336
SC Greenville, L. G. White Southern 803-271-0630
TN Knoxville, Panduit Corp. 800-777-3300
TN Memphis, Byron Carson Co. 901-276-0614
TN Nashville, Panduit Corp. 800-777-3300
TX Dallas, Panduit Corp. 214-518-0004
TX Houston, Panduit Corp. 713-686-5600
UT Salt Lake City, Ray Walker Co. 801-973-7454
VA Richmond, L. G. White Southern 804-752-7055
WA Seattle, Panduit Corp. 800-777-3300
WV Parkersburg, Cody Assocs., Inc. 304-464-4302
WI Appleton, H. Mercer Co. 414-739-6223
WI Milwaukee, Panduit Corp. 800-777-3300
PR Santurce, L. Gandia & Assocs. 809-725-3473
Can Markham, Ont., Panduit Canada Ltd. 416-475-6922

PANEL COMPONENTS CORPORATION

FAX: 707-578-5478

PANEL COMPONENTS CORP., P.O. Box 6626M, Santa Rosa, CA 95406, Tel: 707-523-0600, TELEX: 176-747; Empl.: 18 ..... **B•1403; C•1470-1475, 1910-1914; D•2232**

Local Sales Offices & Reps

AL Huntsville, DHR Mktg. Inc. 205-722-0440
CA Santa Clara, Ross Mktg. Assoc. 408-988-8111
CA Tustin, Schoenbachler-Dobson Co. 714-544-1888
CO Englewood, Omega Ltd. 303-762-1921
FL Deerfield Beach, Newell-Hynes Assoc., Inc. 305-429-3207
GA Duluth, DHR Mktg., Inc. 404-564-0529
IL Northbrook, Raines & Assocs. 312-498-0890
IA Marion, M-S-B Assocs., Inc. 319-377-6261
KS Shawnee Mission, M-S-B Assocs., Inc. 913-432-2131
MA Scituate, Olsen Tech. Sls. 617-545-5101
MN St. Paul, Arkco Sls. 612-777-7454
MO St. Louis, M-S-B Assocs., Inc. 314-946-5577
NJ Mountain Lakes, Components For Elctrns. 201-334-2921
NY Victor, Net Sls. 716-924-1844
NC Raleigh, DHR Mktg., Inc. 919-829-1970
OH Cleveland, Rockford Controls 216-932-3848
OH Medina, Rockford Controls 216-725-3705
OR McMinnville, Electro-Design 503-472-0481
PA Philadelphia, Eastern Sci. Mktg. 215-368-4570
PA Pittsburgh, Rockford Controls 412-331-0306
SC Greenville, DHR Mktg. Inc. 803-235-3594
TX Lewisville, Jim Hughes Co. 214-221-1536
WA Redmond, Electro-Design 206-867-9300
EXP Burnaby, B.C., Darmac Agencies, Ltd. 604-520-7121
Can Ottawa, Ont., Lloyd Ellam Assocs. 613-727-3892

PAN-MAGNETICS, See Tamura Corp. of America

PAPST

FAX: 401-849-4640

PAPST MECHATRONIC CORP., Aquidneck Indl. Pk., Newport, RI 02840, Tel: 401-849-8810 ... **C•1683-1685**

Local Sales Offices & Reps

AL Huntsville, Robert O. Whitesell & Assocs. 205-883-5110
AZ Phoenix, Jr. Engrg. Sls., Inc. 602-956-4670
CA Campbell, Luscombe Engrg. Co. 408-370-2020
CA Campbell, Papst Mechatronic Corp. 408-377-4842
CA Pasadena, Luscombe Engrg. Co. 213-684-2000
CA San Diego, Luscombe Engrg. Co. 619-549-9699
CO Denver, Quorum 3 3030-750-3267
CT Hartford, Sturgeon Co. 203-249-7800
FL Oviedo, Conley & Assocs. 305-365-3283
GA Norcross, Robert O. Whitesell & Assocs. 404-449-9190
IL Arlington Hgts., Brainard-Wilson Mktg. 312-437-2700
IN Indianapolis, Elctrn. Mktg. Consits. 317-253-1668
IA Marion, MSB Assocs. Inc. 319-377-6261
KS Shawnee Mission, MSB Assocs., Inc. 913-432-2131
MA Needham, Sturgeon Co. 617-444-6603
MN Edina, Mel Foster Tech. Sls., Inc. 612-941-9790
MO St. Charles, MSB Assocs. 314-946-5577
NJ Cherry Hill, Trinkle Sls., Inc. 609-795-4200
NJ Englewood, Harold Gray Assocs., Inc. 201-894-0894,215-922-2080
NY Johnson City, Tech-Mark, Inc. 607-729-
NY Mendon, Tech-Mark, Inc. 716-624-3840
NY Utica, Tech-Mark, Inc. 315-733-0575
NC Greensboro, Robert O. Whitesell & Assocs. 919-273-1945
OH Beachwood, Elctrn. Salesmasters, Inc. 216-831-9555
OR Beaverton, Venture Elctrns. 503-626-7418
TN Knoxville, Robert O. Whitesell & Assocs. 615-694-9476
TX Dallas, JYSCO/Comps., Inc. 214-349-1650
WA Bellevue, Venture Elctrns. 206-454-4594
WI Waukesha, Brainard-Wilson Mktg. 414-797-7940
Can Pickering, Ont., A.C. Simmonds & Sons, Ltd. 416-839-8041

PARACOM INC., Bldg. 9, Unit60, 245 W. Roosevelt Rd., West Chicago, IL 60185, Tel: 312-293-9500, TELEX: 4974811, FAX: 312-231-0015; Empl.: 7; *Sls. Mgr.:* Randy Cochran

PARAGON ELECTRIC CO., INC., 606 Parkway Blvd., Two Rivers, WI 54241, Tel: 414-793-1161, TELEX: 26-3450, FAX: 414-793-3736; Empl.: 500; *Sls. Mgr.:* Don Karman

PARALINE

FAX: 818-281-5867

PARA-LINE TRANSFORMER CO., INC., 511 South Palm Ave., Alhambra, CA 91803, Tel: 818-281-0222; FSC No.: 59465; Empl.: 52 ..... **A•2372**

PARK ELECTRONICS, 16 Xenia Court, Mine Hill, NJ 07801, Tel: 201-328-9299; Empl.: 60; *Sls. Mgr.:* Kelly Faulkenham

PARKER HANNIFIN CORP., 17325 Euclid Ave., Cleveland, OH 44112-1290, Tel: 216-531-3000, TELEX: 980636; Empl.: 33,225

PARKER HANNIFIN CORPORATION, Compumotor Division, 1179 N. McDowell Blvd., Petaluma, CA 94952, Tel: 707-778-1244, 800-358-9068, TWX: 510-744-2155

PARKER MCCRORY MFG. CO., 2000 Forest Ave., Kansas City, MO 64108, Tel: 816-221-2000, FAX: 816-221-9879; *Sls. Mgr.:* Ken Turner; *Dist. Mgr.:* Ken Turner

PARKER SEAL GRP., 18321 Jamboree Blvd., Irvine, California 92715, Tel: 714-851-3763, FAX: 714-851-3277; Empl.: 2,200; *Sls. Mgr.:* Frank Chesnik; *Dist. Mgr.:* John Dutton

PAR-METAL

FAX: 718-439-3930

PAR METAL PRODUCTS, INC., 1260 Atlantic Ave., Brooklyn, NY 11216, Tel: 718-774-5900, TELEX: 424 823 SNDS UI Attn:Par; Empl.: 100; *Sls. Mgr.:* J. Troiano ..... **C•1076**

PARSONS MANUFACTURING, 1055 O'Brien Dr., Menlo Park, CA 94025-1476, Tel: 415-324-4726, FAX: 415-324-3051; Empl.: 45; *Sls. Mgr.:* S. Wurzer

PARVEX DIVISION, Alsthom International, Inc., Two Ram Ridge Road, Spring Valley, NY 10977, Tel: 914-425-6908, FAX: 914-425-8108

PASO SOUND PRODUCTS, 14 First St, Pelham, NY 10803, Tel: 914-738-4800, FAX: 914-738-3954; Empl.: 50; *Sls. Mgr.:* David Moore

PASTERNACK ENTERPRISES, P.O. Box 16759, Irvine, CA 92713, Tel: 714-261-1920; FSC No.: 53919; *Sls. Mgr.:* Heather Marshall

PATTON-MACGUYER INC., 17 Virginia Ave., Providence, RI 02905, Tel: 401-941-6000, FAX: 401-941-5290; FSC No.: 77147; Empl.: 55; *Sls. Mgr.:* F. Spunzo

PAVE TECHNOLOGY CO., INC., 2751 Thunderhawk Ct., Dayton, OH 45414-3445, Tel: 513-890-1100, FAX: 513-890-5165

PAYNE ENGINEERING, Box 70, Scott Depot, WV 25560, Tel: 304-757-7353, TELEX: 88-5452, FAX: 304-757-7305; Empl.: 40; *Sls. Mgr.:* Matthew J. Gilberto

PCA ELECTRONICS INC

FAX: 818-894-5791

PCA ELECTRONICS, 16799 Schoenborn St., Sepulveda, CA 91343, Tel: 818-892-0761, TWX: 910-496-1525; FSC No.: 97722; Empl.: 45; *Sls. Mgr.:* Ben Weinberg ..... **A•1612-1621, 2373-2375**

Local Sales Offices & Reps

AZ	Phoenix, Toward Engrg. Assocs.	602-955-3193
CA	San Diego, Ramsey & Assocs.	619-546-9277
CA	San Jose, Arnold Techn. Sls.	408-954-0400
FL	Ft. Lauderdale, Sunland Assoc.	305-561-1303
FL	Goldenrod, Sunland Assocs.	305-365-9533
IL	Westchester, W. G. Brouillette & Assocs.	312-345-6500
IN	Carmel, W. G. Brouillette & Assocs., Inc.	317-848-2016
MA	Sudbury, KSA of New England	617-443-5881
MN	Minneapolis, Bill Deming and Assocs.	612-888-5000
NJ	Medford, Linear Sls.	609-953-8250
NJ	Springfield, F. F. Sylvester	201-376-3324
OH	Dayton, Electro-Com	513-898-5140
OR	Tigard, Elctrn. Comp. Sls.	503-245-2342
PA	Exton, Linear Sls.	215-524-8080
TX	Dallas, Blackburn Assocs.	214-750-8484
UT	Salt Lake City, Sage Sls.	801-467-5451
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301

Local Distributors

CA	Buena Pk., Cypress Elctrns. Inc.	714-521-5230
CA	San Diego, Cypress Elctrns. Inc.	619-535-0011
CA	San Jose, Cypress Elctrns.	408-980-2500
CA	Santa Clara, Cypress Elctrns. Inc.	408-980-2500
CO	Wheatridge, Cypress Elctrns. Inc.	303-431-2622
MA	Sudbury, ASK Elctrns.	617-443-5881
NJ	Rockaway, NASCO Elctrns.	201-625-7777
OR	Beaverton, Cypress Elctrns.	503-641-2233
PA	Exton, VSH Elctrns.	215-363-2250
WA	Bothwell, Cypress Elctrns.	206-483-1144

PCB PIEZOTRONICS, 3425 Walden Ave., Depew, NY 14043-2495, Tel: 716-684-0001, TWX: 710-263-1371, FAX: 716-684-0987; Empl.: 175; *Sls. Mgr.:* Roy Maines

PCD, 2 Technology Dr., Peabody, MA 01960, Tel: 508-532-8800, FAX: 508-532-6800; FSC No.: 58982; *Sls. Mgr.:* A. Arcisz

P C EXPRESS, INC., 15103 U.S. Hwy. 19, Hudson, FL 34667, Tel: 813-863-6114; Empl.: 15

PCK ELASTOMERICS, INC., See Elastomeric Technologies, Inc.

PCK TECHNOLOGY DIV., Kollmorgen Corp., 322 South Service Rd., Melville, NY 11747, Tel: 516-454-4400, TELEX: 6852163, FAX: 516-454-0317; Empl.: 180; *Sls. Mgr.:* J. F. Dennis-Browne

PCT- PRIME CIRCUIT TECHNOLOGY, 2350 Lundy Pl., San Jose, CA 95131, Tel: 408-945-0900, FAX: 408-945-8505; Empl.: 121; *Sls. Mgr.:* Bill Kernion

PC TRANSFORMER CORP., 64 D Nancy St., West Babylon, NY 11704, Tel: 516-491-3300, FAX: 516-491-3689; FSC No.: 62281; Empl.: 11; *Sls. Mgr.:* Stanley L. Goldstein ..... **A•2377-2385**

PDS TECHNOLOGIES, INC.

FAX: 203-254-3624

PDS TECHNOLOGIES, INC., 875 Bridgeport Ave., Shelton, CT 06484, Tel: 203-925-0123; Empl.: 95; *Sls. Mgr.:* Guy Favreau ..... **D•1939-1944**

Local Sales Offices & Reps

AL	Huntsville, B C Elctrn. Sls. Inc.	205-837-6657
CA	Long Beach, QPI Sls.	714-552-2849
CA	Sunnyvale, Zytronix, Inc.	408-749-1326
CT	Norwalk, J. Magnano Assoc.	203-847-9704
GA	Marietta, B C Elctrn. Sls., Inc.	404-565-2088
IL	Westchester, Cadre Techn. Rep., Inc.	312-449-3900
IN	Fishers, Carter Techn., Inc.	317-842-9277
MD	Lanham, W. A. Brown Equip. Corp.	301-577-6105
MA	Marlborough, Digital Sls. Assocs., Inc.	508-480-0516
MI	Farmington Hills, Carter Techn., Inc.	313-477-7700
MN	Minneapolis, R J, Inc.	612-866-3661
NY	Amsterdam, Traxonics, Inc.	518-843-1445
NY	Great Neck, Mos Assocs.	516-487-3966
OH	Berea, Carter Technlgs., Inc.	216-826-0400
PA	King of Prussia, Kirk Sls., Inc.	215-783-6400
PA	Pittsburgh, Carter Technlgs., Inc.	412-826-3800
TX	Plano, GW Prods.	214-422-1746
VA	Union Hall, B C Elctrn. Sls., Inc.	703-576-3716
OH	Englewood, Carter Technlgs., Inc.	513-836-0951

PEARSON ELECTRONICS, INC., 1860 Embarcadero Rd., Palo Alto, CA 94303, Tel: 415-494-6444, TELEX: 171-412, FAX: 415-494-6716; FSC No.: 05280; Empl.: 23; *Sls. Mgr.:* Patricia L. Pearson ..... **A•2386**

PECA, INC., 592 Winks Lane, Bensalem, PA 19020, Tel: 215-245-1550; Empl.: 30; *Sls. Mgr.:* Jean Douglass

Distributor

PEERLESS, 19 Wilbur St., Lynbrook, NY 11563, Tel: 516-593-2121, 1-800-645-2268 744

FAX: 714-662-1437

PEER PROTOCOLS, 3176 Pullman, Ste. 101, Costa Mesa, CA 92626, Tel: 714-662-1929; Empl.: 10; *Sls. Mgr.:* Don Bergis

PENFIELD, INC., 8 West St., Plantsville, CT 06479, Tel: 203-621-9141, TWX: 5101003285, ESYLNK: 6287757, FAX: 203-621-2380; Empl.: 77

PENN ENGINEERING & MANUFACTURING CORP., P.O. Box 1000, Danboro, PA 18916, Tel: 215-766-8853, FAX: 215-766-0143; FSC No.: 46384; Empl.: 480; *Sls. Mgr.:* John E. O'Brien

PENN KEYSTONE CORP., 30 N. Plains Ind. Ste.13, Wallingford, CT 06492, Tel: 203-294-0537; FSC No.: 03034; *Sls. Mgr.:* Robert Ginter

The New PENN-TRAN

FAX: 814-355-1524

PENN-TRAN CORP., Box 1321, Rte. 144N, Wingate, PA 16880, Tel: 814-355-1521, TELEX: 706473; FSC No.: 50783; Empl.: 120; *Sls. Mgr.:* William Holt ..... **A•1246; B•1027; D•1945**

Local Sales Offices & Reps

AZ	Mesa, Systems Sls. of Arizona	602-464-9989
CA	Los Altos, Cain-White & Co.	415-948-6533
CA	Pasadena, A-F Sls. Engrg., Inc.	213-681-5631
CA	San Diego, AF Sls. Engrg. Inc.	619-581-1206
CO	Englewood, Dynatech, Inc.	303-773-2830
CT	Madison, United Comp.	203-245-4810
IL	Lake Bluff, R & R Mktg. Assoc.	312-295-6660
MN	Minneapolis, International Sls. Co.	612-831-8423
NY	Johnson City, Teckmark, Inc.	607-729-6340
NY	Mendon, Tech-Mark, Inc.	716-624-3840
OR	Portland, Intertech Sls.	503-775-7885
PA	Glenside, Koebert Assocs., Inc.	215-887-2310
TX	Dallas, Seaton Corp.	214-980-9860
UT	Layton, Dynatech, Inc.	801-546-4837
WV	Inwood, Koebert Assoc.	304-229-8401

PENN VIDEO INC., 929 Sweitzer Ave., Akron, OH 44311, Tel: 216-762-4840, TELEX: 98-6327 PVI-AKR, FAX: 216-762-4840 (ext. 34); Empl.: 66; *Sls. Mgr.:* Sandra Donaldson; *Dist. Mgr.:* Gary Wagner

PENNWALT CORP., Three Pkwy., Philadelphia, PA 19102, Tel: 215-587-7520, TELEX: 84-5234, FAX: 215-587-7497

PENNY & GILES, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401, Tel: 213-393-1497, TELEX: 65-2337

PENRIL DATA COMM., 207 Perry Parkway, Gaithersburg, MD 20877, Tel: 301-921-8600, TWX: 710-828-0522; Empl.: 200; *Sls. Mgr.:* Bob Maranzani

PENSTOCK ENGINEERING LABS., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, Tel: 408-730-0300, TWX: 910-370-7450, FAX: 408-730-4782; Empl.: 37; *Sls. Mgr.:* Steve Ulett; *Dist. Mgr.:* Steven Ulett

Local Sales Offices & Reps

AZ	Phoenix, Penstock Desert States	800-255-6788
AZ	Tempe, Penstock Desert States	800-255-6788
CA	Anaheim, Penstock, Inc.	714-758-8868
CA	Beverly Hills, Penstock, Inc.	213-383-6100
CA	San Diego, Penstock, Inc.	619-225-8600
CA	Sunnyvale, Penstock Intl.	408-730-0300
CA	Sunnyvale, Penstock, Inc.	408-730-0300
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Can	Markham, Ontario, SPI (Branch)	416-475-5305

FAX: 818-369-2961

PILLAR INDUSTRIES, INC., 15318 E. Valley Blvd., City of Industry, CA 91746, Tel: 818-369-3750, 818-333-8803; Empl.: 3 ..... **D•1972-1975**

Local Sales Offices & Reps

CA	Los Angeles, Power Partner, Inc.	213-215-0800
CA	Santa Cruz, LEREP	408-458-0667

PIND TESTERS INC., 19-B Thomas, Irvine, CA 92718, Tel: 714-380-1551, FAX: 714-951-1269; FSC No.: 66; Empl.: 25; *Sls. Mgr.:* J. Baker

PINE INSTRUMENT CO., 101 Industrial Dr., Grove City, PA 16001, Tel: 412-458-6391, FAX: 412-458-4648; Empl.: 60

PIONEER COMPONENTS, 2352 E. 66th St., Brooklyn, NY 11234, Tel: 718-444-3880; Empl.: 3; *Sls. Mgr.:* Michael R. Verter; *Dist. Mgr.:* Michael R. Verter

Pioneer Magnetics

FAX: 213-453-3929

PIONEER MAGNETICS, 1745 Berkeley St., Santa Monica, CA 90404, Tel: 213-829-6751, TELEX: 182-093, TWX: 910-343-6249; FSC No.: 08676; Empl.: 475; *Sls. Mgr.:* A. Hagiwara, V.P. of Mktg. ..... **D•1976-1977**

Local Sales Offices & Reps

AL	Huntsville, Pen-Tech Assocs.	205-881-9298
AZ	Scottsdale, Williams Assocs.	602-947-4297
CA	Ben Lomond, Pioneer Magnetics	408-335-1042
CA	Los Altos, Frauman Assocs.	415-941-0660
CA	Santa Monica, Pioneer Magnetics, Inc.	213-829-6751
CO	Commerce City, Williams Assocs.	303-289-5647
FL	Boca Raton, Pen-Tech Assocs.	305-394-7400
GA	Marietta, Pen-Tech Assocs.	404-424-1931
IL	Chicago, Heartland Tech. Mktg.	312-577-9222
IN	Milwaukee, Heartland Tech. Mktg.	312-577-9222
MD	Columbia, Stein Instrmn.	301-596-3748
MA	Teaticket, Pioneer Magnetics	508-256-3166
MI	Ann Arbor, KRW Sls., Inc.	313-769-0056
MN	St. Paul, Cahill, Schmitz & Cahill	612-636-7217
MO	Lee's Summit, Omni Tech. Sls.	816-578-4221
NJ	Glen Gardner, Daner-Hayes Inc.	201-537-4534
NM	Albuquerque, Williams Assocs.	505-255-1368
NY	Brewster, Daner-Hayes Inc.	914-279-2168
NY	E. Norwich, Daner-Hayes Inc.	516-922-0080
NY	Pittsford, Comms. Technlg.	716-586-9433
NC	Greensboro, Pen-Tech Assocs.	919-852-6000
OH	Dublin, KRW Sls. Inc.	614-885-2598
OH	Westlake, KRW Sales	216-871-7521
OR	Lake Oswego, RTS, Inc.	503-244-4123
PA	Cheltenham, Stein Instrm.	215-379-1990

PA Oakmont, KRW Sls. Inc. 412-828-1490
TX Dallas, Kruvand 214-437-3355
UT Salt Lake City, Williams Assocs. 801-485-6511
WA Vashon, RTS, Inc. 206-285-1363
Can Lachine, Electrodesign Ltd. 514-636-4838

PIRELLI CABLE CORP., See Specialty Cable Corp.

PITTMAN, Penn Engrg. & Mfg. Corp., 343 Godshall Dr., Harleysville, PA 19438, Tel: 215-256-6601, TELEX: 283668, TWX: 510-661-8696, ESYLNK: 62894738; FSC No.: 98938; Empl.: 160 ..... **B•1295-1297**

Local Sales Offices & Reps

AL Leeds, Motion Technlg., Inc. 205-699-4269
AZ Fountain Hills, Halbar Assocs. 602-837-2464
CA Glendale, Halbar Assocs. 818-246-8263
CA San Mateo, Halbar Assocs. 415-349-4700
CO Englewood, Integrated Motion Sys. 303-792-5516
CT Old Saybrook, M. L. Assocs., Inc. 203-388-9718
FL Palm Bay, Motion Technlg., Inc. 800-438-1380
GA Lilburn, Motion Technlg., Inc. 800-438-1380
IL Mount Prospect, K-W Assocs. 312-253-6680
IN Elkhart, Shaum Mfg., Inc. 219-264-0771
MA Wayland, M. L. Assocs. 617-358-5540
NY Great Neck, Marcus Sls. Assocs., Inc. 516-671-6820
NY Rochester, Application Spec. 716-586-6226
NC Charlotte, Motion Technlg., Inc. 800-438-1380
OH Cleveland, Servo-Mark 216-871-2353
OK Edmond, Motion Reps, Inc. 405-340-8100
PA Exton, Kiley Elect. Co., Inc. 215-363-8550
TX Austin, Motion Reps, Inc. 512-288-5758
TX Denton, Motion Reps, Inc. 817-565-9411
TX Houston, Motion Reps, Inc. 713-981-8700
WA Radford, Motion Technlg., Inc. 703-639-0158
WA Redmond, Halbar Assocs. 206-882-0990
WA Vancouver, Halbar Assocs. 206-696-0170
Can Montreal, Brian Engrg. Ltd. 514-738-5757

PLAINVIEW BATTERIES, INC., 1121 Holland Dr., Ste. 7, Boca Raton, FL 33487, Tel: 407-997-7705, FAX: 407-997-7803; *Sls. Mgr.:* B. Erde ..... **D•1510-1511**

PLAINVIEW ELECTRONICS, See Plainview Battieries, Inc.

PLANT SPECIALTIES, INC., P.O. Box 110537, Carrollton, TX 75011-0537, Tel: 214-245-9673; *Sls. Mgr.:* J. E. Bryer

PLASMA RESEARCH CORP., 5675 Chappell Pl, Oakland, CA 94619, Tel: 415-530-1468; FSC No.: 8Y067; Empl.: 7

PLASTIC CAPACITORS, INC., 2623 N. Pulaski Rd, Chicago, IL 60639, Tel: 312-489-2229, TWX: 910-221-1354, FAX: 312-489-0496; FSC No.: 99120; Empl.: 90; *Sls. Mgr.:* Thomas J. Brown; *Dist. Mgr.:* Thomas J. Brown

Local Sales Offices & Reps

AL Huntsville, B.J.R., Inc. 205-881-3569
AZ Phoenix, The Knight Co. 602-994-1311
CA Los Angeles, The Knight Co. 213-670-2833
CA Palo Alto, Horne Electro Sls., Inc. 415-494-6777
CO Broomfield, Technet Sls. & Svcs., Ltd. 303-466-7777
CT E. Haven, Eagle Assocs. 203-467-6542
FL Longwood, Mathias Assocs., Inc. 305-682-1700
IL Elk Grove Village, Carlson Elctrn. Sls. Co. 312-956-8240
IN Fort Wayne, W. W. Bieberich, Inc. 219-432-2537
IA Cedar Rapids, Carlson Elctrn. Sls. Assocs. 319-378-1450
MD Baltimore, Eastern Comps. Sls. Corp. 301-788-7050
MA Pinehurst, Eagle Assocs. 617-444-3446
MN Wayzata, Cardinal Sls. Co. 612-475-0042
NJ Springfield, F. F. Sylvester Assoc. 201-376-3324
NY Rochester, APEX Assocs., Inc. 716-272-7040
OR Tigard, Components West, Inc. 503-684-1671
PA W. Conshohocken, Eastern Comps. Sls. Corp. 215-825-8610
TX Seagoville, Delta Comps., Inc. 214-287-6333
WA Redmond, Components West, Inc. 206-885-5880
WI Milwaukee, Carlson Elctrn. Sls. Co. 414-476-2790

PLASTIC FORMING, 20 S. Bradley Rd., Woodridge, CT 06525, Tel: 203-397-1338, TELEX: 963437, FAX: 203-389-0420; Empl.: 80; *Sls. Mgr.:* Bruce J. Dokurno

PLASTICORP, 24105 S. Frampton Ave., Harbor City, CA 90710, Tel: 213-539-9530, FAX: 213-539-8325; Empl.: 120; *Sls. Mgr.:* Robert Hurley

PLASTIMATIC, INC., Glynwed Int'l, 3 Oak Rd., Fairfield, NJ 07006, Tel: 201-575-0038, FAX: 201-575-8748; Empl.: 95; *Sls. Mgr.:* B. Matthews

PLASTOID CORPORATION, 45 Gingerbread Castle Rd., Hamburg, NJ 07419, Tel: 201-827-7141, FAX: 201-827-7141 (ext 52); Empl.: 200

PLATO PRODUCTS, INC., 2120 E. Allen Ave., Glendora, CA 91740, Tel: 800-423-4510, TELEX: 287291, FAX: 714-592-7062; FSC No.: 32399; Empl.: 75; *Sls. Mgr.:* Walter Schaub

PLESSEY ELECTRONIC SYSTEMS CORP., 164 Totowa Rd., Wayne, NJ 07470, Tel: 201-633-6000, FAX: 201-633-6167; FSC No.: 0D0D0; Empl.: 2700; *Sls. Mgr.:* M. G. Gordon, VP

PLETRONICS, INC., 9026 Roosevelt Way N.E., Seattle, WA 98115, Tel: 206-523-9395, FAX: 206-525-2350; Empl.: 125; *Sls. Mgr.:* Les Podgorny; *Dist. Mgr.:* Les Podgorny ..... **A•1464-1467**

Local Sales Offices & Reps

CA Mission Viejo, Jay Mktg. Assocs. 714-768-7519
CA Pleasanton, Moulthrop 415-463-0450
CO Aurora, Electrodyne 303-695-8903
CT Cheshire, Nesco 203-272-0368
FL Orlando, MacKay, Smith & Assocs. 305-423-4353
GA Tucker, MacKay, Smith & Assocs. 404-496-9913
IL Woodridge, Trend-Tronics 312-985-0626
MD Baltimore, Chesapeake Ind. Mktg. 301-653-0476
MA Randolph, Bengal 617-961-4120
MN St. Paul, Countryman 612-645-9151
NJ Springfield, Radix 201-467-4970
NC Raleigh, MacKay, Smith & Assocs. 919-847-2277
OH Centerville, Omega 513-434-5507
OH Shaker Hgts., Omega 216-751-9600
TX Austin, Sage Mktg. 512-335-0300
UT Salt Lake City, Electrodyne 801-264-8050
WA Redmond, Halbar 206-882-0990

Local Distributors

CA El Segundo, Force 213-772-1324
CA Fullerton, Pyramid 714-773-0781
CA Orange, Target Elctrns. 714-639-1418
CA San Diego, Pyramid 619-271-5404
CA San Jose, Force 408-435-1324
CA Santa Clara, Pyramid 408-727-9810
CA Sunnyvale, Capsco 408-734-3020
CA Sunnyvale, Target 408-734-5611
CT Norwalk, Cobra Comps. 203-847-6442
FL West Melbourne, Pridmore Corp. 407-727-2491
IL Woodridge, Trend-Tronics 312-985-0626
MD Beltsville, PSI 301-937-4960
MA Middleboro, Glynn Elctrns. 617-947-4262
MA Norwood, Gerber Elctrns. 617-947-4262
MA Woburn, First Frequency 617-933-7386
MN Fridley, Voyager 612-571-7766
NY Stony Brook, Dove Elctrns. 516-689-7733
NC Raleigh, Century Elctrns. 919-782-2116
PA Norristown, Century Elctrns. 215-631-5400
WA Redmond, Priebe 206-881-2363
WA Redmond, Pyramid 206-883-7200

PLUMER PRECISION OPTICS, 601 Montgomery Ave., Pennsburg, PA 18073, Tel: 215-679-6272, FAX: 215-679-2277; Empl.: 180; *Sls. Mgr.:* Max Haskins

PMI MOTION TECHNOLOGIES, 49 Mall Dr., Commack, NY 11725-5703, Tel: 516-864-1000, TWX: 510-233-0007, FAX: 516-864-2084; Empl.: 250; *Sls. Mgr.:* Peter Dougherty

POCO SLS., Porter Co., 8925 Fullbright St., Chatsworth, CA 91311, Tel: 818-700-8727, FAX: 818-700-8453; FSC No.: 69-1603; Empl.: 8

POINT 4 DATA CORP., 15442 Del Amo Ave., Tustin, CA 92680, Tel: 714-259-0777, TELEX: 4722040; Empl.: 180; *Sls. Mgr.:* Mr. Ted Cooper; *Dist. Mgr.:* Mr. Ted Cooper

POLARA ENGINEERING INC., 4115 W. Artesia Ave., Fullerton, CA 92633, Tel: 714-521-0900, TELEX: 688489, FAX: 714-522-8001; Empl.: 62

POLAROID CORPORATION, Polarizer Div., 1 Upland Rd., Norwood, MA 02062, Tel: 800-225-2770, FAX: 617-446-4600

POLYCASE PRODS., ECP Corp., 4726 Superior Ave, Cleveland, OH 44103, Tel: 216-391-0444, FAX: 216-391-2891; Empl.: 14 ..... **C•1077**

POLY CIRCUITS, INC., 215 Park St., Bensenville, IL 60106, Tel: 312-860-3560, FAX: 312-860-5350; Empl.: 125; *Sls. Mgr.:* Will Allen

POLYCORE ELECTRONICS, 1107 Tourmaline Dr., Newbury Pk., CA 91320, Tel: 805-499-6777, TWX: 910-336-1547, FAX: 805-499-6017; Empl.: 40; *Sls. Mgr.:* S.K. Leong

POLYMER CORP., 2120 Fairmont Ave., Reading, PA 19605, Tel: 215-320-6600, TELEX: 836-440, TWX: 510-651-5696, FAX: 215-320-6866; Empl.: 1000; *Sls. Mgr.:* R. A. Alberts; *Dist. Mgr.:* R. F. Wagner

POLYPHASE INSTRUMENT, 175 Commerce Dr., Ft. Washington, PA 19034, Tel: 215-643-6950, FAX: 1-215-643-5237; FSC No.: 98330; Empl.: 200; *Sls. Mgr.:* Bert Rashkow ..... **A•2420-2421**

Local Sales Offices & Reps

CA Chatsworth, WCV-Raltech Inc. 818-700-0933
FL Longwood, Beacon Assoc. 407-332-1940
IA Cedar Rapids, Lorenz Sls. Inc. 319-377-4666
KS Overland Pk., Lorenz Sls. Inc. 913-649-5556
MA Brookline, Technlg. Prods. Grp. 617-731-0858
MO University City, Lorenz Sls. Inc. 314-997-4558
NE Lincoln, Lorenz Sls. Inc. 401-475-4660
NJ Madison, Livera Polk Assocs., Inc. 201-377-3220
NY Glen Head, Livera Polk Assocs., Inc. 516-759-9300
PA Erdenheim, Omni Sls. 215-233-4702
TX Austin, Mil-Rep Assocs., Inc. 512-346-6331
TX Richardson, Mil-Rep Assocs., Inc. 214-644-6731

POLYPHASER CORPORATION, 1425 Industrial Way, P.O. Box 1237, Gardnerville, NV 89410-1237, Tel: 702-782-2511, 800-325-7170, TELEX: 272718 PolyPhaser, FAX: 702-782-4476 ..... **B•1405**

Local Sales Offices & Reps

CA Fallbrook, Gov. Comms. Mktg. 619-728-2530
CA Sacramento, JN Sls. 916-635-5899
CO Aurora, Electro-Tek Sls., Inc. 303-343-8020
FL Coral Springs, Cemco 305-753-6777
GA Atlanta, Cemco 404-491-0520
HI Honolulu, Manon Engrg. 808-833-9545
IN Greenfield, Webster Assocs., Inc. 317-326-8575
KS Olathe, Maury E. Bettis Co. 913-764-0621
KY Louisville, Webster Assocs. 502-937-8189
LA Houma, Horizon Comm. Sls. Co. 504-868-7629
MI Rochester, Webster Assocs., Inc. 313-375-0420
MN Stillwater, Ned Gordon & Assocs. 612-430-1572
NV Gardnerville, PolyPhaser Corp. 702-782-2511
NH Manchester, Assocd. Sys. 603-472-2297
NJ Totowa, Holzberg Inc. 201-256-8555
NM Rio Rancho, Webster Assocs. 505-892-4969
NY Ossining, Webster Assocs. 915-762-0136
NC Black Mountain, Cemco 704-669-4777
OK Tulsa, Horizon Comm. Sls. Co. 918-252-7222
PA Venetia, Webster Assocs. 412-941-8848
TX Houston, Horizon Comm. Sls. Co. 713-495-1018
TX Rowlett, Horizon Comm. Sls. Co. 214-475-1179
WA Kirkland, Manon Engrg. 206-827-7449

Local Distributors

CA Sacramento, Sacramento Elctrns. 916-441-4821
CO Aurora, Electro-Comm Distrs. 303-343-8937
HI Honolulu, Honolulu Elec.
ID Idaho Falls, Teton Comms. 208-522-0750
IL Joliet, Primus Elctrns. Corp. 815-436-8945
MI Detroit, Adams Distrbg. Co. 313-584-6640
MO Springfield, Communications Assocs. 417-882-1401
NE Lincoln, Dynocom-Tower Maintenance 712-255-9010
NV Carson City, Schwartz Radio, Inc. 702-883-4500
NV Gardnerville, PolyPhaser Corp. 702-782-2511
NC Greensboro, West Antenna 919-621-2473
TX Rowlett, Horizon Comm. Sls. Co. 214-475-1179
VA Blacksburg, Professional Comms. 703-552-4443

POLY-PLANAR INC., 1800 Mearns Rd,Unit J-P.O. Box 2578, Warminster, PA 18974, Tel: 215-675-7805; Empl.: 12

POLYPLY INC., Rd. No. 1, Route 5 South, Amsterdam, NY 12010, Tel: 518-843-3900, FAX: 518-843-5829; *Sls. Mgr.:* B. Slomski

POLYTRON DEVICES, INC

FAX: 201-345-1264

POLYTRON DEVICES, INC., Box 398 - River St. Sta., Paterson, NJ 07544, Tel: 201-345-5885; Empl.: 26 ..... **D•1979-1983**

Local Sales Offices & Reps

CA Huntington Bch., Mil-Com Sls. 714-840-2424
CA Huntington Beach, Mil-Com Sls. 714-840-2424
CA San Jose, P & M Elctrns. 408-287-0402
NY Canandaigna, Mamula Sls. 716-394-5560
NY Canandaigua, Mamula Sls. 716-394-5560

POMFRET RESEARCH OPTICS, P. O. Box 1265, Orange, VA 22960, Tel: 703-854-4350; Empl.: 5

POMONA

FAX: 714-629-3317

POMONA ELECTRONICS, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, Tel: 714-623-3463, TWX: 910-581-3822; FSC No.: 05276; Empl.: 170; *Sls. Mgr.:* Thomas Barber; *Dist. Mgr.:* Thomas Barber
..... **C•1477-1505, 1623**

Local Sales Offices & Reps

AL	Hazel Green, Braden & Assocs.	205-828-6290
AZ	Phoenix, More Sls.	602-788-9181
AR	Little Rock, Erickson Sls., Inc.	501-455-0618
CA	Burbank, Darco	818-504-2425
CA	Irvine, Vale Elctrn. Assocs.	714-551-4004
CA	Santa Clara, Engrg. Assocs. Corp.	408-988-5001
CA	So. San Francisco, Carelli/EMA	415-873-2524
CO	Broomfield, Connors Co.	303-466-9628
FL	Maitland, EIR Inc.	407-660-9600
IL	Deerfield, W. M. Linz	312-945-9600
IN	Indianapolis, Blind Elctrn. Sls. Co.	317-241-3742
IA	West Des Moines, Nevco	515-225-9866
LA	Chalmette, Erickson Sls., Inc.	504-271-1976
MD	Baltimore, David S. Linz, Inc.	301-727-6651
MA	Foxboro, Al Appell Assoc., Inc.	617-784-3439, 508-543-1109
MI	Jenison, C. A. Geer Co.	616-534-9449
MI	Kentwood, C. A. Geer Co.	616-534-9449
MN	Minneapolis, Hei-lite Sls., Inc.	612-861-6051
MO	Crestwood, Nevco, Inc.	314-843-7406
OH	Eastlake, Spectrum Technlg.	216-951-4455
MO	Independence, Nevco, Inc.	816-478-4582
NJ	Belleville, D. F. Tobias & Co.	201-751-8680
OR	Beaverton, Eclipse Mktg. Grp. Ltd.	503-642-1661
PA	Philadelphia, David S. Linz, Inc.	215-379-0734
SC	Greenville, Hal C. Norman Sls. Co.	803-244-6254
TX	Dallas, Erickson Sls., Inc.	214-739-5833
TX	Houston, Erickson Sls., Inc.	713-266-1604
TX	Round Rock, Erickson Sls., Inc.	512-244-3068
WA	Redmond, Eclipse Mktg. Grp., Ltd	206-885-6991
WA	Spokane, Eclipse Mktg. Grp., Ltd.	509-928-2903
EXP	CA, Tarzana, Nate Beckerman & Co., Inc.	818-708-0021
Can	Whitby, ITT Cannon Canada	416-668-8881

PORTESCAP U.S., INC., 36 Central Ave., Hauppauge, NY 11788, Tel: 516-234-3900, FAX: 516-234-3986; Empl.: 16; *Sls. Mgr.:* Dave Hall

POSITRONIC INDUSTRIES, INC., 423 N. Campbell St., P.O. Box 8247, Springfield, MO 65801, Tel: 417-866-2322, TELEX: 436445, FAX: 417-866-4115; FSC No.: 28198; Empl.: 300

Local Sales Offices & Reps

AZ	Phoenix, Jarko Assocs.	602-243-4387
CA	Fallbrook, Gary Chilcote & Assocs.	619-728-7678
CA	Irvine, J.V. Earley & Assocs.	714-833-1806
CA	Los Angeles, Positronic Inds.	714-528-4103
CA	Redwood City, Positronic Inds.	415-366-0483
CA	San Jose, Arnold Technical Sales	408-954-0400
CO	Englewood, Romtech, Inc.	303-779-0291
FL	Lakeland, Positronic Ind. inc.	813-859-3941
MD	Gaithersburg, Carwithen Assoc.	301-921-9545
MN	Minneapolis, R K Sls.	612-571-1001
MO	Springfield, David Ray	417-866-2322
NH	Merrimack, Positronic Inds., Inc.	603-882-8718
NH	Salem, Sls. Engrg. Co.	603-893-5521
NJ	Wyckoff, N.E. Comps.	201-848-1100
NY	Whallon Tool & Services	
NY	Unadilla, Positronic Inds.	607-563-1021
NC	Raleigh, R.W. Mitscher Co., Inc.	919-848-9156
TX	Dallas, Positronic Inds.	817-540-5448

Local Distributors

AL	Huntsville, Mobile Elctrns.	205-533-1942
CA	Campbell, Applied Specialties	408-370-2644
CT	Norwalk, Cobra Comps.	203-847-6442
MD	Columbia, Aztech Elctrns.	301-995-6800
MA	Canton, Electronic Packaging Corp.	617-821-2111
MI	Fraser, Madison Elctrns.	313-294-8300
NJ	Bellmawr, Mid-Atlantic Elec. Corp.	609-931-5303
NY	Copiague, Restart Elctrns.	516-842-1500
OH	Wickliffe, Gateway Megatech	216-953-0333
PA	Philadelphia, Shap Electronics	215-969-3300
PA	Philadelphia, Sharp Electronics	215-969-3300
WA	Redmond, Pan Pacific Electronics	206-881-7252

P&B

FAX: 812-386-2335

POTTER & BRUMFIELD, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, Tel: 812-386-1000, TELEX: 27-8451, TWX: 810-350-2343; Empl.: 3000; *Sls. Mgr.:* Don Patton; *Dist. Mgr.:* Sherry Colborn
..... **B•1406, 1597-1613**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Los Altos, Recht Assocs.	415-964-6321
CA	Mission Viejo, Potter & Brumfield-Western U.S.	714-582-1231
CA	San Diego, CERCO	619-450-1754
CA	Santa Ana, Jones & McGeoy Sls., Inc.	714-547-6466
CO	Littleton, Simpson Assocs.	303-794-8381
FL	Deerfield Beach, Cartwright & Bean	305-429-3400
FL	Orlando, Cartwright & Bean	305-422-4531
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Rolling Meadows, Sumer, Inc.	312-991-8500
IN	Fort Wayne, R. O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R. O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R. O. Whitesell & Assocs.	317-457-9127
IN	Princeton, Potter & Brumfield-Central U.S.	812-386-2130
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
KS	Leawood, Dy-Tronix, Inc.	913-339-6333
KS	Wichita, Dy-Tronix, Inc.	316-838-0884
KY	PeeWee Valley, R. O. Whitesell & Assocs.	502-241-1441
LA	Covington, Cartwright & Bean	504-892-1780
MD	Baltimore, Micro-Comp	301-644-5700
MA	Braintree, Potter & Brumfield-Eastern U.S.	617-848-6550
MA	Framingham, Gallagher Assocs., Inc.	617-626-2346
MI	Grand Blanc, R. O. Whitesell & Assocs.	313-695-0770
MI	Grand Rapids, R. O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R. O. Whitesell & Assocs.	313-559-5454
MI	St. Joseph, R. O. Whitesell & Assocs.	616-983-7337
MN	Edina, Mel Foster Tech. Sls.	612-941-9790
MS	Jackson, Cartwright & Bean	601-981-1170
MO	Bridgeton, Dy-Tronix, Inc.	314-291-4777
NJ	Medford, The McCoy Grp., Inc.	609-953-0770
IN	Princeton, Potter & Brumfield-Southern U.S.	812-386-2211
NM	Albuquerque, C. T. Carlberg & Assocs.	505-888-3883
NY	Kingston, Micro-Tech Mktg. Inc.	914-338-7588
NY	Melville, Comtronic Assocs.	516-249-0505
NY	N. Syracuse, Micro-Tech Mktg. Inc.	315-458-5254
NY	Rochester, Micro-Tech Mktg. Inc.	716-328-3000
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Cincinnati, R. O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R. O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R. O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R. O. Whitesell & Assocs.	513-298-9546
OK	Tulsa, Components, Inc.	918-583-9149
PA	Exton, The McCoy Grp., Inc.	215-363-0350
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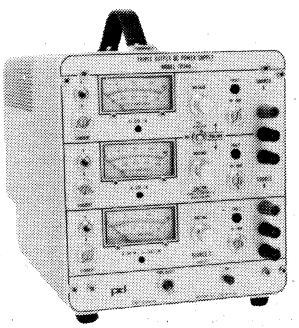

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OH Cincinnati, Hughes Peters 513-351-2000
OH Cleveland, CAM/RPC Elctrns. 216-461-4700
OH Cleveland, Darrah Elec. 216-631-0912
OH Columbus, Electronics Mktg. Corp. 614-299-4161
OH Columbus, Hughes Peters 614-294-5351
OH Dayton, Electronics Mktg.Corp. 513-439-4711
OH Dayton, Hamilton/Avnet 513-439-6700
OH Dayton, Hamilton/Avnet (MIL) 513-439-6733
OH Dublin, Time Elctrns. 614-761-1100
OH Highland Heights, Electronics Mktg.Corp. 216-442-3441
OH Solon, Hamilton/Avnet 216-349-5100
OH Westerville, Hamilton/Avnet 614-882-7004
OK Tulsa, Altair Co. 918-252-5781
OK Tulsa, Hamilton/Avnet 918-252-7297
OR Beaverton, Almac Elctrns. Corp. 503-629-8090
OR Beaverton, Hamilton/Avnet 503-627-0201
OR Portland, Dunn Elctrns. 503-285-0214
OR Portland, Time Elctrns. 503-684-3780
PA King of Prussia, Time Elctrns. 215-337-0900
PA Mars, Almo Elctrns. 412-931-5990
PA Philadelphia, Almo Elctrns. 215-698-4003
PA Pittsburgh, CAM/RPC Elctrns. 412-782-3770
PA Pittsburgh, Hamilton/Avnet 412-281-4150
TX Austin, Hamilton/Avnet 512-837-8911
TX Austin, Time Elctrns. 512-339-3051
TX Carrollton, Time Elctrns. 214-241-7441
TX Dallas, Hamilton/Avnet 214-308-8104
TX El Paso, International Elctrns. 915-598-3406
TX Houston, Altair Co. 713-462-3029
TX Richardson, Altair Co. 214-231-5166
TX Stafford, Hamilton/Avnet 713-240-7733
UT West Valley, Time Elctrns. 801-973-8181
VA Charlottesville, Virginia Elec. Comps. .. 804-296-4184
WA Bellevue, Almac Elctrns. Corp. 206-643-9992
WA Redmond, Hamilton/Avnet 206-867-0149
WA Redmond, Time Elctrns. 206-882-1600
WA Spokane, Almac Elctrns. Corp. 509-924-9500
WV Charleston, McJunkin Corp. 304-348-5211
WI Mequon, Taylor Elec. Co. 414-241-4321
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI Waukesha, Hamilton/Avnet 414-784-4510
WY Gillette, WESCO 307-687-0014
Can Burnaby, BC, Hamilton/Avnet 604-437-6667
Can Burnaby, BC, ITT/RAE Electronics 604-291-8866
Can Calgary, Alberta, Hamilton/Avnet 403-250-9380
Can Calgary, Alberta, ITT/RAE Elctrns. 403-253-8575
Can Concord, Ont., ITT/RAE Elctrns. 416-736-1144
Can Dartmouth, Nova Scotia, ITT/RAE Elctrns. 902-465-2350
Can Edmonton, Alberta, ITT/RAE Elctrns. 403-451-4001
Can Mississauga, Ont., Hamilton/Avnet 416-677-7432
Can Mississauga, Ont., Time Elctrns. 416-672-5300
Can Moncton, New Brunswick, ITT/RAE Elctrns. 506-857-8011
Can Nepean, Ont., Hamilton/Avnet 613-266-1700
Can Nepean, Ont., ITT/RAE Elctrns. 613-266-7406
Can St. Laurent, Que., Hamilton/Avnet 514-335-1000
Can St. Laurent, Que., ITT/RAE Elctrns 514-335-7697
Can Stoney Creek, Ont., Westinghouse Canada, Inc. 416-664-3300
Can Willowdale, Ont., Electro Sonic, Inc. ... 416-494-1666
Can Winnipeg, Manitoba, ITT/RAE Elctrns. 204-786-8401

POWER FUNCTIONS ENGINEERING, 3831 Cavalier Dr., Garland, TX 75042, Tel: 214-278-0996; Empl.: 9

POWER GENERAL, Unitrode Corp., 152 Will Dr., Canton, MA 02021, Tel: 617-828-6216, TWX: 710-348-0200; Empl.: 300; *Sls. Mgr.:* Steve Dutton, Natl. Sls. Mgr.

POWER INSTRUMENTATION DIV., Datapower, Inc., 3545 Cadillac Ave., Costa Mesa, CA 92626, Tel: 714-754-4400, TWX: 910-595-1560, FAX: 714-754-5407

POWER INTEGRITY CORP., 1834 Pembroke Rd, Greensboro, NC 27429-0682, Tel: 919-379-9773, 800-237-6260, TELEX: 919-379-1301; *Sls. Mgr.:* James T. Fesmire

POWERLINE,INC., Chloride Power Elctrns., 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-881-7329, TELEX: 5161003630, FAX: 508-879-8669

POWER MAGNE-TECH CORPORATION, 441 High Street, Perth Amboy, NJ 08861, Tel: 201-826-4700, TELEX: 284401PMCQ, FAX: 201-826-4706; Empl.: 65; *Sls. Mgr.:* Arthur Zuckerman; *Dist. Mgr.:* Arthur Zuckerman ..... **A•2419**

POWERMARK, See Topaz, Inc., 9192 Topaz Way, San Diego, CA 92123

POWER/MATE, See RTE Power/Mate

POWERNETICS LTD., Clarence St. Loughborough, Leics, ENG LE11 1DX, Tel: 0509 214153, TELEX: 34306, FAX: 0509 262460; Empl.: 105; *Sls. Mgr.:* Margaret A. Foggon, Mktg. Svcs. Mgr.

Power-One
D.C. POWER SUPPLIES
FAX: 805-388-0476

POWER-ONE D.C. POWER SUPPLIES, 740 Calle Plano, Camarillo, CA 93010, Tel: 805-987-8741, TWX: 910-336-1297; FSC No.: 54407; Empl.: 480; *Dist. Mgr.:* Julius Hirsch, Dir. of Distrbn. ..... **D•1990-1997**

Local Sales Offices & Reps

AL Huntsville, Mktg. Mktg., Inc. 205-830-0498
AZ Tempe, Sys. Sls. of AZ 602-464-9989
CA Orange County, A-F Sls. Engrg. 714-641-2903
CA Pasadena, A-F Sls. Engrg. 213-681-5631
CA Santa Clara, Nova-Tronix, Inc. 408-727-9530
CO Denver, Quorum 3 303-799-8100
CT Hamden, Datcom 203-288-7005
FL Clearwater, Electrocraft 813-573-2277
FL Coral Springs, Electrocraft 305-753-8666
GA Norcross, Montgomery Mktg. Inc. 404-447-6124
IL Chicago, M. Gottlieb & Assocs. 312-775-1151
IN Carmel, Technlg. Mktg. Corp. 317-844-8462
IN Ft. Wayne, Technlg. Mktg. Corp. 219-432-5553
IA Cedar Rapids, J.R. Sls. Engrg. 319-393-2232
KS Olathe, ATS 913-782-8702
KY Louisville, Technlg. Mktg. Corp. 502-893-1377
MD Timonium, Eastern Comps. Sls. 800-223-3851
MA Waltham, Datcom, Inc. 617-891-4600
MI Grand Rapids, Rathsburg Assocs. Inc. 616-949-7400
MI Southfield, Rathsburg Assocs. Inc. 313-559-9700
MN Minneapolis, George Russell & Assocs. 612-854-1166
MO St. Louis, ATS 314-878-2921
NM Albuquerque, Sys. Sls. of AZ 505-889-2901
NY Great Neck, Trionic Assocs. 516-466-2300
NY Syracuse, Nycom, Inc. 315-437-8343
NC Cary, Montgomery Mktg. Inc. 919-467-6319
NC Raleigh, Montgomery Mktg. Inc. 919-851-0010
OH Columbus, Tom Mulligan Co. 614-457-2242
OK Tulsa, Advance Tech. Sls. 918-664-0482
OR Portland, W3 503-629-9871
PA W. Conshohocken, Eastern Comp. Sls. 215-825-8610
TX Dallas, Advance Tech. Sls. 214-340-1300
TX Houston, Advance Tech. Sls. 713-440-3888
UT Salt Lake City, Quorum 3 801-943-9227
WA Seattle, W3 206-285-0210
WI Milwaukee, M. Gottlieb & Assocs. 414-546-4466

Local Distributors

AL Huntsville, Arrow Elctrns. 205-837-6955
AL Huntsville, Bell Inds. 205-837-1074
AL Huntsville, Pioneer Elctrns. 205-837-9300
AZ Phoenix, Sterling Elctrns. 602-268-2121
AZ Phoenix, Wyle Labs 602-437-2088
AZ Tempe, Arrow Elctrns. 602-437-0750
AZ Tempe, Bell Inds. 602-966-7800
CA Calabasas, Wyle Labs. 818-880-9000

CA Canoga Pk., FLW 818-719-0037
CA Chatsworth, Arrow Elctrns. 818-701-7500
CA Costa Mesa, FLW 714-751-7512
CA Garden Grove, Bell Inds. 714-895-7801
CA Gardena, Bell Inds. 213-515-1800
CA Irvine, Wyle Labs. 714-863-9953
CA Los Alamitos, Compumech Elctrns. ... 714-826-0866
CA Los Angeles, Wyle Labs. 213-322-9953
CA Mtn. View, Bell Inds. 415-960-1440
CA Newport Bch., Arrow Elctrns. 714-838-5422
CA Rocklin, Bell Inds. 916-652-0414
CA Sacramento, Bell Inds. 916-652-0414
CA Sacramento, Wyle Labs. 916-638-5282
CA San Diego, Arrow Elctrns. 619-565-4800
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, FLW 619-434-5251
CA San Diego, Wyle Labs. 619-565-9171
CA San Jose, Compumech Elctrns. 408-280-6446
CA Santa Clara, Wyle Labs. 408-727-2500
CA Sunnyvale, Arrow Elctrns. 408-745-6600
CA Sunnyvale, Bell Inds. 408-745-0400
CA Sunnyvale, Bell Inds. 408-734-8570
CA Thousand Oaks, Bell Inds. 805-499-6821
CA Tustin, Arrow Elctrns. 714-838-5422
CO Aurora, Arrow Elctrns. 303-790-4444
CO Denver, Bell Inds. 303-424-1985
CO Denver, Wyle Labs. 303-457-9953
CO Englewood, Sterling Elctrns. 303-792-3939
CT New Haven, Greene-Shaw Co. 203-265-3333
CT Norwalk, Pioneer Elctrns. 203-853-1515
CT Wallingford, Arrow Elctrns. 203-265-7741
CT Wallingford, Sterling Elctrns. 203-265-9535
FL Altamonte Springs, Arrow Elctrns. 407-682-6923
FL Altamonte Springs, Pioneer Elctrns. ... 407-834-9090
FL Deerfield Bch, Pioneer Elctrns. 305-428-8877
FL Deerfield Bch., Bell Inds. 305-421-1997
FL Ft. Lauderdale, Arrow Elctrns. 305-429-8200
FL Largo, Bell Inds. 813-541-4434
FL Miami, Elctrn. Equip. Co. 305-526-6000
FL Palm Bay, Arrow Elctrns. 407-323-0252
FL Tampa, Elctrn. Equip. 813-988-0810
GA Norcross, Arrow Elctrns. 404-449-8252
GA Norcross, Bell Inds. 404-662-0923
GA Norcross, Pioneer Elctrns. 404-448-1711
ID Boise, Radar Elec. 208-336-2227
IL Arlington Heights, C. W. Elctrns. 312-439-9880
IL Bensonville, Voyager Elctrns. 312-860-1300
IL Elk Grove Village, Bell Inds. 312-640-1910
IL Elk Grove Village, Pioneer Elctrns. 312-495-9680
IL Itasca, Arrow Elctrns. 312-250-0500
IL Northbrook, Classic Comps. 312-272-9650
IL Urbana, Bell Inds. 217-328-1077
IN Ft. Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Arrow Elctrns. 317-243-9353
IN Indianapolis, Bell Inds. 317-875-8200
IN Indianapolis, Classic Comps. 317-872-4777
IN Indianapolis, Pioneer Elctrns. 317-849-7300
IA Cedar Rapids, Arrow Elctrns. 319-395-7230
IA Cedar Rapids, Bell Inds. 319-395-0730
IA Cedar Rapids, Dee, Inc. 319-365-7551
KS Lenexa, Arrow Elctrns. 913-541-9542
KS Lenexa, Pioneer 913-492-0500
KS Overland Pk., Sterling Elctrns. 913-236-5589
LA Westwego, Sterling Elctrns. 504-436-1418
MD Baltimore, Arrow Elctrns. 301-995-6002
MD Columbia, Arrow Elctrns. 301-995-6002
MD Gaithersburg, Pioneer Elctrns. 301-921-0660
MD Rockville, Arrow Elctrns. 301-424-0244
MA Binghamton, Pioneer Elctrns. 617-748-8211
MA Canton, Impact Sales 617-821-1500
MA Lexington, Pioneer Elctrns. 617-861-9200
MA Newton, Greene-Shaw Co. 617-969-8900
MA Woburn, Arrow Elctrns. 617-658-0900
MA Woburn, Sterling Elctrns. 617-938-6200
MI Ann Arbor, Arrow Elctrns. 313-971-8220
MI Ann Arbor, Bell Inds. 313-971-9093
MI Grand Rapids, Arrow Elec. 616-243-0912
MI Grand Rapids, Pioneer 616-698-1800
MI Livonia, Chelsea Indl. RS Elctrns. 313-525-1155
MI Livonia, Pioneer Elctrns. 313-944-3355
MN Eden Prairie, Pioneer 612-944-3355
MN Edina, Arrow Elctrns. 612-830-1800
MN Fridley, Voyager 612-571-7766
MO St. Louis, Arrow Elctrns. 314-567-6888
MO St. Louis, Chelsea Indl. Olive Elec. 314-997-7709
MO St. Louis, Pioneer 314-432-4350
NE Lincoln, Scott Elctrns. 402-466-8221
NE Omaha, Scott Elctrns. 402-734-6750
NH Hudson, Bell Inds. 603-882-1133
NH Manchester, Arrow Elctrns. 603-668-6968
NJ Fairfield, Arrow Elctrns. 201-538-0900
NJ Marlton, Arrow Elctrns. 215-928-1800
NJ Pine Brook, Pioneer Elctrns. 201-575-3510
NJ S. Plainfield, Sterling Elctrns. 201-769-7000
NJ W. Berlin, GCI 609-768-6767
NM Albuquerque, Arrow Elctrns. 505-243-4566
NM Albuquerque, Bell Inds. 505-292-2700
NM Albuquerque, Sterling Elctrns. 505-884-1900
NY Binghamton, Pioneer 607-722-9300
NY Hauppauge, Arrow Elctrns. 516-231-1000
NY Mamaroneck, Logicomp Elctrns. 914-698-9332
NY Melville, Arrow Elctrns. 516-391-1300
NY Rochester, Arrow Elctrns. 716-427-0300
NY Rochester, Pioneer Elctrns. 716-427-9999
NY Rochester, Pioneer Elctrns. 716-381-7070
NY Rochester, Zeller Elctrns. 716-254-8840
NY Woodbury, Pioneer Elctrns. 516-921-8700
NC Charlotte, Pioneer Elctrns. 704-527-8188
NC Raleigh, Arrow Elctrns. 919-876-3132
NC Winston-Salem, Arrow Elctrns. 919-725-8711
OH Centerville, Arrow Elctrns. 513-435-5563
OH Cleveland, CAM/RPC Elctrns. 216-461-4700
OH Cleveland, Pioneer Elctrns. 216-587-3600
OH Dayton, Bell Inds. 513-435-8660
OH Dayton, Bell Inds. (Military) 513-434-8231
OH Dayton, Pioneer Elctrns. 513-236-9900
OH Solon, Arrow Elctrns. 216-248-3990
OK Tulsa, Arrow Elctrns. 918-252-7537
OK Tulsa, Sterling Elctrns. 918-663-2410
OR Beaverton, Arrow Elctrns. 503-645-6456
OR Portland, Bell Inds. 503-635-6500
OR Portland, Radar Elec. 503-232-3404
OR Portland, Wyle Labs. 503-640-6000
PA Horsham, Pioneer Elctrns. 215-674-4000
PA Monroeville, Arrow Elctrns. 412-856-7000
PA Pittsburgh, CAM/RPC Elctrns. 412-782-3770
PA Pittsburgh, Pioneer Elctrns. 412-782-2300
RI Warwick, Major Edwards Elctrns. 401-725-7400
TN Nashville, Bell Inds. 615-367-4400
TX Austin, Arrow Elctrns. 512-835-4180
TX Austin, Pioneer Elctrns. 512-835-4000
TX Austin, Sterling 512-836-1341
TX Austin, Wyle Labs. 512-834-9957
TX Carrollton, Arrow Elctrns. 214-380-6464
TX Dallas, Force Elctrns. 214-247-9955
TX Dallas, Pioneer Elctrns. 214-386-7300
TX Dallas, Sterling Elctrns. 214-243-1600
TX Dallas, Wyle Labs. 214-235-9953
TX Houston, Arrow Elctrns. 713-530-4700
TX Houston, Force Elctrns. 713-561-8644
TX Houston, Pioneer Elctrns. 713-988-5555
TX Houston, Sterling Elctrns. 713-623-6600
TX Houston, Wyle Labs. 713-879-9953
UT Salt Lake City, Arrow Elctrns. 801-973-6913
UT Salt Lake City, Bell Inds. 801-255-9611
UT Salt Lake City, Wyle Labs. 801-974-9953
VA Richmond, Sterling Elctrns. 804-226-2190
VA Sterling, Sterling Elctrns. 703-742-8400
WA Bellevue, Bell Inds. 206-747-1515
WA Kent, Arrow Elctrns. 206-575-4420
WA Richardson, Radar Elec. 509-747-3053
WA Seattle, Radar Electric 206-282-2511
WA Seattle, Wyle Labs 206-881-1150
WA Spokane, Radar Elec. 509-747-3053
WI Brookfield, Arrow Elctrns. 414-792-0150
WI New Berlin, Classic Comps. 414-786-5300
WI Waukesha, Bell Inds. 414-547-8879
EXP CA, Los Angeles, Hanex, Inc. 213-556-3807
TX Austin, Advance Tech. Sls. 512-467-9209

POWER PAC INC.

FAX: 203-866-4487

POWER PAC, P.O. Box 777, 32 Meadow St., S. Norwalk, CT 06856-0777, Tel: 203-866-4484; FSC No.: 53998; Empl.: 140; *Sls. Mgr.:* Charles Mittel

POWER-PAK, INC., 6216 Oakton St., Morton Grove, IL 60053, Tel: 312-966-6000, FAX: 312-966-6009; Empl.: 35; *Sls. Mgr.:* Robert Villari ..... **D•1516**

POWER PRODUCTS DIV., COMPUTER PRODS./POWER PRODS., See Computer Prods. Inc., Fremont, CA.

POWER-SCIENCE, 7667 Vickers St., San Diego, CA 92111, Tel: 619-292-4322; Empl.: 10; *Sls. Mgr.:* E. Cooper

POWER SONIC
RECHARGEABLE BATTERIES

FAX: 415-366-3662

POWER-SONIC, Box 5242, 3106 Spring St., Redwood City, CA 94063, Tel: 415-364-5001, TELEX: 348400; Empl.: 50; *Sls. Mgr.:* Carl E. Fischetti; *Dist. Mgr.:* Carl E. Fischetti ..... **D•1517**

Local Sales Offices & Reps
CA Irvine, English/Damco 714-837-3801
CO Denver, Rick Moody 303-893-3771
FL Tampa, SRT Mktg. 813-884-4805
IL Hinsdale, Pete Collins 312-325-9888
MD Woodbine, DJC Elctrns. 301-795-7020
MA Norwood, Associd. Power Prods. 617-769-7516
MS Jackson, Doby Assocs. 601-981-1138
MO St. Louis, Lowell Kangas 314-821-4050
NJ Dumont, John Hart 201-385-5595
NC Raleigh, Electronic Mktg. Assocs. 919-847-8800
NC Raleigh, Positive Comps. 919-772-8073
PA Newtown Sq., Willwarn Reeves Assocs. 215-356-7500
TX Dallas, Power Connection 214-357-8207

Local Distributors
AK Anchorage, Revl 907-349-8790
CA Long Beach, Battery Specialties 800-352-3706
CA Mtn. View, Energy Sls. 415-969-0800
CA Redmond City, HDB Elctrns. 415-368-1388
CO Denver, Hensley Battery 303-455-3643
CT Waterbury, Lighting Svcs., Inc. 203-756-8148
FL Altamonte Springs, TNR Tech. 800-722-7267
FL Tampa, Specialty Distrbg. 813-870-3315
GA Norcross, Allied Elctrns. 800-433-5700
IA Cedar Rapids, Iowa Radio 319-393-4510
LA Lafayette, Ralph's Elctrns. 318-233-0105
LA New Orleans, Wm. B. Allen Supp. Co. 800-462-9528
MA Sharon, Adcour 617-784-3996
MA Wellesley Hills, Target Elctrns. 617-235-2545
MI Brighton, Applied Power 313-221-1331
MO Maryland Hgts., Chelsea Inds. 314-997-7709
NE Lincoln, Scott Elctrn. Supp. 402-466-0221
NJ Pinebrook, Ussco 201-882-8015
NY Ridgewood, J.A. McDermott Corp. 212-456-3606
OH Cleveland, Security Prods. Co. 216-451-1400
TX Austin, Galtronics 512-837-7470
TX Ft. Worth, Allied Elctrns. 800-433-5700
TX Texas city, Elctrn. Supp. 409-945-4401
VA Arlington, Arlington Elctrns. 703-524-2412
WA Redmond, Energy Sls. 206-883-2343

POWER SOURCES INTERNATIONAL INC., Sources Electronics, 3106 Sleepy Hollow Dr., Stockton, CA 95209, Tel: 209-476-8747, TWX: 510-600-5831, FAX: 209-476-8742

Power Star, Inc.

FAX: 714-261-5381

POWER STAR, INC., 17346 Eastman St., Irvine, CA 92714, Tel: 714-261-5377, 800-854-9420; Empl.: 15; *Sls. Mgr.:* Les O'Lennick ..... **D•2226-2227**

Local Sales Offices & Reps
OR Portland, Underwood & Hanify 503-224-0583
TX Dallas, Seaton Corp. 214-380-0414
WA Bellevue, Underwood & Hanify 206-643-1793

power SWITCH Corp.

FAX: 201-641-7871

POWER SWITCH CORPORATION, 50 Graphic Place, Moonachie, NJ 07074, Tel: 201-641-4544; Empl.: 33; *Sls. Mgr.:* Danice Donito ..... **D•1998-2001**

Local Sales Offices & Reps
CA Santa Clara, SAE 408-988-0700
CA Westlake Vl, The Tricamo Co. 805-496-3177
CO Aurora, High Technlg. Assocs. 303-695-1990
FL Melbourne, VM2 Mktg. 305-984-1918
IL Berkeley, ESA Tech. Mktg. 312-544-0120
IN Indianapolis, STB & Assocs. 317-844-9227
MD Middletown, S.T./Woolard Co. 301-371-4500
MN Minneapolis, Electro-Serv 612-338-3475
MO Grandview, R. R. Burton Assocs. 816-763-5385
MO St. Louis, G.M. Brown & Assoc. 314-741-4424
NJ Franklin Lakes, Hansen & Hughes 201-848-8900
NY Cazenovia, S.T./Woolard Co. 315-655-8145
NY Greenlawn, Hansen & Hughes 516-754-3608
OH Cleveland, Bradcor Elctrns. 216-261-0888
OH Dayton, Bradcor Elctrns. 216-671-1200
PA Hatboro, Electro Rep Engrg. 215-674-4421

RI Providence, ISM 401-351-7348
SC Pickens, S.T./Woolard Co. 803-878-3830

POWER SYSTEMS, INC., 45 Griffin Rd., South, Bloomfield, CT 06002, Tel: 203-726-1300, TWX: 710-425-8778, FAX: 203-726-1495; FSC No.: 50463; Empl.: 250; *Sls. Mgr.:* Leon Gedacht ..... **D•2003**

Local Sales Offices & Reps

AZ Tempe, A5 Co. 602-968-4923
CA Los Gatos, Luscombe Engrg. of San Francisco 408-370-2020
CA Mission Viejo, The Powerhouse, Inc. .. 714-770-9009
CO Parker, A5 Co. 303-841-3651
CT Broadbrook, Comptech, Inc. 203-623-8014
AL Decatur, R. K. Welter & Assocs. 205-350-3441
FL Mt. Dora, R.K. Welter & Assocs., Inc. .. 904-357-3011
GA Dunwoody, R. K. Welter & Assocs., Inc. 404-390-9718
IL Rolling Meadows, Eagle Tech. Sls. 312-991-0700
MD Timonium, Bresson Assocs., Inc. 800-523-5512
MA Tyngsboro, Comptech, Inc. 508-649-3030
MN Ann Arbor, Augnat Assocs. 313-668-3134
MN Edina, Mel Foster Tech. Sls., Inc. 612-941-9790
NJ Franklin Lakes, Hansen & Hughes 201-848-8900
NY Mendon, Marchese, Marsey & Barden, Inc. 716-582-2240
NY N. Syracuse, Marchese, Marsey & Barden, Inc. 315-458-6920
OH Akron, Augnat Assocs. 216-273-1211
PA Narberth, Bresson Assocs., Inc. 215-664-6460
TX Houston, Barry Sls., Inc. 713-784-5860
TX Richardson, Barry Sls., Inc. 214-234-0255
UT Salt Lake City, A5 Co. 801-483-1034
VA Forrest, Bresson Assocs. 800-523-5512
WA Kirkland, Northwest Comps. Sls. 206-828-4838
Can Burnaby, BC, Davetek Mktg., Inc. 604-430-3680

POWER SYSTEMS & CONTROLS, INC., 3206 Lanvale Ave., Richmond, VA 23230, Tel: 804-355-2803, FAX: 804-358-0498; Empl.: 55

POWER SYS. GRP., Rantec Div., Emerson Elec. Co., 9401 Oso Ave., Chatsworth, CA 91311, Tel: 818-885-8223, TWX: 910-493-1247; FSC No.: 04971; Empl.: 265; *Sls. Mgr.:* Fred Silver

POWERTEC, INC.

FAX: 818-998-4225

POWERTEC POWER SUPPLIES,INC., Div.of Astec America, 20550 Nordhoff St., Chatsworth, CA 91311-6168, Tel: 818-882-0004, TELEX: 277483, TWX: 910-494-2092; Empl.: 349; *Sls. Mgr.:* Barry A. Chenes ..... **D•2004-2020**

POWERTECH, INC., 0-02 Fairlawn Ave., Fairlawn, NJ 07410, Tel: 201-791-5050, TELEX: 353970; FSC No.: 32953; Empl.: 49; *Sls. Mgr.:* Chris Marino

POWER TECHNOLOGY COMPONENTS, A Div. of Microsemi Corp., 23201 S. Normandie Ave., Torrance, CA 90501, Tel: 213-534-3737, FAX: 213-530-5609

POWER TECHNOLOGY, INC., P.O. Box 9769, Little Rock, AR 72219, Tel: 501-568-1995, TWX: 910-722-7313, FAX: 501-568-1994; Empl.: 85; *Sls. Mgr.:* John Webb

POWER TEN, INC., 486 Mercury Dr., Sunnyvale, CA 94086, Tel: 408-738-5959, FAX: 408-738-4326; FSC No.: 61987; *Sls. Mgr.:* Vince Mutascio ..... **D•2021**

Local Sales Offices & Reps

AL Huntsville, Reynolds & Assocs. 205-881-9362
AZ Phoenix, Jayson Co., Inc. 602-867-1964
CA Los Alamitos, Power Specialists 213-594-9418
CA San Diego, Power Specialists 619-726-4799
FL Melbourne, Reynolds & Assocs. 800-255-1965
GA Atlanta, Reynolds & Assocs. 404-934-8525
MA Acton, Framar 617-263-2285
NY Fairport, Hi-Tec Sls. 716-223-5922
NC Raleigh, Reynolds & Assocs. 919-872-6668
PA Glenside, Koebert 215-887-2310
TX Austin, Eberts Elctrns. Sls. 512-258-1067
TX Latexo, Eberts Elctrns. Sls. 409-687-4342
WA Bellevue, A. J. Smith Co. 206-746-6770
Can N. Vancouver, BC, Jerome & Francis 604-986-1286
Can Toronto, Duncan Instruments 416-742-4448

POWERTREND, INC., 1111 Rancho Conejo Blvd., Ste. 401, Newbury Pk., CA 91320-1415, Tel: 805-496-2945, FAX: 805-498-6880; *Sls. Mgr.:* R. Jones

POWERTRON, See Industrial Test Equipment Co., Inc., FAX: 516-883-7155

POWERTRON, Contraves Goerz Corp., 3821 Barranger Dr., Charlotte, NC 28210, Tel: 704-525-8962, TELEX: 572-444

POWERTRON CORP., Rte. 15, P.O. Box 932, Dept. E, Sparta, NJ 07871, Tel: 201-579-5599, TELEX: 136198; *Sls. Mgr.:* William E. Cannon; *Dist. Mgr.:* William E. Cannon ..... **D•2022**

POWR-UPS CORP., Brookhaven R&D Plaza, 1 Roned Rd., Shirley, NY 11967, Tel: 516-345-5700, 1-800-333-POWR; Empl.: 50; *Sls. Mgr.:* Darlene DiRosa ..... **B•1298-1299**

Local Sales Offices & Reps

CA Valencia, Blair Randle & Assoc. 805-259-3326
IL Oak Brook, A.G. Erickson 312-323-1367
IL Oak Brook, A.G. Erickson Assoc. 312-573-1367
MO St. Charles, Drives Plus, Inc. 314-441-7765
NJ Waldwick, Motors, Controls & Reducers Inc. 201-670-0270
OH Dover, AJ Assocs. 216-343-2224

Local Distributors

IN Ft. Wayne, PHC Inds., Inc. 219-423-9461
NY Long Island City, B & B Motor & Control Corp. 800-638-7808
NY Long Island City, B & B Motor Control Corp. 718-784-1313
OH Cincinnati, Cincinnati Belting & Transmission 513-621-9050
OH Copley, Ohio Brake & Clutch Corp. ... 216-666-4192

PPC PRODUCTS CORPORATION, 7516 Central Industrial Dr., Riviera Beach, FL 33404, Tel: 407-848-9606, TWX: 510-952-7611; FSC No.: 33178; Empl.: 100; *Sls. Mgr.:* Nick Ernick

PPD, INC., 6001 Resco Ct., Raleigh, NC 27613, Tel: 919-781-3955, FAX: 919-781-4980 ..... **A•1163-1169**

Local Sales Offices & Reps

NC Raleigh, Godwin Assocs. 919-878-8000

PPM, INC., 5385 Harper Rd., Cleveland, OH 44139, Tel: 216-349-2300, FAX: 216-349-2302; Empl.: 20; *Sls. Mgr.:* A. L. Bletcher ..... **D•1334**

Local Sales Offices & Reps

AL Huntsville, Jim Springer, Inc. 205-883-4163
AZ Phoenix, J. Smith & Assocs. 602-267-0981
CO Denver, J. Smith & Assocs. 303-597-5343
MI Ferndale, Tiby Co. 313-547-3550
NM Albuquerque, J. Smith & Assocs. 505-345-6501
OH Cleveland, Tiby Co. 216-371-5335
OH Dayton, Tiby Co. 513-277-3822

PRACTICAL AUTOMATION, INC., 2 Research Dr., Shelton, CT 06484, Tel: 203-929-5381, TELEX: 6813310, FAX: 203-929-9941; Empl.: 150; *Sls. Mgr.:* R. M. Banzaca

PRD ELCTRNS., DIV. OF HARRIS CORP., see Harris Corp., PRD Electronics Div.

Precicontact, inc.

FAX: 215-757-8025

PRECICONTACT, INC., 835 Wheeler Way, Langhorne, PA 19047, Tel: 215-757-1202, TELEX: 37-29448; FSC No.: 60197; Empl.: 100; *Sls. Mgr.:* Stephen Lawler ..... **C•1510-1513, 1718**

Local Sales Offices & Reps

AL Huntsville, Electramark 205-830-4400
CA Chatsworth, First Rep 818-718-6155
CA San Diego, Qualtronics 619-695-0118
CA San Jose, Applied Elctrn. Mktg. 408-971-9377
CO Englewood, Megatronix 303-799-3700
GA Norcross, Electramark 404-446-7915
IL Schaumburg, Tech-Tron Sls. Inc. 312-843-7530
IN Greenwood, Valentine & Assocs. 317-888-2260
IN South Bend, Valentine & Assocs. 219-288-7070
IA West Des Moines, SPS Assocs. 515-225-0607
KS Olathe, SPS Assocs. 913-764-4460
MD Towson, Arbotek 301-825-0775
MA Norwood, The Mac Innis Co. 617-762-8090
MN Maple Grove, Design Technlg. 612-424-7605
MO Earth City, SPS Assocs. 314-291-0521
NE Panama, SPS Assocs. 402-477-7227
NJ Marlton, Naudain Assocs. 609-983-5300
NY Port Washington, Ashtec, Inc. 516-767-0336
NY Victor, Integrity Mktg. Co. 716-924-3671
OH Cincinnati, Makin & Assocs. 513-871-2424
OH Cleveland, Makin & Assocs. 216-248-7370
OH Columbus, Makin & Assocs. 614-848-5424
OK Tulsa, Component Technlg. 918-749-2107
OR Portland, Elctrn. Mktg. Grp. 503-684-5935
TX Austin, Component Technlg. 512-250-2450
TX Dallas, Components Technlg. 214-783-8831
TX Houston, Components Technlg. 713-961-1262
UT Salt Lake City, Charles Fields & Assocs. 801-531-6177
VA Harrisonburg, Blueridge Prods. 703-433-0990
WA Cattaroy, Electronic Mktg. Grp. 509-922-2718
WA Redmond, Electronic Mktg. Grp. 206-882-0962
WA Vancouver, Electronic Mktg. Grp. 206-254-4572
Can Burnaby, B.C., Vitel Elctrns. 604-439-1136
Can Markham, Ont., Avotronics 416-475-2024
Can Ontario, Avotronics 416-475-2024
Can Pointe Claire, Que., Avotronics 514-697-2135

Local Distributors

AZ Litchfield Park, GB Elctrns. 602-935-3984
AZ Phoenix, Future/Cetec 602-272-7951
AZ Tempe, Cypress Elctrns. 602-966-2256
CA Buena Pk., Cypress/RPS Elctrns. 213-744-0355
CA Chatsworth, Future/Cetec 818-700-0914
CA Irvine, Future/Cetec 714-250-4141
CA Orange, Electronic Connexions Corp. 714-998-2901
CA San Diego, Cypress/RPS Elctrns. 619-292-5611
CA San Diego, Future/Cetec 619-278-5020
CA San Jose, Cypress Elctrns. 408-945-8400
CA San Jose, Future Elctrns. 408-945-9100
CO Denver, CSID, Inc. 303-292-9594
CO Westminster, Future Elctrns. 303-650-0123
CO Wheatridge, Cypress Elctrns. 303-431-2622
CT Bethel, Future Elctrns. 203-743-9594
CT Bridgeport, Park Distrs. 203-366-8414
CT East Haven, J.V. Elctrns. 203-469-2321
CT Wallingford, Cronin Elctrns., Inc. 203-265-3134
CT Wallingford, Sager 203-265-4600
FL Altamonte Springs, Future Elctrns. 305-767-8414
FL Clearwater, Electronic Precepts of FL 813-530-9781
FL Clearwater, Future Elctrns. 813-441-4771
FL Orlando, Reptron Elctrns. 305-735-1112
FL Tampa, Reptron Elctrns. 813-854-2351
GA Altanta, Reptron Elctrns. 404-446-1300
GA Atlanta, Future Elctrns. 404-441-7676
IL Crystal Lake, Subsem 815-459-4139
IL Lisle, Components, Inc. 312-852-7707
IL Palatine, OHM Elctrns., Inc. 312-359-5500
IL Schaumburg, Future Elctrns. 312-882-1255
IL Schaumburg, Reptron Elctrns. 312-882-1700
IN Indianapolis, Mar Elctrns. 317-875-4510
MD Baltimore, Source Comps. 301-335-7171
MD Columbia, Aztech Elctrns. 301-995-6800
MD Columbia, Future Elctrns. 301-995-1222
MA Andover, Aved Elctrns. 617-688-3800
MA Hingham, Sager 617-749-6700
MA Needham, Cronin Elctrns. 617-449-5000
MA Westborough, Future Elctrns. 617-366-2400
MA Wilmington, J.V. Elctrns. 617-273-4300
MI Detroit, Reptron Elctrns. 313-525-2700
MI Livonia, Future Elctrns. 313-261-5270
MN Eden Prairie, Future Elctrns. 612-944-2200
MN Minnetonka, Reptron Elctrns. 612-938-0000
MO Kansas City, Walters Elctrns. 816-531-7015
MO St. Charles, Finnegan Elctrns. 314-946-6201
NH Salem, Sager 603-898-1348
NJ Bellmawr, Mid-Atlantic Elctrns. 609-931-5303
NJ Berlin, GCI Corp. 609-768-6767
NJ Fairfield, Future Elctrns. 201-227-4346
NJ Mt. Laurel, Future Elctrns. 609-778-7600
NJ Parsippany, North American Sls. Co. .. 201-299-1123
NJ Springfield, Route Elctrns. 201-379-7710
NM Albuquerque, Bestech 505-298-0034
NM Albuquerque, Connecting Comps. Div. 505-345-8921
NY Brooklyn, Connector Resources 718-383-2208
NY Hauppauge, Future Elctrns. 516-234-4000
NY Hauppauge, Jaco Elctrns. 516-273-5500
NY Hauppauge, Sager 516-348-1300
NY Liverpool, Future Elctrns. 315-451-2371
NY Rochester, Future Elctrns. 716-272-1120
OH Dayton, Televox, Inc. 513-294-4499
OH Mansfield, Rush Elctrns. Distrs., Inc. ... 419-756-2322
OH Solon, Reptron Elctrns. 216-349-1415
OH Worthington, Reptron Elctrns., Inc. 614-436-6675
OR Beaverton, Component Resources 503-641-8488
OR Beaverton, Cypress Elctrns. 503-641-2233
OR Beaverton, Future Elctrns. 503-645-9454
PA Wayne, Peak Elctrns. 215-293-9000
PA York, E.C.I. 717-846-5334
RI Warwick, Cal-Greg Comps. 401-738-6170
TX Allen, Prime Distrbg. Co. 214-231-0170
TX Austin, Southwest Elctrns. 512-837-8971
TX Dallas, Cypress Elctrns. 214-869-1435

TX Richardson, Future Elctrns. 214-437-2437
TX Richardson, Jaco Elctrns. 214-235-9575
TX Richardson, Southwest Elctrns. 214-234-3050
TX Stafford, Southwest Elctrns. 713-491-4900
UT Salt Lake City, Future Elctrns. 801-972-8489
WA Bellevue, Future Elctrns. 206-881-8199
WA Bothell, Cypress Elctrns. 206-622-6833
WA Seattle, Pacific Elctrns. 206-575-1050
Can Calgary, Alb., Future Elctrns. 403-235-5325
Can Edmonton, Alb., Future Elctrns. 403-438-2858
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Toronto, Ont., Future Elctrns. 416-638-4771
Can Vancouver, B.C., Future Elctrns. 604-438-5545
Can Winnipeg, Manitoba, Future Elctrns. ... 204-339-0554

PRECI-DIP, See Mill-Max Mfg. Corp.

PRECISION COMPONENTS, INC., 1110 W. National Ave., Addison, IL 60101, Tel: 312-543-6400, FAX: 312-628-8788

PRECISION CONTROL MANUFACTURING, INC., 1509 B Queen Anne Ave. N., Seattle, WA 98109, Tel: 206-281-9380; FSC No.: 64782 ..... **A•2141**

Local Sales Offices & Reps
WA Seattle, Precision Control Mfg., Inc. 206-281-9380

Local Distributors
CA Granada Hills, Lion Elctrn., Inc. 818-363-0993

PRECISION DIGITAL CORP., 80 Coolidge Hill Rd., Watertown, MA 02172, Tel: 617-924-2256, FAX: 617-924-9219

PRECISION ELECTRONICS, 9101 King Ave., Franklin Park, IL 60131, Tel: 312-678-5350, FAX: 312-678-0511; Empl.: 25; *Sls. Mgr.:* William Stow

PRECISION EXTRUSIONS, INC., Box 120, Bensenville, IL 60106, Tel: 312-766-0340, FAX: 312-766-0495; Empl.: 185; *Sls. Mgr.:* Richard Ziehm

PFT PRECISION FABRICATION TECHNOLOGIES, INC.

FAX: 219-253-6570

PRECISION FABRICATION TECHNOLOGIES, INC., State Road 16 W., Monon, IN 47959, Tel: 1-800-558-7297, 219-253-6666; Empl.: 62; *Sls. Mgr.:* Joseph Rogers; *Dist. Mgr.:* Duane Nagel ..... **C•1079-1083**

Local Sales Offices & Reps
CA Saratoga, Edward King & Assocs. 408-741-0434
CA Valencia, Lessing & Assocs. 805-295-0225
CT Old Saybrook, FJS Assocs. 203-388-5374
FL Tampa, SRT Mktg. 813-884-4805
IL Park Ridge, Bob Burns & Assocs. 312-823-9360
MA Burlington, FJS Assocs. 617-273-5959
NJ Medford, Champion Elctrn. Sls. 609-983-0932
NY Islandia, Schmitt Mktg. Corp. 516-582-5888
OH Dayton, Baehr, Greenleaf & Assocs. .. 513-439-0724
OH Westlake, Baehr, Greenleaf & Assocs. 216-892-1770
OH Worthington, Bachr, Greenleaf & Assoc. 614-847-0220
OR Portland, Caruso & Co. 503-620-0375
PA Warrensdale, Bachr, Greenleaf & Assoc. 412-934-3088
TX Dallas, S.W. Mktg. Assocs. 214-341-8631
TX Houston, S.W. Mktg. Assocs. 713-537-8166
WA Bellevue, Caruso & Co. 206-455-8811
WI Colgate, Rep One & Assocs. 414-628-4016

PRECISION FILTERS, INC.

FAX: 607-277-4466

PRECISION FILTERS, 240 Cherry St., Ithaca, NY 14850, Tel: 607-277-3550, TELEX: 646846; FSC No.: 66-II-F & 66-II-I; Empl.: 95; *Sls. Mgr.:* D. F. Chandler ..... **A•1682, 1716-1724; D•1017-1020**

Local Sales Offices & Reps
AL Huntsville, Burnette Techno-Metrics Inc. 205-830-2832
CA Laguna Hills, Elotek Sys., Inc. 714-830-4856
CA Pleasonton, SECCO Sales, INc. 415-484-1030
CO Broomfield, Hannah-Hill, Inc. 303-460-0602
AZ Phoenix, Western Region Sls. Off. 602-953-0345
DC Arlington, Gans & Pugh 703-527-3262
FL Osprey, Dick Ridgewell Co. 813-484-2020
LA New Orleans, Abcor, Inc. 504-833-5861
MD W. Friendship, Gans & Pugh Assocs. 301-442-2189
MA Beverly, Ellis Assocs. 617-922-2015
MO Manchester, Vertec Assocs., Inc. 314-394-6242
NM Albequerque, Hannah-Hill, Inc. 505-292-4098
NY Saugerties, Beckrep, Inc. 914-246-3031
PA North Wales, Gans & Pugh Associates, Inc. 214-699-6655
TX Houston, ABCOR, Inc. 713-486-9251
VA Arlington, Gans & Pugh Assocs. 703-527-3262
WA Bellevue, Topp Engrg. Sls. 206-747-5400
EXP Can./Ottawa, Ont., Rayonics Sci. 613-521-8251
Can Downsview, Ont., Rayonics Scientific 416-736-1600
Can St. Laurent, Que., Rayonics Sci. 514-335-0105

PRECISION GRAPHICS INC., 59 La Grange St., Raritan, NJ 08869, Tel: 201-707-8880, FAX: 201-707-8884; Empl.: 36; *Sls. Mgr.:* Robert T. Weissman

PRECISION INTERCONNECT, 16640 SW 72nd Ave., Portland, OR 97224, Tel: 503-620-9400, TELEX: 36-0963; FSC No.: 60381; Empl.: 260; *Sls. Mgr.:* Walt Harwood ..... **C•1917-1919**

Local Sales Offices & Reps
CA Hayward, Precision Interconnect 415-785-1277
DE Wilmington, Precision Interconnect 302-798-7071
NH Portsmouth, Precision Interconnect ... 603-433-5802
OR Portland, Precision Interconnect 503-620-9400

PRECISION LAMP, INC., 681 Portal St., Cotati, CA 94931, Tel: 707-792-0333, FAX: 707-792-2738; FSC No.: FSCM 58451; Empl.: 25

PRECISION MECHANISMS, 44 Brooklyn Ave., Westbury, NY 11590, Tel: 516-ED3-5955; FSC No.: 08127; Empl.: 26; *Sls. Mgr.:* Leon N. Canick

PRECISION METAL PRODUCTS CO., Centennial Indl. Pk., Peabody, MA 01961-6026, Tel: 508-532-5500, FAX: 508-532-9403; FSC No.: 86577; Empl.: 54; *Sls. Mgr.:* Robert H. Degnan

PRECISION MICROELECTRONICS, 1000 E. Campbell, Ste. 106, Richardson, TX 75081, Tel: 214-437-4141, FAX: 214-644-2771; Empl.: 350; *Sls. Mgr.:* C. G. Willis

PRECISION POWER SYSTEMS, 1840 Industrial Circle, Longmont, CO 80501, Tel: 303-443-6250, FAX: 303-678-8360; Empl.: 75; *Sls. Mgr.:* Linda Tholen

FAX: 319-394-9280

PRECISION RESISTIVE PRODUCTS, INC., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, Tel: 319-394-9131, TWX: 510-100-8039; Empl.: 65; *Sls. Mgr.:* Oscar Cline; *Dist. Mgr.:* Oscar Cline ..... **A•2032-2033**

Local Sales Offices & Reps
AL Huntsville, Hughes & Assocs. 205-533-9108
CA Anaheim, Impact Electrns. Inc. 714-533-1351
CA Los Altos, Frauman Assoc. 415-941-0660
CA San Diego, KCE 619-278-7640
CO Denver, Williams Assocs. 303-373-4730
IL Chicago, Ellinger Sls. 312-763-1570
IN Greenwood, Valentine Assocs. 317-888-2200
MA Waltham, Jesco, Inc. 617-893-0094
MI Warren, DEM Elctrns. Sls. 313-575-9444
MN Minneapolis, Intl. Sls. 617-831-8423
NJ Mountainside, Kevtron Elctrns. 201-654-7600
OH Cincinnati, G & H Sls. Co. 513-272-0580
TX Richardson, Campion Sls. Co. 214-238-8145
WA Seattle, W3 Assocs., Inc. 206-285-2667

PRC

FAX: 813-546-9515

PRECISION RESISTOR CO., INC., 10601 75 St. N., Largo, FL 34647, Tel: 813-541-5771, TELEX: 821788; FSC No.: 48615; Empl.: 45; *Sls. Mgr.:* Arleen Reid ..... **A•2034-2039**

PRECISION SPECIALTIES, INC., 19414 Londelius St., Northridge, CA 91324, Tel: 818-349-9774, FAX: 818-772-7577; FSC No.: 66785; Empl.: 5

PRECISION STANDARD TIME, INC., 105 Fourier Avenue, Fremont, CA 94539, Tel: 415-656-4447, FAX: 415-656-1671; *Sls. Mgr.:* Ken Brandt

PRECISION TECH. SEWING, 921 E. Charleston Rd., Palo Alto, CA 94303, Tel: 415-856-2128, FAX: 415-856-1638

PRECISION TUBE, Church Rd. & Wissahickon, N. Wales, PA 19454, Tel: 215-699-5801, FAX: 215-699-0761; FSC No.: 82413; Empl.: 240; *Sls. Mgr.:* William J. McNeil

PREFERRED ELECTRONICS, INC., Main Line Dr., P.O. Box 248, Westfield, MA 01086, Tel: 413-568-2301, TELEX: 955-329, FAX: 413-562-7275; Empl.: 175; *Sls. Mgr.:* John Vaughan

Preh

FAX: 312-438-5522

PREH ELECTRONIC INDUSTRIES, INC., 470 E. Main St., Lake Zurich, IL 60047-2578, Tel: 312-438-4000, TELEX: 297-112 PEI; FSC No.: 36-3193682; Empl.: 7; *Sls. Mgr.:* Ken Wood ..... **A•2142; B•1830, 1882; C•1514**

Local Sales Offices & Reps
AL Huntsville, Hughes Assocs. 205-533-9108
AZ Phoenix, More Sls., Inc. 602-788-9181
CA Carlsbad, Bart Budge Assocs. 619-471-2554
CA Mtn. View, Bart Budge Assocs. 415-961-0940
CO Arvada, Arrowhead CSI/ Sls. 303-423-5597
CO Littleton, Anodyne Tech. Sls. 303-979-2435
CT Cheshire, MacInnis 203-272-8877
FL Miami, Indl. Comps. 305-477-0387
GA Norcross, Hughes Assocs. 404-662-1587
IL Des Plaines, Essco Assocs. 312-298-5310
MD Columbia, L. D. Lowery, Inc. 301-381-0225
MA Norwood, MacInnis Co. 617-762-8090
MI Troy, C.B. Jensen & Assocs. 313-643-1652
MN Bloomington, Electronic Sls. Agy. 612-884-8291
MS Corinth, Hughes Assocs. 601-287-2915
MO St. Louis, Jim Amberg 314-946-5777
NJ Woodbridge, John Chirico Assocs. 201-855-9600
NC Cary, Hughes Assocs. 919-467-7029
OH Cincinnati, Bob Gilbert & Assocs. 513-574-1932
OR Portland, SPS Elctrns. 503-297-6919
PA Broomall, L.D. Lowery Inc. 215-356-5300
TN Jonesboro, Hughes Assocs. 615-753-2719
TX Round Rock, Encore Tech. Comps. ... 512-388-7930
UT Salt Lake City, Arrowhead CSI/Sls. ... 801-268-8440
WA Redmond, SPS Elctrns. 206-885-5257
Can Markham, Ont., Avotronics Ltd. 416-475-2024

Local Distributors
CA Belmont, LoDan Elctrns. Inc. 415-592-4600
CA Gardena, California Switch & Signal .. 213-770-2330
CO Arvada, Denver Beta Wintronic 303-431-7161
CT Norwalk, Cobra Comps. 203-847-6442
FL Largo, LoDan Elctrns., Inc. 813-586-2851
IL Arlington Hgts., LoDan Elctrns. 312-398-5311
IL Wheeling, Hawk Elctrns. 312-459-4030
MA Hingham, Sager Elctrl. Supp. Co. 617-749-6700
MA Hopedale, Teccon Elctrns. 617-478-8544
MA Westborough, In Stock Prods. Co. 617-870-5750
NJ Camden, Gen. Radio Supp. Co. 609-964-8560
NY Bohemia, Key Comps. 516-567-7500
NY Hauppauge, Broadline Elctrns. 516-231-4100
NY Hempstead, Elctrn. Equip. 516-538-5510
NY Rochester, Whirlwind Music Distrs. ... 716-663-8820
OH Akron, Aesco Elctrns. 216-762-8818
OR Beaverton, Component Resources 503-641-8488
PA Harrisburg, Cumberland Elctrns. 717-232-5999
TX Dallas, Off the Shelf Comps. 214-247-0052
WA Seattle, Radar Elec. 206-282-2511
Can London, Ont., C. M. Peterson Co. Ltd. 519-434-3204
Can Montreal, Que., Ferro Technique 514-341-3450
Can Scarborough, Ont., Carsten Elctrns. Ltd. 416-495-9999
Can Toronto, Ont., Atlas Elctrns. Ltd. 416-789-7761
Can Willowdale, Ont., Electrosonic Inc. 416-494-1666

PREMA PRECISION ELECTRONICS, INC., 6290 Sunset Blvd., Suite 1126, Los Angeles, CA 90028-8770, Tel: 213-463-2294, TWX: 910-321-2903, FAX: 213-463-4319

FAX: 212-993-9211

PREMIER METAL PRODS. CO., 381 Canal Pl, Bronx, NY 10451, Tel: 212-993-9200; Empl.: 75; *Sls. Mgr.:* Anthony E. Bozza ..... **C•1084-1085**

Local Sales Offices & Reps

AZ	Phoenix, Scientific Dvcs.	602-957-0401
CA	Fontana, Premier Metal	714-829-3089
CA	Huntington Bch., Scientific Dvcs.	714-840-3501
CA	San Jose, Scientific Dvcs.	408-554-0455
CO	Denver, AKI Enterprises	303-338-4488
CT	East Haven, Eagle Assocs.	203-467-6542
GA	Marietta, Adams & Assocs.	404-973-0853
IL	Elmhurst, Utronix Sls.	312-834-1100
KS	Kansas City, Delltron Co.	816-436-6445
MD	Burtonsville, Eastern Instrmn.	301-384-8500
MA	Needham, Eagle Assocs.	617-444-3446
MI	Brighton, Electronic Sources	313-227-3598
MN	Minneapolis, J.E.M. Anderson Co.	612-823-6459
MO	Florissant, Delltron Co.	314-839-0033
NM	Albuquerque, Scientific Dvcs.	505-293-3494
NY	New Hyde Park, Harris & Aldrich Sls.	516-488-2622
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Greenboro, Adams & Assocs.	919-272-6838
PA	Penndel, Delta Mktg.	215-750-1440
TX	Euless, W. Pat Fralia Co. Inc.	817-354-9720
TX	Houston, W. Pat Fralia Co. Inc.	713-772-1572
WA	Redmond, Scientific Dvcs	206-885-0004
EXP	FL, Ft. Lauderdale, GM Intl.	305-434-6617

Local Distributors

AL	Binmingham, American Elctrn. Supp.	205-942-4656
AZ	Phoenix, Dalis Elctrns.	602-275-2885
CA	Burlingame, Rose Elctrns.	415-348-2740
CA	San Jose, Quement Elctrns.	408-998-5900
CT	Danbury, Pilgrim Elctrns.	203-792-7274
CT	Wallingford, Sager Elctrl. Supp.	203-265-4600
IL	Elk Grove Village, GBL/Gould Elctrns.	312-593-3220
LA	Baton Rouge, Menard Elctrns.	504-355-0323
MD	Baltimore, Resco	301-823-0070
MD	Bethesda, Empire Elctrns.	301-656-3300
MA	Hingham, Sager Electrical Supp.	617-749-6700
MI	Ann Arbor, Purchase Radio Supp.	313-668-8696
MO	St. Louis, Gateway Elctrn. Supp.	314-427-6116
NJ	Cranford, Garden State Indl. Elec.	201-272-6400
NJ	Hanover, State Elctrns. PTS	201-887-2550
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Hauppauge, Broadline Elec. Dist.	516-231-4100
NY	Hempstead, Davis Elctrn. Corp.	516-483-9200
NY	LIC, H. L. Dalis Inc.	212-361-1100
NY	New York, Martin Audio/Video Corp.	212-541-5900
NY	Portchester, Wise Comps.	914-939-8600
NY	Rochester, Simcona Elctrn. Corp.	716-328-3230
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Raleigh, Southeastern Radio	919-828-2311
OH	Warren, Rem Elctrns.	216-248-1636
PA	Allentown, Federated Elctrns.	215-437-4481
PA	Horsham, Toner Cable Equip.	215-675-2053
PA	West Chester, West Chester Elec. Supp.	215-696-7500
SC	Charleston, Wholesale Indl. Elec.	803-722-2634
TN	Clarksville, Randolph Hale & Matthews	615-647-2325
TN	Cookeville, Randolph & Parks	615-526-6184
TN	Nashville, Randolph & Rice	615-255-5601
TN	Tullahoma, Randolph Rice & Williams	615-455-4531
TX	Ft. Worth, Swieco Inc.	817-335-6521
TX	Houston, Lenert Co.	713-225-1465
VA	Arlington, Arlington Elctrns.	703-524-2412
WA	Seattle, Radar Elec. Co.	206-282-2511

PREMIER MICROWAVE, 35 New Broad St., Port Chester, NY 10573, Tel: 914-939-8900, TWX: 710-569-1609, FAX: 914-939-9239; FSC No.: 15870; Empl.: 90; *Sls. Mgr.:* Mel Radner

PREM

FAX: 815-385-8578

PREM MAGNETICS, INC., 3521 N. Chapel Hill Rd, McHenry, IL 60050, Tel: 815-385-2700; FSC No.: 20462; Empl.: 150; *Sls. Mgr.:* D. Hertel ..... **A•1288-1291, 2422-2433**

PRES-AIR-TROL CORP., 1009 Boston Post Rd, Mamaroneck, NY 10543, Tel: 914-698-2026, 800-431-2625 (outside NY), FAX: 914-698-9456 ..... **B•1831**

PRESIDIO COMPONENTS, INC., 7185 Construction Ct, San Diego, CA 92121, Tel: 619-578-9390, TWX: 310-371-6407; FSC No.: 60212

PRESS-ON PRODUCTS, 21 Factory Rd, Addison, IL 60101, Tel: 312-628-2255, FAX: 312-543-4414; Empl.: 20; *Sls. Mgr.:* T. Cummins

PRESSURE CONTROLS, INC., 406 Cortlandt St, Belleville, NJ 07109, Tel: 201-751-5002, TWX: 510-600-6973; FSC No.: 52193; Empl.: 15; *Sls. Mgr.:* P. Emmarco

PRESSURE SYSTEMS, INC., 34 Research Dr., Hampton, VA 23666, Tel: 804-865-1243, TELEX: 901406, FAX: 804-766-2644; Empl.: 88; *Sls. Mgr.:* J. S. Yakshe

PRESTON SCIENTIFIC, 805 E. Cerritos Ave., Anaheim, CA 92805, Tel: 714-776-6400, TELEX: 5101004596 ESL UD, FAX: 714-776-3660; Empl.: 60; *Sls. Mgr.:* Charles J. McGuire

PRIMELINE, Soltec Corporation, P. O. Box 670, San Fernando, CA 91341-0670, Tel: 818-365-0101, TELEX: 494-3094 SOLTEC UI, FAX: 818-365-7839; *Sls. Mgr.:* Byron McIntire

PRIME POWER, A Prime Technology Co., Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; *Sls. Mgr.:* J. L. Jamieson

PRIME TECHNOLOGY, INC., See General Resistance, A Prime Technology Co.

PRIMO COMPANY LIMITED, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, Japan 181, Tel: 0422-43-3121, TELEX: 2822-326; FSC No.: 0422 49 8865; Empl.: 391; *Sls. Mgr.:* K. Shinai; *Dist. Mgr.:* S. Mizutani

PRINCETON CASE CO., INC., 667 Lehigh Ave., Union, NJ 07083, Tel: 201-687-1750, FAX: 201-687-1755; Empl.: 60; *Sls. Mgr.:* S. E. Parker

PRINCETON ELECTRONIC PRODUCTS, Box 101, North Brunswick, NJ 08902, Tel: 201-297-4448, FAX: 201-821-5950; Empl.: 29; *Sls. Mgr.:* H. Center; *Dist. Mgr.:* H. Center

PRINCO INSTRUMENTS, INC., 1020 Industrial Hwy., Southampton, PA 18966; FSC No.: 48620; Empl.: 70; *Sls. Mgr.:* G. G. Pfaff

Printer Products

FAX: 617-254-6848

PRINTER PRODUCTS, 25 Denby Road, Boston, MA 02134, Tel: 617-254-1200, TELEX: 951589; Empl.: 200; *Sls. Mgr.:* Blaine Wotring; *Dist. Mgr.:* Blaine Wotring ..... **D•1108-1109**

Local Sales Offices & Reps

CA	Anaheim, Paul Porter Printer Prods.	714-774-8650
MA	Boston, Richard Anger Printer Prods.	617-254-1200
Can	Markham,Ont., Technical Logistics Support	416-479-1911

PROBE MASTER, INC., 4898 Ronson Ct., San Diego, CA 92111, Tel: 619-560-9676, 800-854-1519, 800-772-1519, FAX: 619-560-7354; *Sls. Mgr.:* Dick Press

PROBE-RITE, INC., P.O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, TWX: 910-338-0260; *Sls. Mgr.:* Frank J. Ardezzone

PRODELIN CORPORATION, P.O. Box 368, Conover, NC 28613, Tel: 704-464-4141, FAX: 704-464-5725; Empl.: 100; *Sls. Mgr.:* Dan Johnson

PRODUCTION AUTOMATION, INC., 3160 De la Cruz Blvd., Santa Clara, CA 95054, Tel: 408-980-9880, FAX: 408-980-8018; Empl.: 4; *Sls. Mgr.:* Bill Minnick; *Dist. Mgr.:* Bill Minnick

PRODUCTS ENGRG. CORP., 503 S. Vincent Ave., Azusa, CA 91702, Tel: 818-969-5879, TELEX: 910-587-1559, FAX: 818-969-9381; FSC No.: CAGE 3S621; Empl.: 50; *Sls. Mgr.:* Richard Mitchell

PRODUCTS FOR RESEARCH, 88 Holten St., Danvers, MA 01923, Tel: 508-774-3250, TELEX: 940-287, FAX: 617-245-1628; Empl.: 22; *Sls. Mgr.:* Skip Moccia

PTI PRODUCT TECHNOLOGY INC.

FAX: 714-474-1340

PRODUCT TECHNOLOGY, INC., 2811-B McGaw Avenue, Irvine, CA 92714, Tel: 714-474-8998; FSC No.: 1Z295; Empl.: 35 ..... **C•1719**

Local Sales Offices & Reps

CO	Broomfield, Ramark Sls.	303-469-1758

PROF. A/V & SPECIALTY PROD. DIV., 223-5N-01, St. Paul, MN 55144-1000, Tel: 612-733-1110, TWX: 910-563-3712, FAX: 612-736-1246; Empl.: 38,351

PROGRAMMABLE DEVICES, INC., 155-T New Boston St., Woburn, MA 01801, Tel: 617-935-9530, FAX: 617-935-3654; Empl.: 10

PTS FREQUENCY SYNTHESIZERS

FAX: 508-486-4495

PROGRAMMED TEST SOURCES, Beaver Brook Rd., P.O. Box 517, Littleton, MA 01460, Tel: 508-486-3008; FSC No.: 66381; Empl.: 30 ..... **D•1335**

PROJECTS UNLIMITED, 3680 Wyse Rd., Dayton, OH 45414, Tel: 513-890-1918, TWX: 810-450-2523, FAX: 513-890-4911; Empl.: 90; *Sls. Mgr.:* Greg Kimpton

PRO-LOG, 2560 Garden Rd., Monterey, CA 93940, Tel: 408-372-4593, TWX: 910-360-7082; Empl.: 120

PROTO STAMPING CORP., 811 Kaynyne St., Redwood City, CA 94063, Tel: 415-365-0498, TELEX: 709241, FAX: 415-366-6329; Empl.: 35; *Sls. Mgr.:* John Bristow

PROTOTEK, INC., 25 Standen Dr., Hamilton, OH 45015, Tel: 513-874-5094, FAX: 513-874-2252; FSC No.: 60813; Empl.: 45; *Sls. Mgr.:* Robert A. Shaver; *Dist. Mgr.:* Earl Rohe

PSG INDS., 1225 Tunnel Road, Perkasie, PA 18944, Tel: 215-257-3621, TELEX: 827361; FSC No.: 18509; Empl.: 150; *Sls. Mgr.:* Robert Banion

PTC INDUSTRIES, INC., 5721 Research Drive, Huntington Beach, CA 92649, Tel: 213-598-9547, 714-891-7561, FAX: 714-373-0269; Empl.: 14; *Sls. Mgr.:* Steve Varonka

PTC TRANSFORMERS, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505, Tel: 609-298-8200, TELEX: 510-685-3645; Empl.: 25; *Sls. Mgr.:* C. W. Harrison

PTS CORPORATION, Box 272, Bloomington, IN 47401, Tel: 812-824-9331; Empl.: 350; *Sls. Mgr.:* Jeff Hamilton; *Dist. Mgr.:* David Melwid

PTX-PENTRONIX INC., 1737 Cicotte, Lincoln Park, MI 48146, Tel: 313-388-3100, TELEX: 23-0398, FAX: 313-388-9171; Empl.: 21; *Sls. Mgr.:* J. Schultz

Z-LINE®

FAX: 714-641-9062

PULIZZI ENGINEERING, INC., 3260 S. Susan St., Santa Ana, CA 92704-6865, Tel: 714-540-4229; FSC No.: 70513; Empl.: 35; *Sls. Mgr.:* Michael B. Pulizzi; *Dist. Mgr.:* Michael B. Pulizzi ..... **D•2228-2231**

Local Sales Offices & Reps

CA	Los Angeles, Power Partners	213-215-0800
CA	Los Gatos, Norwest Elctms.	408-395-1190
GA	Roswell, Acurep Assocs.	404-998-5008
MD	Silver Spring, L. G. White & Co., Inc.	301-792-0660
MA	N. Reading, Tech. Instrs., Inc.	508-640-0795
MI	Farmington Hills, E.M.A.	313-553-3377
NE	Omaha, Ioneb	402-895-0488
NY	Bay Shore, CPS-NY	516-665-7758
WI	Genoa City, Vine Technical	414-279-3871

Local Distributors

CA	San Jose, Dansco Comp. Sls., Inc.	408-292-9740
MA	Sharon, Adcour	617-784-8123

PULNIX AMERICA, INC., 770 Lucerne Dr., Sunnyvale, CA 94086, Tel: 408-733-1560, TELEX: 172541 PULNIX AMERICA, FAX: 408-737-2966; *Sls. Mgr.:* Richard Hofmeister

PULSE INSTRUMENTS CO., 1234 Francisco, Torrance, CA 90502, Tel: 213-515-5330; Empl.: 30; *Sls. Mgr.:* Ron Perry

PULSE TRONIC INC., P.O. Box 5196, Ville St. Laurnet, Que., Canada H4L 4Z8, Tel: 514-747-6028, TELEX: 05-826652, FAX: 514-747-7330; *Sls. Mgr.:* Pamela Hirsh

PURE DATA LTD., 180 West Beaver Creek Rd., Richmond Hill, Ont., Canada L4B 1B4, Tel: 416-731-6444, FAX: 416-731-7017; Empl.: 75; *Sls. Mgr.:* Terrence Hickey, Cdn. Sls.; *Dist. Mgr.:* Byron Kirkwood, US Sls.

PYLE INDUSTRIES, INC., 501 Center St., P.O. Box 620, Huntington, IN 46750, Tel: 219-356-1200, FAX: 219-356-2830; Empl.: 325; *Sls. Mgr.:* Frank Pyle, Jr.; *Dist. Mgr.:* Mark Pyle

PYLE-NATIONAL DIVISION, BRIntec Corp., 1334 N. Kostner Ave., Chicago, IL 60651, Tel: 312-342-6300, TELEX: 25251, TWX: 910-221-0335; FSC No.: 49367; Empl.: 650; *Sls. Mgr.:* Mike Carroccia; *Dist. Mgr.:* Mike Curroccia

PYLON CO., See Augat/Pylon Corp., Inc.

PYLON ELEX DEVELOPMENT CO. LTD., 2300 Victoria, Lachine, PQ, Canada H8S 1Z3, Tel: 514-637-1186, TELEX: 05-821680, FAX: 514-636-1970; Empl.: 50; *Sls. Mgr.:* Sydney Harland

PYROCOM CO., 924 N. 143rd St., Seattle, WA 98133, Tel: 206-365-3535; *Sls. Mgr.:* Bill Kurtz

PYROFERRIC INTERNATIONAL, INC., 200 Madison St., Toledo, IL 62468, Tel: 217-849-3300, TWX: 910-663-0616, FAX: 217-849-2544; Empl.: 50; *Sls. Mgr.:* S. John Horner

PYROFILM RESISTOR CO., See KDI Electronics

PYROHM, INC., 24268 Indoplex Circle, Farmington Hills, MI 48018, Tel: 313-478-5060; *Sls. Mgr.:* Charles R. Berry

Q-CARD, INC., 2 Chellis Ct., Owings Mills, MD 21117-1634, Tel: 301-581-0112

QSI CORPORATION, 1740 Research Pkwy., Logan, UT 84321, Tel: 801-753-3657, FAX: 801-753-3822; Empl.: 10; *Sls. Mgr.:* Dennis R. Durfee

Q-TECH CORP., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, Tel: 213-836-7900, TELEX: 69-6140, FAX: 213-836-2157; FSC No.: 51774; Empl.: 125; *Sls. Mgr.:* Sandra Rappaport ..... **A•1468-1470**

Local Sales Offices & Reps

CA	Northridge, Tauber-Dreyer	818-993-0048
CA	San Jose, Blue Elctrn. Sls.	408-248-4399
CO	Parker, Howard Assoc.	303-841-5755
IL	Northbrook, Allied Comp. Reps., Inc.	312-498-6658
IN	Fort Wayne, TX Sales Indiana	219-489-4447
MA	Malden, J-K Assocs.	617-321-2922
MO	St. Louis, Abrams & Assoc.	314-569-0447
NJ	Glen Gardner, F & M Tech. Sls.	201-832-7216
NJ	Paramus, Eltech Sls.	201-967-1309
TX	Austin, Texoma Technical Sales, Inc.	512-459-0802
TX	Houston, Texoma Technical Sales, Inc.	713-462-1432
Can	Ont./Don Mills, C.R. Sneigrove Co.	416-447-8531

QUALCOMM, INC., 10555 Sorrento Valley Rd., San Diego, CA 92130, Tel: 619-587-1121, FAX: 619-452-9096; Empl.: 300; *Sls. Mgr.:* Ellie Glaser; *Dist. Mgr.:* Ellie Glaser

Qualidyne

FAX: 619-429-1011

QUALIDYNE SYSTEMS, Unitech Ltd., 3055 Del Sol Blvd., San Diego, CA 92154, Tel: 619-575-4000, 800-445-0425, TELEX: 7090290; Empl.: 300; *Sls. Mgr.:* James J. Louden ..... **D•2023-2032**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctms.	205-881-5031
AZ	Phoenix, Thor Engrg.	602-438-8494
CA	Laguna Hills, Electroventure	714-581-9244
CA	San Diego, Digitrust	714-498-2777
CA	Santa Clara, Gagner-Toomey Assocs.	408-244-2200
CO	Westminster, Gemini	303-428-5600
FL	Boca Raton, Beacon Elctms.	305-997-5740
GA	Atlanta, Beacon Elctms.	404-256-9640
ID	Boise, J.J. Backer Co.	208-344-9588
IL	Northbrook, Howard Benjamin & Assocs.	312-272-9200
KS	Lenexa, Midtec	913-541-0505
MD	Gaithersburg, Deltatronics Inc.	301-253-0615
MA	Canton, Northern Computer Sls.	617-821-2180
MN	Burnsville, QualiDyne	800-445-0425
MO	St. Louis, Midtec	314-275-8666
NJ	Madison, Livera-Polk	201-377-3220
NY	Glen Head, Livera-Polk	516-759-9300
NY	Rochester, Elcom Sls., Inc.	716-385-1400
NY	Syracuse, Elcom Sls., Inc.	315-685-8245
NC	Raleigh, Beacon Elctms.	919-787-0330
OH	Medina, Rockford Controls	216-725-3705
OR	Beaverton, J.J. Backer Co.	503-627-0775
PA	Chestnut Hill, Deltatronics, Inc.	215-248-0294
TX	Richardson, Spectra Sls. Corp.	214-234-3600
UT	Murray, Butterworth	801-268-2244
VA	Powhatan, Deltatronics	804-492-9027
WA	Seattle, J.J. Backer Co.	206-285-1300
Can	Toronto, Norgay Entprs. Ltd.	416-259-9663

QUALITEC TECHNOLOGIES, INC., 2251 E. Euclid Ave., Palo Alto, CA 94303-1706, Tel: 408-984-1763; Empl.: 30; *Sls. Mgr.:* Kevin Daniels ..... **D•1336**

QUALITY POWER SYSTEMS, INC., 2400 S. Texas Ave., Pearland, TX 77581, Tel: 713-997-1700, 800-992-1701, FAX: 713-997-1907; Empl.: 20; *Sls. Mgr.:* Clarence Oliver; *Dist. Mgr.:* Clarence Oliver

QUALITY TECHNOLOGIES, 3400 Hillview Ave., Palo Alto, CA 93404, Tel: 415-493-0400, FAX: 415-493-7055; Empl.: 2000; *Sls. Mgr.:* Bob Taber; *Dist. Mgr.:* Candace Johnson

Qti
Quality Thermistor, Inc.

FAX: 208-376-4754

QUALITY THERMISTOR, 2147 Centurion Pl., Boise, ID 83709, Tel: 208-377-3373; FSC No.: 56866; Empl.: 45; *Sls. Mgr.:* John Mahoney ..... **A•2198-2199; B•1914-1915**

QUALTEK ELECTRONICS CORP., 7158 Industrial Pk. Blvd., Mentor, OH 44060, Tel: 216-951-3300, TELEX: 985319, FAX: 216-951-7252; Empl.: 75; *Dist. Mgr.:* James Bof

QUAM-NICHOLS CO., 234 E. Marquette Rd., Chicago, IL 60637, Tel: 312-488-5800, FAX: 312-488-6944; Empl.: 200; *Sls. Mgr.:* William G. Little; *Dist. Mgr.:* Greg Johns ..... **D•1050-1051**

Local Sales Offices & Reps

AZ	Mesa, Yocum Mktg.	602-834-3334
CA	Belmont, Brian Trankle & Assocs.	415-595-4004
CA	Gardena, Bidwell-Schwartz Assocs.	213-770-0300
CO	Littleton, K. C. Martketers, Inc.	303-972-8411
FL	Orlando, Cartwright & Bean of FL	407-422-4531
GA	Norcross, Cartwright & Bean of GA	404-368-0160
IL	Elk Grove Village, Levy, Grams, & Lassers	312-364-7800
IL	Mt Prospect, The Dombrow Co.	312-253-3326
IN	Carmel, Green-Wissler Sls.,Inc.	317-843-5785
KS	Prairie Village, R. W. Kunz & Assocs., Inc.	913-648-3535
MA	Chicopee, Repworks, Inc.	413-533-0845
MN	Edina, Mel Foster Techn. Sls. Inv.	612-941-9790
NJ	Rahway, R. E. Breuer CO.	201-388-5045
NY	Rockville Centre, R & Sls.	516-678-6887
NY	Syracruse, The Lewis & Dunnigan Co., Inc.	315-446-5522
OH	Stow, J. W. Lehner Co.	216-686-1965
PA	Broomall, Lowery Assocs. Co.	215-356-5300
TN	Menphis, Cartwright & Bean of TN	901-362-8345
TX	Dallas, J. Y. Schoonmaker CO., Inc.	214-349-4650
WA	Seattle, Vector Manufacturers' Rep.	206-322-4343
EXP	Yonkers, NY, Roburn Agencies, Inc.	914-968-1016
Can	Waterloo, Ont., McBride Loudspeaker Source, Ltd.	519-884-3500
MI	Southfield, Robert Milsk Co.	313-354-3310

QUAN-TECH, Stansbury Industries Inc., P.O. Box 28, Rte. 206, Flanders, NJ 07836, Tel: 201-927-1766, TWX: 710-987-7500; FSC No.: 63921; *Sls. Mgr.:* Helen A. Kronen

QUANTRONIX, 49 Wireless Blvd., P.O. Box 9014, Smithtown, NY 11788, Tel: 516-273-6900, TELEX: 685-2167, FAX: 516-273-6958; Empl.: 175; *Sls. Mgr.:* R. J. Bruno; *Dist. Mgr.:* R. J. Bruno

QUANTUM DATA®

FAX: 312-888-2802

QUANTUM DATA, INC., 2111 Big Timber Road, Elgin, IL 60123, Tel: 312-888-0450, TELEX: 206725; Empl.: 30 ..... **D•1337**

QUANTUM ELECTRONICS, INC., 31 Industrial Park Rd., Lewistown, PA 17044, Tel: 717-242-1132, FAX: 717-248-8680; Empl.: 70; *Sls. Mgr.:* Kit C. Kennedy

QUARTZITE PROCESSING, INC., 6 Holyoke St., Malden, MA 02148, Tel: 617-322-3611, FAX: 617-322-9623; Empl.: 11; *Sls. Mgr.:* P. S. Yanofsky

QUA TECH, INC., 478 East Exchange St., Akron, OH 44304, Tel: 216-434-3154, ESYLNK: 5101012726, FAX: 216-434-1409; Empl.: 25; *Dist. Mgr.:* Michael Armstrong

Q.V.S., INC., 20 North 15th St., East Orange, NJ 07017, Tel: 201-673-3996; FSC No.: 89820; Empl.: 45

QWINT DATA, INC., 3455 Commercial Ave., Northbrook, IL 60062, Tel: 312-564-0910, TELEX: 27-0498, FAX: 312-564-4714; Empl.: 105; *Sls. Mgr.:* K. S. Berland; *Dist. Mgr.:* Pat Donoso

RACAL-DANA INSTRS. INC., 4 Goodyear St., Irvine, CA 92718, Tel: 714-859-8999; FSC No.: 21793; Empl.: 230

RACAL-MILGO, 1601 N. Harrison Parkway, Sunrise, FL 33323-2899, Tel: 305-475-1601, 800-327-4440, TWX: 510-955-4145; Empl.: 2050; *Sls. Mgr.:* H. Cheli

RACET COMPUTES, LTD., 3150 E. Birch St., Brea, CA 92621, Tel: 714-579-1725, TELEX: 701160, TWX: RACET UD, FAX: 714-579-3183; Empl.: 25; *Sls. Mgr.:* Timothy Mahoney

RADIAL CONTROLS, 2555 E. 55th Place, Indianapolis, IN 46220, Tel: 317-255-2796; Empl.: 25; *Sls. Mgr.:* R. L. Newsom

RADIALL, INC., 150 Long Beach Blvd., Stratford, CT 06497, Tel: 203-386-1030, TELEX: 311796, FAX: 203-375-3808; Empl.: 22; *Sls. Mgr.:* Peter Dionisio; *Dist. Mgr.:* Nancy Thornton

RADIO MATERIALS CORP., P. O. Box 339, Attica, IN 47918, Tel: 317-762-2491, 1-800-356-9956, FAX: 317-762-6814; Empl.: 140; *Sls. Mgr.:* James Vogt; *Dist. Mgr.:* James Vogt

RADIOMETRICS, INC., 12021 South Memorial Pkwy., Huntsville, AL 35803, Tel: 205-881-1272; FSC No.: 62951; *Sls. Mgr.:* W. Shelton Ray

RADIOMETRICS MIDWEST CORP., 2200 S. Main St., Lombard, IL 60148, Tel: 312-932-7262; FSC No.: Cage Code 1Z075 SIC Code 8748 Ext. 0021; Empl.: 5

RADIO RESEARCH INSTRUMENT CO., INC., 584 North Main Street, Waterbury, CT 06704-3506, Tel: 203-753-5840, TELEX: 962444 RADAR DURY, FAX: 203-754-2567; FSC No.: 57174; *Sls. Mgr.:* E. B. Doyle

RADIO SWITCH CORP., 64 S. Main St, P.O. Box A, Marlboro, NJ 07746, Tel: 201-462-6100, FAX: 201-409-6695; FSC No.: 74217; Empl.: 40; *Sls. Mgr.:* J. L. Bernard

RADIO TELEVISION PRODUCTS CORP., 2702 Washington Ave. N., Douglas, AZ 85607, Tel: 602-364-4438, FAX: 602-364-4430; Empl.: 120; *Sls. Mgr.:* W. J. McGaw

RADIX WIRE CO., 26260 Lakeland Blvd., Cleveland, OH 44132, Tel: 216-731-9191, FAX: 216-731-7082; Empl.: 90; *Sls. Mgr.:* Peter B. Thurstone, Mktg. Admin.; *Dist. Mgr.:* Peter B. Thurstone, Mktg. Admin.

RADSTONE TECHNOLOGY, 20 Craig Rd., Montvale, NJ 07645, Tel: 201-391-2700, 800-368-2738, FAX: 201-391-2899; *Sls. Mgr.:* Larry Abzug

RAF ELECTRONIC HARDWARE, 95 Silvermine Rd., Seymour, CT 06483, Tel: 203-888-2133, TWX: 710-472-6216, FAX: 203-888-9860; FSC No.: 55566; Empl.: 120; *Sls. Mgr.:* William R. Bailey, Jr.; *Dist. Mgr.:* Dave Granger/John Capece

Distributor

RAG ELECTRONICS, INC., 21418 Parthenia St, Canoga Park, CA 91304, Tel: 818-998-6500, 800-732-3457
.....623, 631, 689, 702, 705, 728, 732, 773, 794, 807, 809, 811

RAGEN CORP., Systems Div., 9 Porete Ave., N. Arlington, NJ 07032, Tel: 201-997-1000, FAX: 201-997-6948; Empl.: 400; *Sls. Mgr.:* Robert Hurley

RAGEN DATA SYSTEMS, INC., 3 Oval Dr., Central Islip, NY 11722, Tel: 516-234-3800, TELEX: 685-2305, TWX: 510-227-4901; FSC No.: 13068; Empl.: 177; *Sls. Mgr.:* Kevin Douglas

RALTRON ELECTRONICS, 2315 N.W. 107th Ave., Miami, FL 33172, Tel: 305-593-6033, TELEX: 441588, FAX: 305-594-3973; Empl.: 12; *Sls. Mgr.:* Alexander Wolloch; *Dist. Mgr.:* Ramon Quinones ..... **A•1471, 2041**

Local Sales Offices & Reps

AL	Huntsville, J.R. Assocs.	205-850-2130
AZ	Tempe, ACS of Arizona	602-829-7370
CA	Los Angeles, Mission Ridge Mktg.	714-253-4626
CA	San Diego, Scott Gould Co.	619-755-0824
CA	Santa Clara, Cummings & Assoc. N.	408-247-8656
CO	Denver, Summitwest Mktg.	303-460-9600
CT	Guilford, Data Mark	203-453-0575
FL	Boca Raton, Sales Specialists	305-391-3718
GA	Atlanta, J.R. Assocs.	404-922-1231
IL	Chicago, Gaertner & Assocs.	312-593-2332
MA	Boston, KSA of New England	508-443-5881
IN	Indianapolis, Bell Inds.	317-299-5487
MA	Boston, KSA of New England	617-443-5881
MI	Detroit, Elcon Michigan Sls.	313-855-3240
MN	Minneapolis, Hanna-Lind	612-925-5700
NJ	Teaneck, Strategic Sls.	201-833-0099
NC	Winston Salem, J.R. Assocs.	919-919-9574
OK	Tulsa, Advanced Tech. Sls.	918-664-0482
OR	Portland, Quest Mktg.	503-641-7377
PA	Horsham, Nexus Technlg. Sls.	215-675-9600
TN	Chattanooga, J.R. Assocs.	615-892-7630
TX	Austin, Advanced Tech. Sls.	512-331-9979
TX	Dallas, Advanced Tech. Sls.	214-340-1300
UT	Salt Lake City, Component Well	801-263-8131
WA	Seattle, Quest Mktg.	206-747-9424
Can	Montreal, Vitel Elctrns.	514-633-5951

Local Distributors

AL	Huntsville, Bell Inds.	205-837-1074
AZ	Phoenix, Bell Inds.	602-966-7800
CA	Canoga Pk., C & A Corp.	818-340-6035
CA	Sunnyvale, Bell Inds.	408-734-8570
CO	Denver, Indl. Elctrns.	303-694-9444
CT	E. Haven, J. V. Elctrn.	203-469-2321
CT	Stratford, Utronics	203-378-4201
FL	Ft. Lauderdale, N.R.C.	305-949-2400
GA	Norcross, Bell Inds.	404-662-0923
IL	Northbrook, Classic Comps.	312-272-9650
IA	Cedar Rapids, Bergquist Co.	319-366-8733
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Burlington, TLC Components	617-273-0140
MA	Needham, Cronin Elctrns.	617-449-5000
MI	Ann Harbor, Bell Inds.	313-971-9093
MN	Minneapolis, Bergquist Co.	612-835-2322
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Hauppauge, Circuit Sls.	516-348-7670
NY	Plainview, A.C.I. Elctrns.	516-293-6630
NY	Ronkonkoma, Baldwin Comps.	800-645-5608
OH	Dayton, Bell Inds.	513-435-8660
PA	Exton, V.S.H. Corp.	215-363-2250
TX	Richardson, Bell Inds.	214-690-0466
WA	Redmond, Bell Inds.	206-885-9963
WI	Mequon, Taylor Elec.	414-241-4321

RAM CHEMICALS, DIV. WHITTAKER CORP., 210 E. Alondra Blvd., Gardena, CA 90248, Tel: 213-321-0710; Empl.: 100; *Sls. Mgr.:* Don Lopez; *Dist. Mgr.:* G. M. Steinman

RAMCOM SYSTEMS, 3007 Washington Blvd., Ste. 205, Marina Del Rey, CA 90292, Tel: 213-827-4432; *Sls. Mgr.:* Ralph Tisdale

RANK BRIMAR INC., 227 Technology Circle, Scotts Valley, CA 95066, Tel: 408-438-6440, FAX: 408-438-6334; FSC No.: 60750; *Sls. Mgr.:* David Hurst

RANSCO INDUSTRIES, INC., Sub. Despatch Ind., Inc., 1400 E. Statham Pkwy., Oxnard, CA 93033, Tel: 805-487-7777, TELEX: 6-59235; Empl.: 180; *Sls. Mgr.:* Robert Briner

RANTEC, Emerson Electric, 9401 Oso Ave., Chatsworth, CA 91311, Tel: 818-885-8223, TWX: 910-493-1247, FAX: 818-993-7780; Empl.: 200; *Sls. Mgr.:* Fred R. Silver

Local Sales Offices & Reps

CA	Chatsworth, Rantec	818-885-8223
CT	Norwalk, Nemarco	203-852-9117
FL	Deltona, Rantec	305-574-6569
NH	Pelham, Rantec	603-635-3503
NJ	Ridgefield Park, Nemarco	201-641-3893
NY	Blue Point, Nemarco	516-363-7295
VA	Sterling, Beacon North	703-478-2480

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RANTEC DIVISION, Emerson Electric Co., 1173 Los Olivos Ave., Los Osos, CA 93402, Tel: 805-528-5858, TELEX: 88-8863, TWX: 910-351-5802; FSC No.: 60132; Empl.: 145; *Sls. Mgr.:* Francesca Peterson ..... **D•2034-2036**

Local Sales Offices & Reps

CA	Huntington Beach, Mil-Com Sls., Inc.	714-840-2425
GA	Marietta, Electro Comp Sls., Inc.	404-922-2344
MO	Florissant, Palatine Engrg. & Sls., Inc.	314-839-0800

RAPID POWER TECHNOLOGIES, Graysbridge Rd., P.O.BOX 291, Brookfield, CT 06804, Tel: 203-775-0411, 800-332-1111, TELEX: 643:012, FAX: 203-775-0666; *Sls. Mgr.:* Mario Napolitano

RAPIDSUN, See Motion Control Grp., American Precision Inds.

RAPID SYSTEMS INC., 433 N. 34th St, Seattle, WA 98103, Tel: 206-547-8311, TELEX: 265017 UR, FAX: 206-548-0322; FSC No.: 91-1197314; Empl.: 30; *Sls. Mgr.:* Bo Ray

RASTER GRAPHICS, INC., P. O. Box 5157, Bend, OR 97701, Tel: 503-388-2584, FAX: 503-389-8249

RATELCO, Power Systems Div., 1260 Mercer, Dept. EEM, Seattle, WA 98109-5589, Tel: 206-624-7770, FAX: 206-382-5447; FSC No.: 14259; Empl.: 160; *Sls. Mgr.:* D. Terpstra

RAULAND-ZENITH ELECTRONICS CORP., 2407 W. North Ave., Melrose Pk., IL 60160, Tel: 312-450-8992, TELEX: 72-1488, FAX: 312-450-8985; Empl.: 2300

Raychem

RAYCHEM CORP., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025, Tel: 415-361-3860, TELEX: 34-8316, TWX: 910-373-1728; *Sls. Mgr.:* Robert Simpson; *Dist. Mgr.:* Joseph Rodgers ..... **B•1407; C•1515, 1700**

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RAYOVAC CORPORATION, 601 Rayovac Drive, Madison, WI 53711-0960, Tel: 608-275-4692, TELEX: 190428; FSC No.: 6135; Empl.: 2000; *Sls. Mgr.:* Jeff Heberlein ..... **D•1519**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Santa Clara, Nova-Tronix, Inc.	408-727-9530
CA	Westminster, West Elctrn. Sls. Co.	714-898-0120
CO	Englewood, William J. Purdy Co.	303-790-2211
IL	Park Ridge, G MCL Cole Co.	312-692-6040
IN	Indianapolis, Elctrn. Sls. & Engrg.	317-849-4260
IA	Cedar Rapids, R. W. Kunz & Assocs.	319-396-5386
KS	Prairie Vl, R. W. Kunz & Assocs.	913-648-3535
LA	New Orleans, The Hancoci Grp.	504-568-0580
MA	Framingham, Stone Comp. Sls.	617-875-3266
MO	St. Louis, R. W. Kunz & Assocs.	314-966-4977
NJ	Berkeley Hgts., Cambridge Allen & Assocs.	201-464-0203
NY	Skaneateles, Empire Tech. Assocs., Inc.	315-685-5703
OH	Westlake, Baehr Greenleaf	216-892-1770
OR	Beaverton, Pacific Mktg. Specialists, Inc.	503-641-9373
PA	Birchrunville, Jadelectronic Assocs., Inc.	215-296-3800
TX	Dallas, TESCO	214-553-1200
WA	Redmond, Pacific Mktg. Specialists, Inc.	206-882-3144

Local Distributors

AK	Anchorage, Frigid North	907-561-4633
AZ	Phoenix, Lynntronics	602-433-0288
AZ	Scottsdale, Cypress Elctrns.	602-949-0802
CA	Buena Pk., Cypress Elctrns.	213-635-8888
CA	Palo Alto, Power Source	415-856-0700
CA	San Diego, Cypress Elctrns.	619-535-0018
CA	San Jose, Rose Elctrns.	408-943-0440
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Tustin, Image Elctrns.	714-259-0900
CO	Wheat Ridge, Cypress Elctrns.	303-431-7191
FL	Ft. Lauderdale, Selex/Southeastern	305-563-4131
GA	Norcross, Dow Elctrns.	404-446-2620
IL	Chicago, Neward Elctrns.	312-784-5100
KS	Wichita, RSC Elctrns.	316-267-5213
MD	Gaithersburg, Axis Elctrns.	800-368-2815
MA	Hingham, Saeger	617-749-6700
MA	Sharon, Adcour	1-800-343-2522
MO	Kansas City, Elctrn. Supp.	816-931-0250
NE	Lincoln, Scotts Elctrns.	402-466-8221
NV	Las Vegas, Kiesub	702-733-3888
NH	Nashua, Brevan Elctrns.	603-889-7230
NJ	W. Berlin, GCI Corp.	800-524-1463
NY	E. Farmingdale, Battery Expeditors	516-752-0011
NY	Hauppauge, Saeger	516-348-1300
NY	Rochester, Masline Elctrns.	716-546-5373
OH	Columbus, Promark	614-876-8885
OH	Reno, New Era	614-373-3384
OR	Beaverton, Micro-Power	503-626-7086
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Ft. Worth, Allied Elctrns.	1-800-433-5700
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
WA	Seattle, Radar Elec.	206-282-2511

RAY PROOF, Shielding Systems Corp., 50 Keeler Ave., P.O. Box 5060, Norwalk, CT 06856-5060, Tel: 800-243-5704, TELEX: 96-5812; *Sls. Mgr.:* James A. Graham, VP Bus. Dev.

RAYTEK, INC., 1201 Shaffer Rd., Santa Cruz, CA 95060, Tel: 408-458-1110, TELEX: 171890; *Sls. Mgr.:* S. Brager; *Dist. Mgr.:* Stuart Brager

RAYTHEON CO., 465 Centre St., Quincy, MA 02169, Tel: 617-479-5300, TWX: 710-337-1020; *Sls. Mgr.:* R. Whitt

RAYTHEON CO., Laser Products, 465 Centre St, Quincy, MA 02169, Tel: 617-479-5300, TELEX: 92-3455, TWX: 710-324-6568, FAX: 617-479-5300 (ext. 2359); Empl.: 1000; *Sls. Mgr.:* B. Werschler

RAYTHEON CO., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154, Tel: 617-899-8400, TWX: 710-324-8400, FAX: 617-899-5451; *Sls. Mgr.:* J. Hieber

RAYTHEON SEMICONDUCTOR, 350 Ellis St., Mountain View, CA 94043, Tel: 415-968-9211, TWX: 910-379-6481; FSC No.: 07933; Empl.: 1200; *Sls. Mgr.:* Al Enamait, Dir. Worldwide Sls.; *Dist. Mgr.:* R. Johnson

RAYTHEON/TAG SEMICONDUCTORS LTD., 43 Third Ave., Burlington, MA 01803, Tel: 617-272-3704 (3705), TELEX: 988586 TAG SEMI LTD UD, ESYLNK: 62958778, FAX: 617-272-1280; Empl.: 7; *Sls. Mgr.:* B. Cavender; *Dist. Mgr.:* Pat Mobilia

RCA SOLID STATE DIV., See GE/RCA Solid State Div.

RCD COMPONENTS, INC., 520 E. Industrial Pk. Dr., Manchester, NH 03103, Tel: 603-669-0054, TELEX: 943-512 RCD COMP MAN, FAX: 603-669-5455; Empl.: 450 ..... **A•2042-2043**

Local Sales Offices & Reps

CA	Arcadia, Van Gott & Assoc.	818-445-9728
CA	Burlingame, William J. Purdy	415-347-7701
FL	Longwood, Beacon	407-332-1940
IL	Barrington, Lancastle Sls.	312-381-6780
MN	Eden Prairie, Twist Co.	612-941-2040
MO	Florissant, Delltron	314-839-0033
NJ	Leonia, Peter E. Schmitt	201-944-1096
OH	Cincinnati, Campisano	513-574-7111
TX	Dallas, Beacon Elec.	214-437-1505
UT	Salt Lake City, Sage Assoc.	801-467-5451
WA	Renton, Excel	206-277-1940
WI	Colgate, Rep One	414-628-4016

Local Distributors

CA	Anaheim, A to Z Inds.	714-634-3620
CA	City of Industry, Ital Elctrns.	213-968-8515
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Jose, Compass Comps.	408-432-7575
CA	San Jose, Passive Technlg. Sls.	408-435-5566
FL	Longwood, Stetco	407-767-0209
FL	Tampa, Reptron	813-854-2358
IL	Hillside, Schuten Elctrns.	312-449-5430
IL	Lisle, Components, Inc.	312-852-7707
IN	Elkhardt, Earlynn Elctrns.	219-862-2425
IN	Wakarusa, Earlynn	219-862-2425
MA	Newton, Greeneshaw	617-969-8900
MA	Wilmington, Heilind Elctrns.	617-657-4870
MA	Wilmington, North Star Elctrns.	617-657-5155
MA	Worcester, Coghlin	800-922-8565
MI	Livonia, Reptron	313-525-2700
MN	New Brighton, Parts One	612-633-8079
NH	Nashua, Brevan Elctrns.	603-889-7130
NJ	Whippany, ADI	201-428-0510
NY	Bohemia, Key Comps. Inc.	516-567-7500
NY	Bohemia, RBD Elctrns.	516-589-7717
PA	McKean, Advacom	814-476-7774
PA	Reading, Barbey Elctrns.	215-376-7451
TX	Ft. Worth, Allied Elctrns.	800-433-5700
WA	Redmond, Priebe Elctrns.	206-881-2363
WI	Oshkosh, Elctrn. Inds.	414-235-8930

R. C. ELECTRONICS INC., 5386 Hollister Ave., Ste. D, Santa Barbara, CA 93111, Tel: 805-964-6708, FAX: 805-964-4906; Empl.: 15; *Sls. Mgr.:* Chao-Sun Pang; *Dist. Mgr.:* Chao-Sun Pang

RCL-SHALLCROSS, 195 McGregor St., Manchester, NH 03102, Tel: 603-627-3831, TWX: 710-220-1876, FAX: 603-623-5610; FSC No.: 01686; Empl.: 400

RCL-SHALLCROSS, INC., U.S. Hwy. 70 East, Smithfield, NC 27577, Tel: 919-934-5181, TWX: 510-939-1463, FAX: 919-934-5186; FSC No.: 54294; Empl.: 150 ..... **A•1959, 1961; B•1015, 1017**

See RCL-Shallcross for Local Sales Reps. and Distributors

R-COLUMBIA PRODS. CO., INC., 2008 St. Johns Ave., Highland Park, IL 60035, Tel: 312-432-7915, TWX: 910-692-2160; Empl.: 20

RDI ELCTRNS., INC., 56 Harrison St., New Rochelle, NY 10801, Tel: 914-632-2828, FAX: 914-632-7464; Empl.: 9; *Sls. Mgr.:* Barry Miller

REACTEL, INC., 687-D Lofstrand La., Rockville, MD 20850, Tel: 301-279-5535, FAX: 301-340-7304; FSC No.: 60458; Empl.: 30; *Sls. Mgr.:* D. E. Claycomb

Local Sales Offices & Reps

CA	Sunnyvale, ESCO Assocs.	408-745-1410
FL	Clearwater, Brennan Assocs.	813-446-5006
NJ	Keansburg, Reps Five	201-495-2315
VA	Fairfax, Beacon North	703-591-1300

REAL TIME DEVICES, INC., Matternville Ctr., US 322, Port Matilda, PA 16870, Tel: 814-234-8087, TELEX: 4948141 SEDACOG; Empl.: 15

Rebco

REBCO INTERNATIONAL, 4960 Minas Dr., San Jose, CA 95136, Tel: 408-723-2932; Empl.: 19; *Sls. Mgr.:* Janice Borland; *Dist. Mgr.:* Andrew Real

RECOGNITION TECHNOLOGY, INC., 160 E. Main St., Westborough, MA 01581, Tel: 617-366-4800, FAX: 508-898-9351; Empl.: 12; *Sls. Mgr.:* J.A. Maddocus

RECORDER SYS. DIV., See Gulton Instruments Div.

RECORTEC, INC., 275 Santa Ana Ct., Sunnyvale, CA 94086, Tel: 408-737-8441, TWX: 910-379-5022, FAX: 408-737-8448; *Sls. Mgr.:* R. R. Troxell

RECOTON CORP., 46-23 Crane St., Long Island City, NY 11101, Tel: 718-392-6442, TELEX: 236047 RCTN, FAX: 718-784-1080; Empl.: 150; *Sls. Mgr.:* Peter Dayton

REDINGTON COUNTERS, 130 Addison Rd., Windsor, CT 06095, Tel: 203-688-6205, FAX: 203-688-1591; *Sls. Mgr.:* Dennis O'Shea; *Dist. Mgr.:* Dennis O'Shea

RED SQUARE COMPANY, 11770 Warner Ave., Ste. 226, Fountain Valley, CA 92708, Tel: 714-751-1373; *Sls. Mgr.:* Ed Burg

REEVE ELECTRONICS, Mellish E. Murray, 1715 W. Carroll Ave., Chicago, IL 60612, Tel: 312-670-0150; Empl.: 25; *Sls. Mgr.:* Ed Martinez

REEVES-HOFFMAN
DIVISION DYNAMICS CORPORATION OF AMERICA

FAX: 717-243-0079

REEVES-HOFFMAN DIV., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013, Tel: 717-243-5929; Empl.: 340; *Sls. Mgr.:* Larry Barbary ..... **A•1472-1476; C•1624-1626**

Local Sales Offices & Reps

AZ	Phoenix, Chaparral Elctrns.	602-252-0897
CA	Culver City, Westaironics	213-641-4123
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
CO	Boulder, R.G. Entprs.	303-447-9211
FL	Tampa, APM Assocs.	813-886-2457
GA	Duluth, DTM, Inc.	404-381-5592
IL	Des Plaines, ESCO Assocs.	312-298-5310
MD	Ellicott City, Nelson Elctrns.	301-747-7887
MA	Wakefield, H. Jappe Co.	617-245-9359
MN	Minneapolis, Intl. Elctrns.	612-571-0000
OH	Cincinnati, Tri-State Mktg.	513-761-7993
PA	Hatboro, Electro Rep Engrg.	215-674-4421
TX	Irving, Kite Elctrns. Sls.	214-438-9336
Can	Rexdale, Ont., Myelco, Inc.	416-674-1636

REGDON SOLENOID, INC., 401 Plaza Drive, Westmont, IL 60559, Tel: 312-789-0600, FAX: 312-789-0614; FSC No.: 27190; Empl.: 65 ..... **B•1670-1671**

Local Sales Offices & Reps

AL	Decatur, Tenn Tech	205-350-0630
CA	Los Altos, J. W. Wilhoit	415-961-3660
CA	Valencia, DJM Elctrns.	818-362-4309
CT	Woodbury, Mark-Rep Assocs.	203-263-3047
FL	Maitland, EIR, Inc.	305-660-9600
GA	Atlanta, Tenn Tech	404-622-5784
IL	Downers Grove, Richmar Elect. Corp.	312-968-0118
IN	Indianapolis, Richmar Elctrns.	317-846-6383
MN	Hopkins, S. J. Collins & Assocs.	612-933-7661
NH	Plaistow, Mark-Rep Assocs.	603-382-9563
NJ	Florham Park, Varrelman-Gorman Co.	201-992-2505
NY	Binghamton, NHA	607-754-3214
NY	Pittsford, NHA	716-586-9002
NC	Raleigh, Tenn Tech	919-266-3610
OH	Cleveland, J. N. Bailey	216-892-1510
OH	New Lebanon, J. N. Bailey	513-687-1325
PA	Huntingdon Valley, Edwin Leiby & Assocs.	215-659-8938
TN	Chattanooga, Tenn Tech.	615-894-3012
TX	Plano, K & H Sales	214-423-6520
WI	Butler, Richmar Elctrns.	414-781-1730

Local Distributors

CA	San Carlos, Logan Elctrn. Supp.	415-594-0700
MA	Lynn, Land Elctrns.	617-592-2220
NJ	Fairlawn, Relay Specialties	201-797-3313

REGENCY LAND MOBILE, INC., 7707 Records St., Indianapolis, IN 46226, Tel: 317-545-4281, FAX: 317-545-2170; Empl.: 500

REGENT CONTROLS, INC., 39 Fanny St., P.O. Box 767, Shelton, CT 06484-0767, Tel: 203-736-2924, FAX: 203-736-2928; Empl.: 35; *Sls. Mgr.:* Lora C. Minor

REHLANDER ASSOCS., 118A Bridge St., Beverly, MA 01915, Tel: 617-922-5961; *Sls. Mgr.:* Michael Rehlander

REICH ASSOCIATES, Rt. 4, Box 4620, Lakehills, TX 78063, Tel: 512-751-3220, TELEX: 358048, ESYLNK: 62705740, FAX: 512-751-3054; FSC No.: 55916; Empl.: 10; *Sls. Mgr.:* W. Reich

RE INSTRUMENTS CORP., 31029 Center Ridge Rd., Westlake, OH 44145, Tel: 216-871-7617, FAX: 216-871-4303; Empl.: 15; *Sls. Mgr.:* P. A. Bosworth

REKCO, INC., See LEM/Rekco

RELAY SERVICE CO., 1300 N. Pulaski Rd., Chicago, IL 60651, Tel: 312-252-2700, FAX: 312-252-0300; Empl.: 25; *Sls. Mgr.:* Chas. H. Badger

Local Sales Offices & Reps

CA	Santa Cruz, Le Rep	408-458-0667
CA	Vista, Sado Sls.	619-941-2654
CO	Broomfield, Sunbird Inds., Inc.	303-460-9199
CO	Monument, Sunbird Inds., Inc.	303-481-2900
CT	Bethany, Reps. Corp.	203-393-0024

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IN Ft. Wayne, Naunas Sls. 219-432-4792
MA Wellesley, Reps. Corp. 617-237-6476
NY New Rochelle, Repco Assocs. 914-235-6405
OH Goshen, John O. Olsen 513-722-3320
OH Warfield Hgts., John O. Olsen 216-662-3454
OR Beaverton, Cascade Sls. Co. 503-626-7978
PA Glenside, Shelmar Elctrns. Corp. 215-885-0800
PA Pittsburgh, John O. Olsen 412-279-2550
TX Lewisville, Elctrn. Prod. Reps. 214-436-4772

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.....603, 609, 621, 622, 643, 648, 659, 693, 698, 717, 744, 772

RELCO PRODUCTS, 5594 E. Jefferson Ave., Denver, CO 80237, Tel: 303-756-1143; FSC No.: 14454; Empl.: 7

Reliability Incorporated

FAX: 713-492-0615

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Local Sales Offices & Reps

AL Decatur, El Tech, Inc. 205-353-7899
AL Huntsville, El Tech, Inc. 205-883-5030
AZ Scottsdale, Electronic Tech. Sls. 602-941-9137
CA Mountain View, Straube Assocs. 415-969-6060
CO Denver, AKI Entpr. 303-388-4488
CT Madison, Omni-Rep 203-421-4561
FL Clearwater, Sigma Tech. Assoc., Inc. .. 813-791-0271
FL Ft. Lauderdale, Sigma Tech. Assoc., Inc. 305-731-5995
GA Lilburn, El Tech, Inc. 404-564-1236
IL Schaumburg, Tech-Tron Sls., Inc. 312-843-7580
IN Ft. Wayne, Jim Finnegan & Co. 219-747-9525
KS Leneva, Mid Tec 913-541-0505
KY Ft. Wright, El Tech, Inc. 606-331-3495
MD Westminster, Eastern Comp. Sls. 301-875-0626
MA Burlington, Omni-Rep 617-245-4511
MI Jenison, R. C. Nordstrom 616-457-5762
MI Southfield, R. C. Nordstrom & Co. 313-559-7373
MN Minneapolis, George Russell & Assocs. 612-854-1166
MO St. Louis, Mid Tech 314-275-8666
NJ West Caldwell, Mariniello Tech. Sls. ... 201-228-4418
NY Rochester, Electra Sls. Corp. 716-427-7860
NC Raleigh, Electro-Mech 919-790-9300
OH Columbus, Tom Mulligan & Co. 614-457-2242
OK Tulsa, Advance Tech. Sls. 918-664-0482
PA W. Conshohocken, Eastern Comp. Sls. 215-825-8610
RI Cumberland, Omni-Rep 401-333-2353
TX Austin, Advanced Tech. Sls. 512-467-9209
TX Dallas, Advanced Tech. Sls. 214-340-1300
TX Houston, Advance Tech. Sls. 713-440-3888
VA Sterling, Eastern Comp. Sls. 703-444-1089
VA Venton, Eastern Comp. Sls. 703-344-4756
Can Langley, B.C., Electro Source, Inc. 604-888-2412
Can Nepean, Ont, Electro Source, Inc. 613-592-3214
Can Pointe Claire, Que., Electro Source, Inc. 514-630-7486
Can Rexdale, Ont., Electro Source, Inc. 416-675-4490

Local Distributors

AZ Phoenix, Force Elctrns. 602-437-1060
AZ Phoenix, Sterling Elctrns. 602-268-2121
CA Calabasas, Milgray 818-704-0041
CA El Segundo, Force Elctrns. 213-772-1324
CA North Hollywood, B.J. Wolfe co. 213-877-5518
CA San Diego, Force Elctrns. 619-569-9661
CA San Jose, B.J. Wolfe Co. 408-371-3443
CA San Jose, Force Elctrns. 408-435-1324
CO Englewood, Sterling Elctrns. 303-792-3939
CT Bethel, Heilind Elctrns. 203-797-8600
CT Milford, Milgray 203-878-5538
CT Wallingford, Sager Elctrl. Supp. 203-265-4600
CT Wallingford, Sterling Elctrns. 203-265-9535
FL Winter Park, Milgray 407-647-5747
GA Norcross, Milgray 404-446-9777
IL Arlington Hgts., Milgray 312-253-1212
IL Bensenville, Voyager Elctrns. 312-860-1300
KS Overland Park, Milgray 913-236-8800
KS Overland Park, Sterling Elctrns. 913-236-5589
LA Westwego, Sterling Elctrns. 504-436-1418
MD Columbia, Milgray 301-621-8169
MD Columbia, Sager 301-995-6580
MA Wilmington, Heilind Elctrns. 617-657-4870
MA Wilmington, Milgray 508-657-5900
MA Wilmington, Northstar Elctrns. 508-657-5900
MA Woburn, Sterling Elctrns. 617-938-6200
MI Mt. Clemens, Milgray 313-791-8200
MN Fridley, Sager Elctrns. 612-571-7766
MN Minneapolis, Sterling Elctrns. 612-831-2666
NJ Marlton, Milgray 609-983-5010
NJ Parsippany, Milgray 201-335-1766
NJ South Plainfield, Sterling Elctrns. 201-769-7000
NM Albuquerque, Sterling Elctrns. 505-884-1900
NY Farmingdale, Milgray 516-391-3000
NY Happauge, Sager Elctrn. Supp. 516-348-1300
NY Rochester, Milgray 716-235-0830
NC Raleigh, Sager Svc. Plus 919-850-9550
OH Cleveland, Milgray 216-447-1520
OH Dayton, Koenike Comps. (KCI) 513-435-5435
OK Tulsa, Sterling Elctrns. 918-663-2410
PA Trevos, Sager Elctrn. Supp. 215-638-7491
TX Austin, Sterling Elctrns. 512-836-1341
TX Dallas, Force Elctrns. 214-247-9955
TX Dallas, Milgray 214-248-1603
TX Dallas, Sterling Elctrns. 214-243-1600
TX Houston, Sterling Elctrns. 713-623-6600
UT Salt Lake City, Milgray 801-272-4999
VA Herndon, Sterling Elctrns. 703-742-8400
Can Willowdale, Ont., Milgray 416-756-4481

RELIANCE COMM/TEC, Reliance Electric, P. O. Box 99502, Cleveland, OH 44199, Tel: 800-245-4501

RELIANCE ELECTRIC CO., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199, Tel: 800-245-4501

RELIANCE PLASTICS & PACKAGING, 225 Belleville Ave., Bloomfield, NJ 07003, Tel: 201-748-2222, FAX: 201-748-5257; Empl.: 60; *Sls. Mgr.:* Hale Smith

REMEE PRODUCTS CORP., 41 Bridge St, Florida, NY 10921, Tel: 914-651-4431, TELEX: 64-6715, FAX: 914-651-4160; FSC No.: 4R362; Empl.: 135; *Sls. Mgr.:* Ken Pimental; *Dist. Mgr.:* Ken Pimental

REMTEK CORPORATION, 46107 Landing Parkway, Fremont, CA 94538, Tel: 415-490-3999, FAX: 415-659-1849; Empl.: 40; *Sls. Mgr.:* Robert A. Wold; *Dist. Mgr.:* Robert T. Collins ..... **C•1701**

Local Sales Offices & Reps

AZ Tempe, Rich Sls. Co. 602-968-7787
CA Fallbrook, Gary Chilcote Assocs. 619-728-7678
CA Fremont, Nicor-II 415-490-5975
CA Fremont, Remtek Corp. 415-490-3999
CA Montrose, Signal Entprs. 818-957-0640
CO Boulder, R. F. Mayo & Assocs. 303-442-2155
FL Deerfield, Brandel Stephens 305-427-8558
GA Marietta, Remtek Corp. 404-977-1630
IL Deerfield, Flaherty-Haines 312-948-7800
IN Ft. Wayne, Hoyle Assocs. 219-485-6433
KS Overland Park, Spectrum Sls. 913-648-6811
MA Clinton, Browning & Naughton 617-365-6365
MI Birmingham, Forand Sls. Co. 313-644-0087
MN Eden Prairie, EMT Engrg. 612-934-4147
NJ Hicksville, J-Square Mktg. 516-935-3200
NY Rochester, L-Mar Assocs. 716-323-1000
OH Cleveland, Versatron 216-581-0090
OR Tualatin, Nicor-I 503-692-0421
PA Telford, Dalbrook 215-723-3300
TX Dallas, R. D. Spooner 214-357-6636

RENARD MANUFACTURING COMPANY, INC., 3131 N.W. 79th Avenue, Miami, FL 33122-1011, Tel: 305-592-1500, TELEX: 989326, ESYLNK: 62929141, FAX: 305-593-9990; *Sls. Mgr.:* S. Simerly

RENCO, Robbins & Myers, 26 Coromar Dr., Goleta, CA 93117-3094, Tel: 805-968-1525, TWX: 910-334-1180; FSC No.: 34479; Empl.: 100; *Sls. Mgr.:* Sid Russell; *Dist. Mgr.:* Sid Russell

RENCO ELECTRONICS, INC. CONSISTENT SERVICE START TO FINISH

FAX: 516-586-5562

RENCO ELECTRONICS, INC., 60 Jefryn Blvd., East, Deer Pk., NY 11729, Tel: 516-586-5566, 1-800-645-5828, TELEX: 220-883; FSC No.: 14778; Empl.: 200; *Sls. Mgr.:* Edward W. Rensing; *Dist. Mgr.:* Rhonda Rizzo ..... **A•1293-1297, 2435-2439**

Toll-Free Engineering Hot Line 800-645-5828, in NY State 516-586-5566

Local Sales Offices & Reps

CA Arcadia, Van Gott & Assoc. 818-445-9728
CA La Jolla, Coastal Elctrn. Sls. 619-459-4148
CA Santa Clara, Cummings & Assoc. 408-247-8656
IL Schaumburg, Tech-Tron Sls. 312-843-7530
NY Buffalo, NRM Mktg. Grp. 716-634-4300
NC Kernsville, El-Tech-East 919-996-8885
AR Ft. Smith, Electra Reps 501-452-7822
CA San Diego, Coastal Sls. 619-459-4148
CO Parker, The Remington Grp. 303-841-0523
CT Norwalk, Northeast Reps. 203-886-6030
FL Casselberry, Symco 407-695-6010
IA Davenport, Rush & West Assocs. 319-388-9494
KS Olathe, Rush & West Assocs. 913-764-2700
MD Gaithersburg, Eltron Sls. 301-963-7082
MA Hingham, Northeast Reps. 617-749-8700
MN Minneapolis, All Phase 612-835-4940
MO St. Louis, Rush & West Assocs. 314-965-3322
NH Nashua, Northeast Reps. 603-880-8199
NJ Marlton, BGR Assocs. 609-983-1020
OH Columbus, Baehr Greenleaf & Assocs. 614-486-4046
OH Westlake, Baehr Greenleaf & Assocs. 216-892-1770
OR Hillsboro, Temco Northwest 503-649-8375
PA Evans City, Baehr Greenleaf & Assocs. 412-776-2151
TX Austin, Electra Reps 512-339-1163
TX Dallas, Electra Reps 214-248-3852
UT Parker, The Remington Grp. 303-841-0523
VA Front Royal, Eltron Sls. 703-635-1933
WA Kirkland, Temco Nortwest 206-823-6388
WI Milwaukee, Bert Wartchow Assocs. ... 414-964-0942
Can Montreal, Eli Manis, Inc. 514-861-5571

REN ELECTRONICS CORPORATION, C.C.G., An Insico Co., 755 New Ludlow Rd., S. Hadley, MA 01075, Tel: 413-536-1800, TELEX: 315617, FAX: 413-536-8425; FSC No.: 70143; Empl.: 75; *Sls. Mgr.:* S. W. Pai, Div. Mgr.

REPRODUCTION TECHNOLOGIES INC., Dept. EM, P.O. Box 790, Bristol, IN 46507-0518, Tel: 219-848-5233, TELEX: 510 600 2378 R T I; Empl.: 10; *Sls. Mgr.:* Maxine Beasey

REPUBLIC ELECTRONICS CO., 200 Wireless Blvd., Hauppauge, NY 11788, Tel: 516-273-9800, TELEX: 96-1460; FSC No.: 95750; Empl.: 145; *Sls. Mgr.:* Sy Newman

RESDEL ENGRG. CORP, Resdel Inds., 300 E. Live Oak Ave., Arcadia, CA 91006, Tel: 213-684-2600, TWX: 910-582-3219; FSC No.: 10412; Empl.: 225

RESEARCH DEVICES, The American Optical Corp., 121 Ethel Rd., Piscataway, NJ 08856, Tel: 201-572-4800, TELEX: 467058, FAX: 201-572-4808; Empl.: 25; *Sls. Mgr.:* Michael Schneider

RESEARCH SPECIALISTS, 1816 Settlers Oval, Cleveland, OH 44145, Tel: 216-871-8909; Empl.: 10; *Sls. Mgr.:* Tim Howard

RESISTANCE TECHNOLOGY INC., 1260 Red Fox Rd., St. Paul, MN 55112, Tel: 612-636-9770, FAX: 612-636-8944; *Sls. Mgr.:* T. Michael Ferris

resistors, inc.

FAX: 312-863-4272

RESISTORS, INC., 5226 W. 26th St., Chicago, IL 60650, Tel: 312-652-7555; Empl.: 35; *Sls. Mgr.:* Marlene Pingel ..... **A•2040**

Local Sales Offices & Reps

CA Santa Clara, K M Entprs. 408-986-1458

FAX: 408-982-0210

RESONANT POWER TECHNOLOGY, 3350 Scott Boulevard, Bldg.5302, Santa Clara, CA 95054, Tel: 408-982-0200; FSC No.: 0BZ13; Empl.: 10; *Sls. Mgr.:* Dan H. Burgoon ..... **D•2038-2039**

Local Sales Offices & Reps

FL	Land O Lakes, AJ'S Power Source	813-996-2583
NH	Salem, OEM Marketing & Sales	603-893-0009
TX	Richardson, Jim Gray & Associates	214-699-9976

REVERE CORPORATION OF AMERICA, 845 N. Colony Rd., Wallingford, CT 06492, Tel: 203-269-7701, TELEX: 96-3482, TWX: 710-476-3197; Empl.: 389; *Sls. Mgr.:* R. Paukstys

RFI CORPORATION, 100 E. Pine Aire Dr., Bay Shore, NY 11706, Tel: 516-231-6400, TWX: 510-227-6233, FAX: 516-231-6465; FSC No.: 13619; Empl.: 250; *Sls. Mgr.:* Dave Radford ..... **A•1667**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Scottsdale, Williams-Assocs.	602-947-4297
CA	Alhambra, M.W. Riedel Co.	213-283-7694
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
CO	Commerce City, Williams Assocs.	303-289-5647
FL	Clearwater, Tech-Rep Assocs.	813-572-9900
FL	Ft. Lauderdale, Tech Rep Assocs.	305-791-2708
FL	Merritt Island, Tech-Rep Assocs.	407-453-3313
FL	Winter Springs, Tech-Rep Assocs.	407-699-4010
IL	Palatine, Technlg. Sls., Inc.	312-991-6600
IN	Fort Wayne, Denton Mktg., Inc.	219-486-0665
IA	Cedar Rapids, Ensco-Rep	319-396-1109
KS	Countryside, Ensco-Rep	913-384-0840
KS	Wichita, Ensco-Rep	316-683-1070
MD	Rockville, Mechtronics Sls.	301-340-2130
MO	Maryland Heights, Ensco-Rep	314-423-3935
NH	Hudson, EMC Sls., Inc.	603-889-5751
NJ	Cherry Hill, H.J. White Co.	609-428-4544
NM	Albuquerque, Williams-Assocs.	505-255-1638
NY	Buffalo, Upstate Engrg. Sls.	716-632-0011
NY	Great Neck, Trionic Assocs.	516-466-2300
NY	Rochester, Upstate Engrg.Sls.	716-225-2383
NY	Utica, Upstate Engrg.Sls.	315-797-6721
NC	Winston-Salem, Murcota Corp.	919-722-9445
PA	Glenside, Koebert Assocs.,Inc.	215-887-2310
TX	Garland, McBride Sci. Sls.	214-494-5000
UT	Salt Lake City, Williams Assocs.	801-485-6511
WA	Bellevue, Quest Mktg.	206-747-9424
WI	Milwaukee, Technlg. Sls., Inc.	414-964-5015
Can	Neapean, Ontario, Norgay Entprs. Ltd.	613-723-1858
Can	New Westminster, B.C., Norgay Entprs. Ltd.	604-524-6910
Can	Richmond B.C., Norgay Entprs. Ltd.	604-275-1121
Can	Toronto, Ontario, Norgay Entprs. Ltd.	416-259-9663
Can	Westmount, Quebec, Norgay Entprs. Ltd.	514-932-3233

RF INDUSTRIES, Celltronics, 10040 Mesa Rim Rd., San Diego, CA 92121, Tel: 619-587-0656, FAX: 619-587-0049

RFL INDS., INC., (DBA) Dowty Elctrns. Co., PO Box 250 Prospect St., Brandon, VT 05733, Tel: 802-247-6811, FAX: 802-247-3946; Empl.: 130; *Sls. Mgr.:* Dan Boutin; *Dist. Mgr.:* Dan Boutin

RF MONOLITHICS, INC., 4441 Sigma Rd., Dallas, TX 75244, Tel: 214-233-2903, TELEX: 463-0088, FAX: 214-387-8148; FSC No.: 2U874; Empl.: 90; *Sls. Mgr.:* C. Baker, T. Hinkle, W. Spurgeon

R.F. POWER LABS., 22125 17th Ave. S.E., , Bothell, WA 98021, Tel: 206-481-8833, TELEX: 32-1042, FAX: 206-486-1002; FSC No.: 057143; Empl.: 17; *Sls. Mgr.:* Glenn Kalmus

RHG ELECTRONICS LABORATORY, INC., Adams Russell, 161 E. Industry Ct., Deer Park, NY 11729, Tel: 516-242-1100, TWX: 510-227-6083, FAX: 516-242-1222; Empl.: 214; *Sls. Mgr.:* David E. Krautheimer

FAX: 714-896-0971

RHOMBUS INDUSTRIES, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, Tel: 714-898-0960, TWX: 910-596-1826; Empl.: 60; *Sls. Mgr.:* L. G. Luthy; *Dist. Mgr.:* L. G. Luthy ..... **A•1622-1626**

Local Sales Offices & Reps

AL	Huntsville, CMR Cross Assocs.	205-883-5991
AZ	Tempe, A-5 Company	602-968-4923
CA	Escondido, Cirolia Sls., Inc.	619-743-3015
CA	Santa Clara, Westrep	408-988-8833
CO	Parker, A-5 Co.	303-841-3651
FL	Orlando, Perrott Assocs., Inc.	407-298-7748
ID	Boise, Cascade Comps.	208-343-9886
IL	Chicago, Rendell Sls. Co.	312-539-1820
MA	Malden, J. K. Assocs.	617-321-2922
MI	Warren, D.E.M. Elctrn. Sls.	313-595-9444
MN	Eden Prairie, Electro-Mark, Inc.	612-944-5850
NJ	Leonia, Peter E. Schmitt Co.	201-944-2806
OH	Cleveland, JMK Elctrns.	216-886-7100
PA	Phoenixville, Henry G. Richter, Inc.	215-495-6176
TX	Austin, Space Elctrns.	512-346-2215
TX	Houston, Space Elctrns.	713-266-9245
TX	Irving, Space Elctrns.	214-251-3636
Can	Toronto, Ont., True North Technlg., Ltd.	416-744-2233

Local Distributors

CA	Chatsworth, Sterling Elctrns.	818-407-8850
CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	Manhattan Bch., Prime Electro Prods.	213-379-3642
CA	Milpitas, California Capacitor, Inc.	800-624-9579
CA	San Diego, Sterling Elctrns.	619-271-6558
CA	San Jose, Eric Elctrns.	408-432-1111
CA	Tustin, Image Elctrns.	714-259-0900
CA	Tustin, Sterling Elctrns.	714-259-0900
MA	Danvers, Nu Horizons Elctrns. Corp.	617-777-8800
MN	Minneapolis, Stark Elctrns. Supp.	612-332-1325
NJ	Pine Brook, Nu Horizons Elctrns. Corp.	201-882-8300
NY	Amityville, Nu Horizons Elctrns. Corp.	516-226-6000
NY	E. Rochester, Nu Horizons Elctrns. Corp.	716-248-5980
WI	Mequon, Taylor Elec. Co.	414-241-4321
Can	Nepean, Ont., Carsten Elctrns. Ltd.	613-726-9250
Can	Scarborough, Ont., Carsten Elctrns. Ltd.	416-495-7705
Can	St. Laurent, Que., Carsten Elctrns. Ltd.	514-334-8321

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RICHARD-LEE CO., 3 Quine St., Cranford, NJ 07016, Tel: 201-276-0710, FAX: 201-276-6179; Empl.: 13

RICHARDS, ARKLAY S., CO., INC., 72 Winchester St., Newton Highlands, MA 02161-1793, Tel: 617-527-4385, FAX: 617-964-3746; *Sls. Mgr.:* L. K. Richards

RICHARDSON ELECTRONICS, LTD., 40W267 Keslinger Rd., LaFox, IL 60147, Tel: 800-323-1770, 312-232-6400, TELEX: 283461RichElecLFox, FAX: 312-208-2550; FSC No.: 5L804; Empl.: 625; *Sls. Mgr.:* William Burton; *Dist. Mgr.:* William Burton

RICHCO PLASTIC CO., P.O. Box 804238, Chicago, IL 60680, Tel: 312-539-4060, TWX: 910-221-1938, FAX: 312-539-6770; FSC No.: 06915; Empl.: 250; *Sls. Mgr.:* Ted E. Pavoris; *Dist. Mgr.:* Ted Pavoris

RIDGE TOOL CO., Sub. Emerson Elec. Co., 400 Clark St., Elyria, OH 44036, Tel: 216-323-5581, TELEX: 0243420, FAX: 216-323-5204

FAX: 308-235-2609

RISK, GEORGE, INDS., 802 S. Elm St., Kimball, NE 69145, Tel: 308-235-4645, TWX: 910-620-9040; FSC No.: 24229; Empl.: 126; *Sls. Mgr.:* Marge Elliott; *Dist. Mgr.:* Marge Elliott ..... **B•1883**

Local Sales Offices & Reps

AL	Huntsville, Effective Mktg.	205-233-2644
OR	Portland, Advanced Power Prods.	503-646-0994
AZ	Phoenix, J. F. Hurlbut Co.	602-952-2079
WA	Seattle, Advanced Power Prods.	206-885-0881
DC	Washington, Tech Reps, Inc.	703-370-2600
FL	Ft. Lauderdale, Newell-Hynes Assocs.	305-429-3207
GA	Atlanta, Effective Mktg.	404-948-6023
CA	San Jose, Context Engrg. Co.	408-748-8676
IL	Chicago, Chadra-Shilke & Assocs.	312-653-8126
IN	Indianapolis, Carter, McCormic & Peirce	317-244-1685
KS	Wichita, Buckman & Assocs.	316-267-2052
MA	Boston, Jodan Technlg.	617-863-8898
MI	Detroit, Carter, McCormic & Peirce	313-477-7700
MN	Minneapolis, Holmgren Assocs.	612-786-7641
MO	St. Louis, Buckman & Assocs.	314-947-4727
NY	New York, Morgan Elctrns.	516-549-5180
NC	Raleigh, Effective Mktg.	919-893-9650
OH	Cleveland, Carter, McCormic & Peirce	216-826-0400
OH	Dayton, Carter, McCormic & Peirce	513-836-0951
OH	Pittsburgh, Carter, McCormic & Peirce	412-826-3800
CA	Santa Ana, VR Elctrns.	714-558-1295
PA	Philadelphia, Jacobsen Assocs.	215-674-2937
TX	Dallas, Barry Sls.	214-234-0255
TX	Houston, Barry Sls.	713-784-5860
UT	Salt Lake City, J. F. Hurlbut Co.	801-595-8818
CO	Denver, J. F. Hurlbut Co.	303-279-7796

Local Distributors

CA	Los Angeles, Electric Switches	213-660-1310
NY	Huntington Station, Morgan Elctrn. Sls.	516-549-5180

RITTAL

FAX: 513-399-0500

RITTAL CORP., 3100 Upper Valley Pike, Springfield, OH 45504, Tel: 800-637-4425, TELEX: 241 354; Empl.: 60 ..... **C•1086**

Local Sales Offices & Reps

CA	Anaheim, Rittal Corp.-John Aram	714-527-7337
CA	San Diego, Rittal Corp.-Dave Glassner	619-272-2287
CA	San Jose, Rittal Corp.-Ray Snyder	408-258-6968
CO	Littleton, Elctrn. Comp. Sys.	303-762-9576
CT	Bristol, Rittal Corp.-David Joy	203-589-1134
FL	Bradenton, Rittal Corp.-Craig Taseff	813-747-1891
GA	Buford, Lakewood Inds. Int'l.	404-932-1106
IL	Downers Grove, Rockford Controls Co.	312-960-2046
IN	Indianapolis, Rockford Controls Co.	317-876-3360
KS	Shawnee Mission, H & H Vega Sls. Assoc.	913-432-6363
MI	Brighton, Rittal Corp./Chuck Marino	313-229-7072
MN	Shoreview, Ten-Tech	612-481-0274
MS	Jackson, Doby Assoc.	601-981-1138

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Datatronics
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MO	St. Charles, Power Transmission Sys.	314-928-1750
NJ	Clifton, R.O.I. Sls. Co.	201-340-1515
NY	N. Syracuse, Lachut Elect. Sls.	315-458-6629
NC	Charlotte, Rittal Corp.-Doug Yinger	704-597-7210
OH	Cleveland, Rittal Corp.-Dwight Patterson	216-251-4676
OH	Columbus, Rittal Corp.-Scott Puderbaugh	614-764-1108
OH	Springfield, Rittal Corp.-Hdqrs.	513-325-1141
OR	Portland, J.A. Gum Assoc.	503-288-5154
PA	Philadelphia, Rittal Corp.-Rich English	215-827-0928
PA	Pittsburgh, Madia-Paul Assoc.	412-331-3121
RI	Cranston, Rittal Corp.-Greg Demirjian	401-942-3344
TX	Dallas, The Power Connection	214-357-8207
VA	Mechanicsville, R.B. Marsland Assoc.	804-746-5770
Can	Toronto, Werner Pischel-PTS Engrg.	416-842-8680

Relco

FAX: 519-696-2670

RITZ ELECTRONICS/RELCO, 196 Queen St. N., New Dundee, Ont., Canada N0B 2E0, Tel: 519-696-2616; Empl.: 30; *Sls. Mgr.:* Leonard Snow; *Dist. Mgr.:* Leonard Snow ..... **C•1087; D•2041**

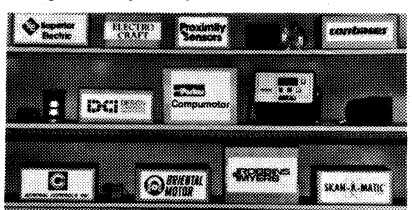
Local Sales Offices & Reps

CA	Redondo Bch.	213-318-9601
CA	Torrance, U.S. Power Converting Co.	213-316-9984
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616

Local Distributors

CA	Redondo Bch.	213-318-9601
CA	Torrance, Leonard Snow & Assocs./U.S. Power	213-316-9984
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616

RLC ELECTRONICS, INC., 83 Radio Cir., Mt. Kisco, NY 10549, Tel: 914-241-1334, TWX: 710-571-2103, FAX: 914-241-1753; FSC No.: 12598; Empl.: 75; *Sls. Mgr.:* Philip H. Wright; *Dist. Mgr.:* Henry D. Nibbe



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RMF PRODUCTS, INC., 1275 Paramount Pkwy., P.O. Box 520, Batavia, IL 60510, Tel: 312-879-0020, FAX: 312-879-6749; Empl.: 11; *Sls. Mgr.:* R. Frieders ..... **C•1613**

RMS COMPANY, Connector Division, 980 Osborne Rd., Minneapolis, MN 55432, Tel: 612-786-1520, FAX: 612-786-1771; Empl.: 50; *Sls. Mgr.:* Jack M. Lundeen

RMS TECHN., 11833 Canon Blvd., Ste 100, Newport News, VA 23601, Tel: 804-873-0100, FAX: 804-873-1512; FSC No.: 59606; Empl.: 42

ROANWELL, 180 Varick St., New York, NY 10014, Tel: 212-989-1090, TWX: 710-581-6555, FAX: 212-989-3285; FSC No.: 82872; Empl.: 80; *Sls. Mgr.:* Ray Lefebvre; *Dist. Mgr.:* Ray Lefebvre

RO ASSOCIATES

FAX: 408-744-1521

RO ASSOCIATES, INC., 246 Caspian Dr., Box 61419, Sunnyvale, CA 94088, Tel: 408-744-1450; FSC No.: 24230; Empl.: 90; *Sls. Mgr.:* R. D. Okada ..... **B•1028-1030; D•2042-2045**

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AL	Huntsville, Lee Assocs.	205-533-5896
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CA	Los Angeles, West Coast Reps.	714-558-6100
CA	San Jose, P & M Elctrns.	408-287-0402
CO	Denver, F.G. Mktg.	303-795-9176
DC	Washington, Gans & Pugh	703-527-3262
FL	Ft. Lauderdale, Panamtech	305-587-3769
FL	Orlando, Panamtech	407-679-5506
IL	Chicago, Mar-con Assocs. Inc.	312-675-6450
KS	Lenexa, Midtec	913-541-0505
MD	Baltimore, Gans & Pugh	703-527-3262
MA	Boston, Power Factor	508-234-6415
MN	Minneapolis, R J Inc.	612-866-3661
NM	Albuquerque, Fry-Gates, Inc.	505-262-1525
NY	Mt Vernon, Sonkin Assocs.	914-968-8282
OH	Centerville, Omega Sls., Inc.	513-434-5507
PA	Philadelphia, Gans & Pugh	215-699-6655
TX	Dallas, Barry Sls.	214-234-0255
TX	Houston, Barry Sls.	713-784-5860
WA	Seattle, West Coast Reps.	206-823-4493
Can	Missisauga, Ont., T. W. Wilson Sls.	416-677-8200
Can	Vancouver, BC, Tracan Elctrn. Western Ltd.	604-984-4141

ROBBINS & MYERS/ELECTRO-CRAFT, 6950 Washington Ave. So., Eden Prairie, MN 55344, Tel: 612-942-3600, FAX: 612-942-3636; *Sls. Mgr.:* Harry Webber

ROBERT SHAW INSTRUMENT DIV., Kendall Lane, Natick, MA 01760, Tel: 617-875-9711, TWX: 710-346-0398, FAX: 617-872-8437; Empl.: 600; *Sls. Mgr.:* David LeBlanc

ROBINSON-HALPERN PRODUCTS, Transicoil, Inc., One Apollo Rd., P.O. Box 248, Plymouth Meeting, PA 19462-0248, Tel: 215-825-9200, TWX: 510-660-9200, FAX: 215-834-1917; FSC No.: 12400; Empl.: 80; *Sls. Mgr.:* Robert C. Rehborn, Prod. Mgr.

ROBINSON NUGENT, INC., 800 East 8th St., New Albany, IN 47150, Tel: 812-945-0211, TWX: 810-540-4082, FAX: 812-945-0804; Empl.: 567; *Sls. Mgr.:* Terry Johnson; *Dist. Mgr.:* Vic Siccone

ROBISON ELECTRONICS, P.O. Box 8121, San Luis Obispo, CA 93403-8121, Tel: 805-544-8000, FAX: 805-544-8091; FSC No.: 19080; Empl.: 45

ROCHESTER INSTRUMENT SYSTEMS, 255 N. Union St., Rochester, NY 14605, Tel: 716-263-7700, TELEX: 978457, TWX: 82971, FAX: 716-262-4777; Empl.: 330

ROCKLAND INSULATED WIRE & CABLE, 87 Broadway, Haverstraw, NY 10927, Tel: 914-429-3103, FAX: 914-947-1712; FSC No.: 12111

ROCKLAND SCIENTIFIC CORPORATION, 10 Volvo Dr., Rockland Indl. Pk, Rockleigh, NJ 07647, Tel: 201-767-7900, TWX: 710-991-9852, FAX: 201-767-1890; Empl.: 60; *Sls. Mgr.:* M. Schiavone

ROCKWELL INT'L:SEMICONDUCTOR PRODUCTS DIVISION, 4311 Jamboree Rd., Newport Beach, CA 92660, Tel: 714-833-4600, TWX: 910-591-1698; FSC No.: 34576; Empl.: 1995; *Sls. Mgr.:* Jack Ordway, Dir. of Sls.; *Dist. Mgr.:* K. Reutemann

RODANN ELECTRONICS MFG. CO., 133 S. Brea Blvd, Brea, CA 92621, Tel: 714-529-1301; *Sls. Mgr.:* Alex Skarbek

RODELCO ELECTRONICS CORP., 111 Haynes Ct, Ronkonkoma, NY 11779, Tel: 516-981-0900, FAX: 516-981-1792; Empl.: 44

ROD-L ELECTRONICS, INC.

FAX: 415-326-1993

ROD-L ELECTRONICS, INC., 923 Hamilton Ave., Menlo Park, CA 94025, Tel: 415-322-0711, TWX: 296210; Empl.: 20; *Sls. Mgr.:* Tom Cooke ..... **D•1338-1339**

Local Sales Offices & Reps

CA	Menlo Park, ROD-L (factory)	415-322-0711
CO	Conifer, Energy Equip. Sls.	303-972-3335
IL	Elk Grove, Loren Green Assocs.	312-593-0282
IN	Indianapolis, Loren Green Assocs.	317-293-9827
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Cockeysville, Sci. Reps.	301-321-1411
MA	Reading, Scheinfein Assocs.	617-944-2304
MI	Detroit, Micro Sls	313-464-4520
MN	Minneapolis, Hei-Lite Sls	612-861-6051
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Fairfield, Addem Sls.	201-882-0993
NJ	Pennsauken, Sci. Reps.	609-662-5222
NY	De Witt, DB Assocs.	315-446-0220
OH	Centerville, Micro Sls.	513-433-8171
OH	N. Olmsted, Micro Sls	216-734-3080
OK	Tulsa, Spectra Sls	918-663-7188
OR	Beaverton, Core II Mktg	503-641-0877
TX	El Paso, Venturesearch	915-594-4094
TX	Houston, Spectra Sls.	713-270-8212
TX	Richardson, Spectra Sls.	214-234-3600
VA	Fairfax, Sci. Reps.	703-385-0600
WA	Redmond, Core II Mktg	206-885-4344
WA	Spokane, Core II Mktg	509-922-2971
WV	Pittsburg, Micro Sls	412-471-0105
Can	Ontario, Webster Instrs. Ltd.	416-625-0600

Local Distributors

CA	Menlo Park, Rod-L (Factory)	415-322-0711
Can	Ontario, Webster Instrs. Ltd.	416-625-0600

ROEAN INDUSTRIES, INC., 12970 Branford, Ste. C, Pacoima, CA 91331, Tel: 818-767-7047, FAX: 818-768-4974; Empl.: 8

ROGAN, 3455 Woodhead Dr., Northbrook, IL 60062, Tel: 312-498-2300, 800-423-1543, FAX: 312-498-2334; FSC No.: 86797; Empl.: 100; *Sls. Mgr.:* D. Pelletier; *Dist. Mgr.:* D. Pelletier

ROGERS CORP. DIV. POWER DISTBN.DIV., 5750 East McKellips Rd., Mesa, AZ 85205, Tel: 602-830-3370, FAX: 602-830-3370

ROGERS CORPORATION, Circuit Components Div., 2400 S. Roosevelt St., Tempe, AZ 85282, Tel: 602-967-0624, FAX: 602-967-9385

ROGERS CORPORATION, Circuit Materials Div., Box 4000, Chandler, AZ 85244, Tel: 602-963-4584, FAX: 602-732-9381

ROGERS CORPORATION, Flexible Interconnections Div., Box 700, Chandler, AZ 85244, Tel: 602-963-4584, TELEX: 140-223, TWX: 910-950-1961, FAX: 602-786-8490; *Sls. Mgr.:* Darrel Brasch

ROGERS CORPORATION, Microwave Materials Div., 100 S. Roosevelt Ave., Chandler, AZ 85244, Tel: 602-961-1382, FAX: 602-961-1302

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ROGERS CORPORATION, Soladyne Div., 7447 Convoy Ct., San Diego, CA 92111, Tel: 619-279-7872, FAX: 619-277-9105; FSC No.: 55655; *Sls. Mgr.:* Dale Reed; *Dist. Mgr.:* Rick Jansen

ROGERS CORP., One Technology Dr., Rogers, CT 06263, Tel: 203-774-9605, TWX: 710-448-0047; Empl.: 2500; *Sls. Mgr.:* Paul L. Anderson

ROHDE & SCHWARZ, INC., 4425 Nicole Drive, Lanham, MD 20706, Tel: 301-459-8800, FAX: 301-459-2810; FSC No.: 82199; Empl.: 65; *Sls. Mgr.:* David R. Cook

ROHM CORPORATION, 8 Whatney, Irvine, CA 92718, Tel: 714-855-2131, TWX: 910-595-1721, FAX: 714-855-1669; Empl.: 125

ROLM SYSTEMS DIVISION, IBM Corp., 4900 Old Ironsides Dr., M/S 605, Santa Clara, CA 95054, Tel: 408-986-1000; Empl.: 4,100; *Dist. Mgr.:* Ken Batorski

ROLYN OPTICS CO., 706 Arrowgrand Circle, Covina, CA 91722-2199, Tel: 818-915-5707/5717, TELEX: 67-0380, FAX: 818-915-1379

ROSE ELECTRONICS,INC. DIV. OF ENERGY PRODUCTS GROUP, 1991 Concourse Dr., San Jose, CA 95131, Tel: 408-943-0440, FAX: 408-943-0360; Empl.: 13; *Sls. Mgr.:* Bob Burres; *Dist. Mgr.:* Bob Burres

ROSE ENCLOSURES SYS., INC., 7330 Executive Way, Frederick, MD 21701, Tel: 301-696-9800, FAX: 301-969-9494; FSC No.: 4Y520/C0242; Empl.: 35; *Sls. Mgr.:* Warren Hudacek ..... **C•1088**

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IL	Chicago, Paddock Mktg.	312-452-7852
IA	Cedar Rapids, Tech. Elctrns.	319-366-5443
NY	Rochester, J. G. Welch Assocs.	716-244-1100
NC	Kernersville, Heritage Sls.	919-996-4374
OH	Chagrin Falls, Pine Sls.	216-247-6198
PA	Frazer, ICI	215-889-0650
WA	Federal Way, K. R. Jensen Sls.	206-874-2772
WI	Milwaukee, Taylor Mktg.	414-332-1211

Local Distributors

Can	Vancouver, BC, Memco	604-590-1553

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ROSS ENGINEERING CORP., 540 Westchester Dr., Campbell, CA 95008, Tel: 408-377-4621, TELEX: 858840, TWX: 910-590-8033; FSC No.: 23598; Empl.: 45; *Sls. Mgr.:* Hugh C. Ross; *Dist. Mgr.:* Hugh C. Ross ..... **B•1217, 1615; D•1340**

ROTEK INSTRUMENT CORP., 390 Main St., Waltham, MA 02254, Tel: 617-899-4611, TELEX: 928034; FSC No.: 06678; *Sls. Mgr.:* Eliot Warner

ROWE INDUSTRIES, INC., 6225 Benore Rd., P.O. Box 6877, Toledo, OH 43612, Tel: 419-729-9761, TWX: 810-442-1734; FSC No.: 82878; Empl.: 89; *Sls. Mgr.:* Nick Ladas; *Dist. Mgr.:* Nick Ladas ..... **C•1517-1519, 1922**

ROYONIC INC., 25345 Ave. Stanford, Ste. 201, Valencia, CA 91355, Tel: 805-257-0303, TELEX: 315672, ESYLNK: 62840158, FAX: 805-257-0802; Empl.: 11; *Sls. Mgr.:* Rory Stoner

RTE POWER/MATE, 2727 Kurtz St., San Diego, CA 92110, Tel: 800-843-8544, 619-299-3800, TWX: 910-335-1241, FAX: 619-291-2584; Empl.: 175

RTRON CORP., 8151 N. Ridgeway, Skokie, IL 60076, Tel: 312-679-7180, TWX: 910-223-0810; FSC No.: 19130; *Sls. Mgr.:* R. McLean

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MI	Grand Rapids, R.P. Urban & Assoc.	616-245-0511
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PA	Jenkintown, Arnold Assoc.	215-742-0600

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RUNDEL PRODS., Allied Control, 100 Relay Rd., Plantsville, CT 06479, Tel: 203-621-6771, FAX: 203-621-4932; FSC No.: 02288; *Sls. Mgr.:* M.A. Freyermuth; *Dist. Mgr.:* R.E. Munson ..... **B•1832-1833**

Local Sales Offices & Reps

CT	Plantsville, Allied Control	203-621-6771

RUSH ENTERPRISES INC.:A HEICO COMPANY, 20 Hampshire Drive, Hudson, NH 03051, Tel: 603-886-9460, FAX: 603-886-0372; Empl.: 12; *Sls. Mgr.:* Richard Mulcahy

RUSSTECH ENGINEERING COMPANY, INC., 23322 (D) Madero Road, Mission Viejo, CA 92691, Tel: 714-472-0880, FAX: 714-951-4601

RUSTRAK INSTRUMENTS, Mark IV Company, Rte. 2 & Middle Rd., E. Greenwich, RI 02818, Tel: 401-884-6800, 800-332-3202, TWX: 710-387-1500; Empl.: 250; *Sls. Mgr.:* John Olobri; *Dist. Mgr.:* John Olobri

RUTHERFORD RESEARCH, Box 249, Rutherford, NJ 07070, Tel: 201-933-2091; Empl.: 4; *Sls. Mgr.:* Dr. A. Blanck; *Dist. Mgr.:* Dr. A. Blanck

DYTRONICS

FAX: 614-885-8307

RYAN INTERNATIONAL CORP., 4800 Evanswood Dr., Columbus, OH 43229-6207, Tel: 614-885-3303; Empl.: 30 ..... **D•1341**

RYE INDUSTRIES, INC., 125 Spencer Pl., P.O. Box M, Mamaroneck, NY 10543, Tel: 914-698-0080; Empl.: 50

S A B NIFE, INC., Div. of Sonesson, P.O. Box 7366, 251 Industrial Blvd., Greenville, NC 27834, Tel: 919-830-1600, TELEX: 92-9407; Empl.: 150; *Sls. Mgr.:* Alan Feo; *Dist. Mgr.:* Alan Feo

SABRE COMMUNICATIONS CORP., 3400 Hwy 75 N., P.O. Box 536, Sioux City, IA 51102, Tel: 712-258-6690, FAX: 712-258-8250; FSC No.: 60348; *Sls. Mgr.:* Jerry W. Audus; *Dist. Mgr.:* Richard Krone

SABRITEC, 1733 Kaiser Ave., Irvine, CA 92714, Tel: 714-660-1970, TELEX: 678401, FAX: 714-660-9136; FSC No.: 58795; Empl.: 49

SAFE POWER SYSTEMS, Acme Electric Corporation, 528 W. 21st St., Tempe, AZ 85282, Tel: 602-894-6864, FAX: 602-921-0470; *Sls. Mgr.:* Rod Pullen; *Dist. Mgr.:* Jim Heidenreich

SAFT AMERICA INC., Box 1886, Valdosta, GA 31601, Tel: 912-247-2331, TELEX: 547620, TWX: 810-786-5866, FAX: 912-247-6680 ..... **D•1520-1525**

SAFT AMERICA INC., 107 Beaver Ct., Cockeysville, MD 21030, Tel: 301-771-3200, TWX: 710-862-2637 ..... **D•1446**

Local Sales Offices & Reps

CA	Chatsworth, Mike Murphy, Zone Mgr.	818-998-0626
CA	Grenada Hills, Don Sandler	818-360-1853
CA	Redwood City, John Marciano	415-365-4539
FL	Boca Raton, Vince Malkiewicz	305-395-1535, 800-328-5049
GA	Marietta, Doug Thompson, Zone Mgr.	404-992-6950
IL	Carol Stream, Tom Roberts	312-690-8035
IL	Oak Forest, Dan Misheck, Zone Mgr.	312-687-6690
MA	W. Hanover, Chuck Dare	617-871-0204
MN	Maplewood, George Petrich	612-770-0082
OH	Brownsville, Roy Edgar	216-861-1877
PA	Bensalem, Milton Batley	215-831-9520

Local Distributors

AZ	Tempe, Anjon Entprs.	602-894-1332
CA	Chatsworth, Mil-Com Dist. Inc.	818-998-3111
CA	Mountain View, Energy Sls.	415-969-0800
CA	N. Hollywood, CH & M Entprs.	818-980-7358
CA	San Rafael, Elctrns. Plus	415-457-0466
CO	Englewood, Indl. Elctrns.	303-694-9444
FL	Altamonte Springs, TNR Tech., Inc.	800-346-0601
FL	Ft. Lauderdale, P.A. Intl.	305-566-5799
FL	Hialeah, Pro Battery Specialists	305-944-8800
GA	Decatur, ELS Prods.	800-521-2903,800-334-5066
IL	Downers Grove, Telecomm. Dvcs. (TDI)	800-323-7307,312-971-3460
IL	Rosemont, Advent Elctrns.	312-297-6200
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
MA	Billerica, A. W. Mayer	617-229-2255
MA	Danvers, Generation Elctrns.	617-777-4866
MA	Middleboro, Glynn Elctrns.	617-947-4262
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	Minneapolis, D.C. Battery Prods, Inc.	612-721-8547
NM	Albuquerque, Alliance Elctrns.	505-292-3360
NY	Deer Pk., TNR Tech., Inc.	516-242-4800
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Charlotte, Electro Sys., Inc.	704-525-2421
OH	Cincinnati, Schuster Elctrns.	216-425-8134
PA	Bensalem, Avex Elctrns.	215-638-3300
TN	Mt. Juliet, Batteries Unltd.	615-754-8179
TX	Houston, K-Tec (Kent) Elctrns.	713-780-7770
TX	Spring, Battery Pak, Inc.	713-367-9393, 1-800-245-1138
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
VA	Falls Church, Perrott Engrg. Labs, Inc.	703-532-0700
WA	Redmond, Energy Sls. (N.)	206-883-2343

SAFT AMERICA, INC., Portable Battery Division, 711 Industrial Blvd., Valdosta, GA 31601, Tel: 912-247-2331, TELEX: 547-620; Empl.: 1200; *Sls. Mgr.:* Michael Marcoux ..... **D•1446, 1520-1525**

Local Sales Offices & Reps

CA	Chatsworth, SAFT America, Inc.	818-998-0626
CA	Granada Hills, SAFT America, Inc.	818-360-1853
CA	Redwood City, SAFT America Inc.	415-365-4539
FL	Boca Raton, SAFT America, Inc.	305-338-7730
GA	Marietta, SAFT America, Inc.	404-992-6950
IL	Carol Stream, SAFT America, Inc.	312-690-8035
IL	Oak Forest, SAFT America, Inc.	312-687-6690
MA	Hanover, SAFT America, Inc.	617-871-0204
MN	Minneapolis, SAFT America, Inc.	612-770-0082
OH	Columbus, SAFT America, Inc.	216-861-1877
PA	Philadelphia, SAFT America, Inc.	215-831-9520

Local Distributors

AZ	Phoenix, Lynntronics	602-433-0288
CA	Carlsbad, Energy Concepts	619-438-2202
CA	Chatsworth, Mill Comm. Distrs., Inc.	818-998-3111
CA	Mountain View, Energy Sls.	415-969-0800
CA	N. Hollywood, C.H. & M	818-982-3150
CA	San Rafael, Elctrns. Plus	415-457-0466
CO	Englewood, Industrial Elctrns.	303-694-9444
FL	Altamonte Springs, TNR Tech.	407-767-2411
FL	Hialeah, Pro Battery	305-884-4040
GA	Decatur, ELS Prods.	404-981-2288
IL	Downers Grove, Telecomms. Dvcs., Inc.	312-971-3460
IL	Lisle, Jabro Batteries	312-964-9358
MA	Billerica, A. W. Mayer Co., Inc.	617-229-2255
MA	Middleboro, Glynn Elctrns.	508-947-4262
MI	Livonia, R. S. Elctrns.	313-525-1155
MN	St Louis, D. C. Battery Prods. Inc,	612-646-7478
NM	Albuquerque, Alliance Elctrns., Inc.	505-292-3360
NY	Deer Park, TNR Tech., Inc.	516-242-4800
NY	Flushing, W & W Assocs.	212-961-2103
NC	Charlotte, Electro Sys., Inc.	704-525-2421
PA	Bensalem, Avex Elctrns. Corp.	215-638-3300
TN	Mt. Juliet, Batteries Unlimited	615-754-8179
TX	Houston, Kent Elctrns.	713-780-7770
TX	Richardson, Kent Elctrns.	214-669-2600
TX	Spring, Battery Pk.	713-367-9393
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
VA	Falls Church, Perrott Engrg. Labs, Inc.	703-532-0700
WA	Redmond, Energy Sls.	206-883-2343

SAGE LABORATORIES, INC., 11 Huron Dr., Natick, MA 01760, Tel: 508-653-0844, TWX: 710-346-0390, FAX: 508-653-5671; FSC No.: 07180; Empl.: 43; *Sls. Mgr.:* Tony Cieri

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Local Sales Offices & Reps

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CA	Alhambra, C.E. Mello Co.	818-282-1405
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
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OK Tulsa, Advance Tech. Sls. 918-664-0482
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PA Wayne, Hodgins Assocs. 215-688-9056
TX Dallas, Advance Tech. Sls. 214-340-1300
WA Bothell, Temco Northwest 206-821-5434
Can Scarborough, Ont., Burgess Switch Co. 416-299-0852

SAINT SWITCH, INC., 103 N. 11th Ave.,Box 604, St. Charles, IL 60174, Tel: 312-377-3779, FAX: 312-377-7438; FSC No.: 60198; Empl.: 30

SAMARIUS PRECISION INSTRUMENTS, INC., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418, Tel: 203-735-7405, TWX: 710-451-2495, FAX: 203-732-8975; FSC No.: 18065; Empl.: 40 ..... **A•2143**

Local Sales Offices & Reps
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TX Houston, Barnhill Assocs. 713-776-2382
TX Richardson, Barnhill Assocs. 214-231-2573
TX San Antonio, Barnhill Assocs. 512-694-5575
UT Orem, Barnhill Assocs. 801-226-1239
VA Fairfax, Scientific Assocs. 703-385-0600
WA Bellevue, Syntek 206-462-7700
Can B.C., Jerome & Francis Co. 604-986-1286
Can Ontario, Amos, Mitchell & Assocs. 416-584-2238

SCHAUER MANUFACTURING, 4500 Alpine Ave., Cincinnati, OH 45242, Tel: 513-791-3030, FAX: 513-791-7192; Empl.: 195; *Sls. Mgr.:* A. A. Groenewold; *Dist. Mgr.:* Dan Shaw

SCHENCK PEGASUS CORP., 2890 John R, Troy, MI 48083, Tel: 313-689-9000, TWX: 810-232-1529, FAX: 313-689-8578; Empl.: 130; *Sls. Mgr.:* David Sallberg

SCHLAGE ELECTRONICS, 5452 Betsy Ross Drive, Santa Clara, CA 95054-1102, Tel: 408-727-5170, FAX: 408-727-6707; Empl.: 200

SCHLEGEL CORP., P.O. Box 23197, Rochester, NY 14692, Tel: 716-427-7200, TELEX: 6854121, FAX: 716-427-9993; Empl.: 250; *Sls. Mgr.:* Jay C. Metzler ..... **C•1747**

SCHLUMBERGER INSTRUMENTS, Schlumberger Technologies, 20 North Avenue, Burlington, MA 01803, Tel: 617-229-4825, FAX: 617-229-4885; FSC No.: 1T316; Empl.: 50; *Sls. Mgr.:* Al Prosuk

SCHONSTEDT INSTRUMENT CO., 1775 Wiehle Ave., Reston, VA 22090, Tel: 703-471-1050, TWX: 710-833-9880; Empl.: 45

SCHOTT CORP., 1000 Parkers Lk. Rd., Wayzata, MN 55391, Tel: 612-475-1173, TWX: 910-576-2964; FSC No.: 80023; Empl.: 325; *Sls. Mgr.:* A. Schmitt

Local Sales Offices & Reps
MA Needham, Hatch Assocs. 617-963-3306

SCHOTT ELECTRONICS, 42 Silvermine Road, Seymour, CT 06483, Tel: 203-881-0102, TWX: 710-451-8911, FAX: 203-881-0098; Empl.: 150; *Sls. Mgr.:* Ross Wieringa

SCHOTT GLASS TECHNOLOGIES, INC., 400 York Ave., Duryea, PA 18642, Tel: 717-457-7485, TWX: 510-671-4535, FAX: 717-457-6960; FSC No.: 23-169-1403; Empl.: 500; *Sls. Mgr.:* D.J. Dougherty

SCHRACK NORTH AMERICA CORP., 1995 Pond Rd., Ronkonkoma, NY 11779-7209, Tel: 516-737-0099, FAX: 516-737-2550; Empl.: 10; *Sls. Mgr.:* John Walsh; *Dist. Mgr.:* James Amor ..... **B•1616-1622**

Local Sales Offices & Reps
AL Huntsville, DHR Mktg. 205-533-5165
AZ Glendale, Aspen Power 602-931-9289
CA Arcadia, Van Gott & Assocs. 818-445-9728
CA Santa Rosa, Cummings & Assocs. North 408-247-8656
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IN Indianapolis, C.C. Elctrns. 317-255-1508
MO Hazelwood, Acorn Elctrns. 314-731-2002
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NJ Lawrenceville, DVS Co. 609-896-1112
NJ Westwood, Jarms 201-666-9390
NY Liverpool, Malcom M. Hare 315-457-6859
NC Raleigh, DHR 919-781-1961
SC Greenville, DHR Mktg. 803-235-3594
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CA City of Industry, ITAL 818-968-8515
CA San Rafael, Elctrns. Plus 415-457-0466
CO Denver, CSID 303-292-9594
CT Middlefield, Control Des. Supp. 203-349-0200
FL Ft. Lauderdale, Southeastern Elctrns. 305-563-4131
FL Opa Locka, Baron Elctrn. Sls. 305-685-1400
GA Stone Mountain, Control Des. Supp. .. 404-979-3500
ID Boise, Bolen's Control House 208-363-5280
IL Carol Stream, Lectro Comps. 312-690-0520
IN Indianapolis, Control Des. Supp. 317-788-4559
IA Marion, Control Des. Supp. 319-373-2923
KS Kansas City, Control Des. Supp. 913-362-4248
ME Gray, Longhill Electro. Tech. 207-657-2183
MA Norwood, Emtel 617-769-9500
MN Minneapolis, Control Des. Supp. 612-721-1628
MO St. Louis, Control Des. Supp. 314-426-3150
NJ Lodi, Nidisco 201-773-1771
NJ Paramus, Electro Control Supp. 201-836-2112
NJ Pennsauken, IMS Distbn. 609-662-1770
NC Pineville, Control Des. Supp. 704-588-4410
OR Portland, O4 Controls, Inc. 503-231-8058
PA Malvern, Control Des. Supp. 215-296-0150
TX Dallas, Control Des. Supp. 214-358-1441
WA Seattle, Stusser Elec. Co. 206-624-8770

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Local Sales Offices & Reps
AL Huntsville, 20th Century Mktg., Inc. 205-933-9281
AZ Scottsdale, Luscombe Engr. 602-949-9333
CA Los Gatos, Luscombe Engrg. 408-370-2020
CA Pasadena, Luscombe Engr. 213-684-2000
CA San Diego, Luscombe Engr. 619-549-9699
CO Longmont, Luscombe Engrg. 303-772-3342
FL Altamont Springs, Carter Assocs. 305-671-6800
GA Norcross, 20th Century Mktg., Inc. 404-446-1999
IL Hillside, Cadre Tech. Rep. 312-449-3900
IA Marion, MSB Assocs. 319-377-6261
KS Roeland Park, MSB Assocs. 913-432-2131
MD Baltimore, Miller & Dietz Co. 215-647-7373
MI Troy, C. B. Jensen 313-643-0506
MN Minneapolis, D. A. Case Assoc. 612-869-3700
MO St. Charles, MSB Assocs. 314-946-5577
NH Salem, Sales Engr. 603-893-5521
NJ Englewood, Sprung-Nussbaum 201-569-5666
NY Clifton Park, Bastian Sls. 518-452-2026
NY E. Syracuse, Bastian Sls. 315-437-1482
NY Fairport, Bastian Sls. 716-223-0237
NC Cary, 20th Century Mktg., Inc. 919-481-3370
OH Aurora, EMA 216-562-6104
OH Centerville, EMA 513-433-2800
OR Tigard, Elctrn. Comps. Sls. 503-245-2342
PA Huntington Valley, Omega Elctrn. Sls. 215-947-4135
TN Knoxville, 20th Century Mktg., Inc. 615-966-2099
TX Garland, CMZ 214-681-1414
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301

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SCHURTER, INC., 1016 Clegg Ct, Petaluma, CA 94952, Tel: 707-778-6311, TELEX: 176-084; FSC No.: 61935; *Sls. Mgr.:* Bruno H. Schurter ..... **A•1670-1671; B•1408, 1835; C•1520-1523**

Local Sales Offices & Reps
AL Athens, Effective Mktg. Force 205-233-2947
AZ Scottsdale, Elctrns. Tech. Sls. Assocs., Inc. 602-941-9137
AR Little Rock, Doby Assoc. 501-221-0326
CA Fullerton, Gru Assocs. 213-691-2993
CA Moraga, Ruppert Sls. & Engrg. 415-376-8040
CA San Jose, Ruppert Sls. & Engrg. 408-998-8717
CO Lakewood, Cristee-Meade Co. 303-232-0287
FL Pompano, IMR, Inc. 305-942-2449
GA Lawrenceville, Effective Mktg. Force .. 404-925-2060
GA Lithia Springs, Effective Mktg. Force .. 404-948-4209
IL Arlington Hgts., MJ Petersen & Assoc., Ltd. 312-577-8200
IN Carmel, Newton & Assocs. 317-848-2016
MN Minnetonka, Frank Anthony Mktg. 612-934-0773
MS Jackson, Doby Assocs. 601-981-1138
NH Nashua, Bell Controls 603-882-6984
NJ Ho-Ho-Kus, D. J. Fisher Co. 201-652-0090
NJ Medford, Champion Elctrn. Sls. Co. 609-983-0932
NY Fairport, TAC Sls, Inc. 716-425-1070
NC Lillington, Effective Mktg. Force 919-893-9650
OH Beachwood, Electronic Salesmasters 216-831-9555
OR Portland, Westmark 503-641-8780
TX Dallas, Reese & Assocs. 214-351-0703
WA Seattle, Westmark 206-281-4025

Local Distributors
CA Scotts Valley, Quail Elctrns. 408-354-3643
CA Sunnyvale, Target Elctrns., Inc. 408-734-5611
IL Elk Grove Village, Nu-Way Elctrn. Distrbs. Inc. 312-437-7120
MD Rockville, FIC Corp. 800-638-6594
MA Wilmington, JV ELctrns. 617-657-6523
OH Strongsville, Fuse World 216-238-1330
OR Tualatin, Moore Elctrns., Inc. 503-692-5333
TX Dallas, Fuses, Inc. 214-341-6407
Can Markham, Ont., Birde Mktg. 416-477-7722

SCHUSTER ELECTRONICS, 8 Beattie Court, Huntington, NY 11530, Tel: 516-271-0590; *Sls. Mgr.:* Max Schuster

SCIENCE ACCESSORIES CORP., 200 Watson Blvd, Stratford, CT 06497, Tel: 203-386-9978, TELEX: 964300 SAC SPRT, FAX: 203-381-9270; Empl.: 40; *Sls. Mgr.:* H. A. Cleveland

SCIENCE & ENGRG. CONSULTANTS, INC., 11800 Sunrise Valley Dr., Ste. 300, Reston, VA 22091, Tel: 703-860-0600, FAX: 703-281-9778; Empl.: 2; *Sls. Mgr.:* Dr. Joseph T. Siewick

SCIENCE/ELECTRONICS, P. O. Box 986, Dayton, OH 45401-0986, Tel: 513-859-5555, FAX: 513-859-7930; Empl.: 25; *Sls. Mgr.:* E. E. Pohl; *Dist. Mgr.:* J. Tanksley

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SCIENTIFIC-ATLANTA, INC., See Optima Enclosures

SCIENTIFIC COLUMBUS, INC., Esterline Corporation, 1900 Arlingate Lane, Columbus, OH 43223, Tel: 614-274-0400, TELEX: 245-426, FAX: 614-272-2288; *Sls. Mgr.:* Donald M. Yore

SCIENTIFIC COMMUNICATIONS, INC., 3425 Kingsley Rd., Garland, TX 75041, Tel: 214-271-3685, TWX: 910-860-5172; *Sls. Mgr.:* Donald G. Luiken

SCIENTIFIC RESEARCH CORP., See TRAK Microwave Corp.

SCIENTIFIC TECHNOLOGIES, Optical Sensor Div. Inc., 31069 Genstar Rd., Hayward, CA 94544, Tel: 415-471-9717, TELEX: 34-5506, FAX: 415-471-9752; Empl.: 100

SCITEQ ELECTRONICS, INC., 8401 Aero Dr., San Diego, CA 92123, Tel: 619-292-0500, TELEX: 882008, FAX: 619-292-9120; FSC No.: 70561; Empl.: 35; *Sls. Mgr.:* Phil Feinberg

SCOPE INCORPORATED, 1860 Michael Faraday Dr., Reston, VA 22090, Tel: 703-471-5600, TWX: 710-883-1178; Empl.: 260; *Sls. Mgr.:* Robert W. Griffin, Sls. Mgr. VP

SCREEN DATA CORP., 65 Elm St, Dover, NJ 07801, Tel: 201-887-7713, 800-248-1212, TELEX: 710-387-209, FAX: 201-633-7119

SC TECHNOLOGY, INC., 2450 Armstrong St., Livermore, CA 94550, Tel: 415-373-9230, FAX: 415-373-9416; *Sls. Mgr.:* Susan L. Karl

SCREENPRINT DOW, See Dow Switch, Div. of Screenprint Dow

SEABOARD ELECTRONICS, 70 Church St, New Rochelle, NY 10805, Tel: 914-235-8073, TELEX: 646289; Empl.: 40; *Sls. Mgr.:* Bernie Klempner; *Dist. Mgr.:* Subhash Grandhi

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FAX: 201-664-8544

SEACOR, INC., 123 Woodland Ave, Westwood, NJ 07675, Tel: 201-666-5600; Empl.: 45 ..... **A•1170**

Local Sales Offices & Reps

CT	Beacon Falls, KSA of England	203-756-8040
IL	Rolling Meadows, Heartland Tech. Mktg.	312-577-9222
MA	Sudbury, KSA of New England	617-443-5881
MN	St. Paul, The Johnson Co.	612-641-1878
NY	Rochester, Upstate Engrg. Sls.	716-225-2383
NC	New Hill, Tom Santel Assocs.	919-362-4091
OH	Powell, Val-Skol Sls.	614-889-0174
OH	Willoughby, Val-Skol Sls.	216-942-6021
OK	Tulsa, Encore Technlg. Co.	918-665-3562
PA	King of Prussia, Freedman-Malta Assocs.	215-337-9211
SC	Mauldin, Carl Hart Assocs.	803-288-2323
TX	Richardson, Encore Technlg. Co.	214-669-0232
TX	Round Rock, Encore Technlg. Co.	512-388-7930
WI	Brookfield, Heartland Tech. Mktg.	414-796-1128

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CA	Garden Grove, Natl. Cap. Supp.	714-892-7744
CA	San Jose, Compass Comps.	408-432-7575
CT	Wallingford, Mid-State Elctrns.	203-265-9900
FL	Ft. Lauderdale, Brothers Elec.	305-561-6700
FL	Ft. Lauderdale, NRC Elctrns.	305-772-4500
IL	Bensenville, Voyager Elec.	312-860-1300
IL	Schaumburg, Q.P.S.	312-884-6620
MA	Burlington, T.L.C.	617-273-0140
MA	Framingham, Now Elctrns.	617-235-9501
MA	N. Chelmsford, Pilgrim Elec.	617-454-9889
MN	Eitzen, Capacitor Assocs.	507-495-3130
MN	Fridley, Voyager Elctrns.	612-571-7766
NH	Hudson, T.N.T.	603-880-8300
NJ	E. Brunswick, Brothers Elctrns.	201-238-2200
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Melville, S.A.I.	516-293-2710
NY	Ronkonkoma, Spectrum Comp.	516-737-6900
TX	Dallas, Off-the-Shelf Comps.	214-238-0808
TX	Ft. Worth, C & W Supp.	817-831-0395
TX	Richardson, G.T.T. Elctrns.	214-234-1555
WA	Seattle, Vesco Elctrns.	206-575-3607

SEA DATA, INC., One Bridge St, Newton, MA 02158, Tel: 617-244-8191, TELEX: 951107; Empl.: 30; *Sls. Mgr.:* D. Crouse

SEAFAB, INC., 14648 N.E. 95th St, Redmond, WA 98052, Tel: 206-881-2778, FAX: 206-882-0707; Empl.: 80; *Sls. Mgr.:* Bruce Murray

SEALTRON, INC., 9705 Reading Road, Cincinnati, OH 45215, Tel: 513-733-8400, FAX: 513-733-0131; Empl.: 140; *Sls. Mgr.:* James Dawson

SEASTROM MANUFACTURING CO., INC., 701 Sonora Ave., Glendale, CA 91201, Tel: 213-245-9121, FAX: 818-246-6803; FSC No.: 86928; Empl.: 75; *Sls. Mgr.:* Bob Seastrom

SEATTLE AIRCRAFT BEARINGS, 2835 82nd Ave. S.E., P.O. Box 20, Mercer Island, WA 98040, Tel: 206-232-4800, TWX: 910-444-4126, FAX: 206-236-5480; Empl.: 40; *Sls. Mgr.:* Jim Innes ..... **C•1686-1688**

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CA	San Diego, Mechatronics SAB	619-944-1184
CA	San Jose, SAB Mechatronics	415-829-4014
FL	Miami Lakes, Mechatronics SAB	305-822-5823
TX	Dallas, SAB Mechatronics	817-488-6634
NH	Nashua, SAB Mechatronics	603-888-3054

SECTOR MICROWAVE IND. INC., 999 Grand Blvd., Deer Park, NY 11729, Tel: 516-242-2300, TWX: 510-227-6075, FAX: 516-242-8158; Empl.: 40; *Sls. Mgr.:* Thomas Nelson

SECURITY PLASTICS, INC., 14427 N.W. 60th Ave., Miami Lakes, FL 33014, Tel: 305-823-5440, FAX: 305-557-1431; Empl.: 400; *Sls. Mgr.:* Nelson Rodriguez

SEEQ TECHNOLOGY, 1849 Fortune Dr., San Jose, CA 95131, Tel: 408-432-7400, 1-800-3EEPROM, TELEX: 296609, TWX: 9103382313, FAX: 408-432-9549; Empl.: 530; *Sls. Mgr.:* Phil Ortiz, V.P Worldwide Sls.; *Dist. Mgr.:* Carolyn Troland

Seiko Instruments

FAX: 213-517-7792

SEIKO INSTRUMENTS U.S.A., INC., Components Div., 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-517-7770; *Sls. Mgr.:* David Brooks; *Dist. Mgr.:* Lee Guio ..... **A•1483; B•1109; D•1110**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech	205-880-0592
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
AZ	Tucson, Fred Board Assocs.	602-299-1508
CA	Irvine, Groh Assoc. 714-837-9871,	619-696-0054
CA	San Diego, Groh Assocs.	619-453-7572
CA	San Jose, Exis, Inc.	408-433-3047
CO	Aurora, Electrodyne	303-695-8903
CT	Madison, Focus Elctrn. Sls.	203-245-4314
FL	Plantation, Gallagher & Assocs.	305-473-2101
GA	Norcross, Electro-Mech	404-447-6478
IL	Elk Grove Village, TriStar Grp., Inc.	312-593-0200
IN	Ft. Wayne, Electro Rep Inc.	219-484-2682
IN	Indianapolis, Electro Rep Inc.	317-842-7202
IA	Cedar Rapids, J.R. Sls. Engrg., Inc.	319-393-2232
KS	Overland Park, Electri-Rep	913-649-2168
MI	Grand Rapids, R.P. Urban & Assoc.	616-245-0511
MD	Middleton, S. T. Woolard Co.	301-371-4500
MA	Taunton, Focus Elctrns. Sls.	508-824-3840
MI	Detroit, R.P. Urban & Assoc.	313-535-2355
MN	St. Paul, Stan Clothier Co.	612-944-3456
MO	St. Louis, Electri-Rep	314-993-4421
NM	Albuquerque, Fred Board Assocs.	505-888-1121
NY	Cazenovia, S.I. Woolard Co.	315-655-6145
NY	E. Syracuse, Nycom, Inc.	315-437-8343
NC	Raleigh, Electo-Mech	919-790-9300
NC	Raleigh, Electro-Mech	919-790-9300
OH	Brunswick, J. N. Bailey & Assocs.	216-273-3798
OH	Columbus, J. N. Bailey & Assocs.	614-262-7274
OH	New Lebanon, J. N. Bailey & Assocs.	513-687-1325
OR	Tigard, Electronic Comp. Sls.	503-245-2342
PA	Frazer, Industrial Comps., Inc.	215-889-0650
TN	Jonesboro, Electro-Mech	615-753-2964
TX	Austin, TL Mktg.	512-467-7370
TX	Dallas, TL Mktg.	214-484-6800
TX	Houston, TL Mktg. Inc.	713-589-2763
UT	Salt Lake City, Electrodyne	801-264-8050
WA	Mercer Island, Electronic Comp. Sls.	206-232-9301
WA	Spokane, Electronic Comp. Sls.	509-456-0100
WI	Brookfield, TriStar Grp., Inc.	414-782-2670

Local Distributors

AZ	Phoenix, Aerospace S.W.	602-582-2779
AZ	Phoenix, Sterling Elctrns.	602-268-2121
CA	Agoura Hills, Pacesetter Elctrns.	818-991-3984
CA	Anaheim, Pacesetter Elctrns.	714-779-5855
CA	Irvine, OBI	714-250-9003
CA	Mountain View, I/O Sls.	415-968-1080
CA	Oakland, Paragon Sys. Inc.	415-452-1024
CA	Reseda, Jan Dvcs.	818-708-1100
CA	San Diego, Added Value Elctrns.	619-792-0251
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Jose, Pacesetter Elctrns.	408-436-8822
CA	Sunnyvale, Pacesetter Elctrns. USA	408-734-5470
CA	Tustin, Added Value Elctrns.	714-259-8258
CA	West Lake Village, Added Value Elctrns.	818-889-2861
CO	Englewood, Sterling Elctrns.	303-792-3939
CT	Wallingford, Sterling Elctrns.	203-265-9535
FL	Melbourne, Greene-Shaw Co. Inc.	407-951-3636
FL	Tampa, Lectro Distrs.	813-960-1631
ID	Boise, Radar Elec.	208-336-2227
IL	Northbrook, Classic Comps.	312-272-9650
IN	Indianapolis, RM Elctrns.	317-291-7110
IA	Cedar Rapids, Dee Elctrns., Inc.	319-365-7551
KS	Lenexa, Sterling Elctrns.	913-492-5406
LA	West Wego, Sterling Elctrns.	504-436-1418
MD	Middletown, Current Comps.	301-473-5333
MA	Norwood, Emtel	617-769-9500
MA	Sharon, Adcour	617-784-8123
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Grand Rapids, RM Elctrns.	616-531-9300
MN	Minneapolis, Aerospace Computer Supps.	612-884-4725
MN	Minneapolis, Sterling Elctrns.	612-831-2666
NJ	S. Plainfield, Sterling Elctrns.	201-769-7000
NM	Albuquerque, Sterling Elctrns.	505-884-1905
NY	E. Syracuse, Add Elctrns.	315-437-0300
NY	Hewlett, Metropolitan Sls.	516-599-7900
NY	Mt. Vernon, QAR Elctrns.	914-699-2224
NY	Victor, Add Elctrns.	716-924-4760
OH	Cincinnati, Schuster Elctrns.	513-489-1400
OK	Tulsa, Sterling Elctrns.	918-663-2410
OR	Portland, Radar Elec./Porland	503-232-3404
OR	Tualatin, Moore Elctrns.	503-692-5333
PA	Exton, VSH Elctrns.	215-363-2250
PA	Pittsburgh, CAM/RPC Elctrns.	412-782-3770
PA	Wayne, Peak Elctrns.	215-293-9000
TX	Austin, Sterling Elctrns.	512-836-1341
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Sterling Elctrns.	713-627-9800
UT	West Valley City, Added Value	801-975-0245
VA	Herndon, Sterling Elctrns.	703-742-8400
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	New Berlin, Classic Comps.	414-786-5300
CO	Wheatridge, Added Value Elctrns.	303-422-1701
Can	Burnaby, B.C., ITT/RAE Multicomps.	604-291-8866
Can	Concord, Ont., ITT Multicomps.	416-736-1144
Can	Markham, Ont., Semad Elctrns./DEW Elctrns.	416-475-8500

SEIKO INSTRUMENTS U.S.A., INC., Robotics/Automation Div., 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-517-7850, FAX: 213-517-7792; *Sls. Mgr.:* K. Curtis

SEKAI ELECTRONICS OF AMERICA, INC., 14700 E. Firestone Blvd., Suite 122, La Mirada, CA 90638, Tel: 714-670-1854, TELEX: 882756, FAX: 714-670-1855; FSC No.: 8V398; Empl.: 6; *Sls. Mgr.:* Larry Klementowski

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FAX: 714-739-1507

SELCO PRODUCTS CO., SEL Sales, Inc., 7580 Stage Rd., Buena Park, CA 90621, Tel: 714-521-8673, TELEX: 65-5457; Empl.: 18; *Sls. Mgr.:* Bill Wilkinson; *Dist. Mgr.:* Bill Keneipp ..... **B•1917; C•1614**

Local Sales Offices & Reps

AR	Hot Springs, ASI	501-767-5444
CA	Arcadia, HMC, Inc.	818-447-0958
CA	La Mesa, Summit Sls.	619-697-0646
CA	Sunnyvale, Pass Assocs.	408-735-9040
IL	Elk Grove VL, Parcom Inc.	312-228-6360
MA	Andover, Crawford Assocs.	617-470-2122
MS	Horn Lake, ASI	601-342-4989
NY	Naples, LMS Sls. Assoc.	716-374-2626
OR	Beaverton, Luscombe Engrg.	503-636-6664
PA	Hatboro, J. S. Wurts Co.	215-674-3562
TX	Dallas, Titan- Hill Co.	214-241-1398
WA	Bellevue, Luscombe Engrg.	206-223-1541

Local Distributors

CA	Arcadia, Parco	818-447-0958
IL	Wheeling, Hawk Elctrns.	312-459-4091
MA	Andover, Crawford Assocs.	617-470-2122
NY	New York City, Martin Audio/Video	212-541-5900

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SEMICOA, 333 McCormick Ave., Costa Mesa, CA 92626, Tel: 714-979-1900, TELEX: 678-315, TWX: 910-595-1961, FAX: 714-557-4541; FSC No.: 34156; Empl.: 85; *Sls. Mgr.:* M. Gregson

SEMICON COMPONENTS, INC., Div. of Semicon, Inc., 10 North Ave., Burlington, MA 01803, Tel: 617-272-9015, TWX: 710-332-1919; Empl.: 300; *Sls. Mgr.:* Jack Lawrence

SEMICONDUCTOR CIRCIUTS, INC., Emerson Electric, Co., 49 Range Rd., Windham, NH 03087, Tel: 603-893-2330, FAX: 603-893-6280; Empl.: 100; *Sls. Mgr.:* Dale Raveney, VP Mktg. & Sls.

SEMICONDUCTOR PACKAGING MATERIALS CO., 431 Fayette Ave., Mamaroneck, NY 10543, Tel: 914-698-5353, ESYLNK: 910-380-9209, FAX: 914-698-5386; Empl.: 30

SEMICONDUCTOR TECHNOLOGY, INC., 3131 S.E. Jay St., Stuart, FL 34997, Tel: 407-283-4500, TWX: 510-953-7511, FAX: 407-286-8914; FSC No.: 50891; Empl.: 45

Local Sales Offices & Reps

AZ	Scottsdale, Fred Board Assocs.	602-994-9388
CA	Costa Mesa, Solid State Sls.	714-650-8414
CA	Mountain View, Leddy Assocs.	415-969-6313
CO	Englewood, Comp. Sls.	303-779-8060
FL	Altamonte Springs, APM Assoc.	305-869-6831
FL	Ft. Lauderdale, APM Assoc.	305-565-0056
FL	Tampa, APM Assoc.	813-886-2457
IL	Downers Grove, Splon Assocs.	312-665-5993
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
KS	Overland Pk., Lorenz Sls.	913-649-5556
MD	Towson, Arbotek	301-825-0775
MA	Burlington, Conti-Younger	617-273-1582
MN	Minneapolis, Bill Deming & Assocs.	612-888-5000
MO	Bridgeton, Lorenz Sls.	314-298-8585
NE	Lincoln, Lorenz Sls.	402-475-4660
NJ	Hasbrouck Heights, Comp Tech Sls.	201-288-7400
NY	New Hyde Park, Comp Tech Sls.	516-593-2628
NY	Syracuse, Electra Sls.	315-463-1248
OH	Vandalia, Cleary Sls.	513-890-8642
OR	Portland, Index Inc.	503-297-3364
PA	Paoli, Stitzer Assocs.	215-644-5500
TX	Dallas, M-Rep	214-484-5711
UT	Salt Lake City, Component Sls.	801-268-8440

SEMIKRON, INC., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066, Tel: 603-883-8102, 1-800-258-1308, TELEX: 6711011, FAX: 603-883-8021; FSC No.: 58687; Empl.: 60; *Sls. Mgr.:* Frank Haase; *Dist. Mgr.:* John Flannery

SEMTECH, 652 Mitchell Rd., Newbury Park, CA 91320, Tel: 805-498-2111, TWX: 910-336-1264; FSC No.: 14099;Multiple; Empl.: 200; *Sls. Mgr.:* John Pennant-Jones; *Dist. Mgr.:* Bita Esfandiar

SEMTRONICS CORP., 211 Prospect Pk., P.O. Box 2248, Peachtree City, GA 30269, Tel: 404-487-6681, TELEX: 8107662244, FAX: 404-487-1128; Empl.: 30; *Sls. Mgr.:* Sue Heise

SENCORE, 3200 Sencore Dr., Sioux Falls, SD 57107, Tel: 605-339-0100, 800-843-3338, TWX: 910-660-0300, FAX: 605-335-6379; FSC No.: 33347; Empl.: 250; *Sls. Mgr.:* Doug Bowden

SENIOR INDS., INC., 610 Pond Dr., Wood Dale, IL 60191, Tel: 312-350-1600, FAX: 312-350-1654

SENSALL, Rosemount Corp., 250 Marcus Blvd., Hauppauge, NY 11788, Tel: 516-273-6600, TELEX: 14-4545, FAX: 516-273-6651; Empl.: 140; *Sls. Mgr.:* V. McCormack

SENSITEK CORPORATION, See Biddle Instruments

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SENSITIVE RESEARCH INSTRUMENTS, 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717; FSC No.: 32590;16034A; Empl.: 35 ..... **D•1344-1345**

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-947-4297
CO	Commerce City, Williams Assocs.	303-289-5647
DC	Washington, Whitcomb Assocs.	202-737-0763
IL	Lincolnwood, Saffro & Assocs.	312-677-9722
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MA	Lexington, Zieco	617-861-8300
MI	Southfield, Comtel Instrs. Co.	313-358-2505
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Mount Vernon, Elctrl. Instr. Svc.	914-699-9717
OH	Cleveland, Comtel Instrs. Co.	216-442-8080
OH	Dayton, Comtel Instrs. Co.	513-426-5310
OH	Hilliard, Comtel Instrs. Co.	614-876-8305
OK	Tulsa, Data Mktg. Assocs.	918-494-2711
PA	Pittsburgh, Comtel Instrs. Co.	412-922-5720
TX	Austin, Data Mktg. Assocs.	512-443-7722
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-954-5020
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
UT	Salt Lake City, Data Mktg. Assocs.	801-485-6511
WI	Lake Mills, Saffro & Assocs.	1-800-327-0312

SENSORAY CORP., 44160 Old Warm Springs Blvd., Fremont, CA 94538, Tel: 415-657-7290; Empl.: 6; *Sls. Mgr.:* Richard Soundy

Local Distributors

SC	Greer, CDI	803-877-8700

SENSOR CORP., Box 140, Scottdale, PA 15683, Tel: 412-887-4080, FAX: 412-887-0383; Empl.: 6

Sensor Scientific, inc.

FAX: 201-227-8063

SENSOR SCIENTIFIC, INC., 6 Kingsbridge Rd., Fairfield, NJ 07006, Tel: 201-227-7790, 800-524-1610; Empl.: 100; *Sls. Mgr.:* Carol Dunbar ..... **B•1918-1919**

Local Sales Offices & Reps

CA	Belmont, Ken Stroube Assoc.	415-593-4137
CA	Irvine, Vale Elctrn. Assoc.	714-551-4004
CA	San Diego, Vale Elctrns.	619-693-0113
CA	Saratoga, Mead Advantage	408-741-5300
CA	Van Nuys, Vale Elctrns.	818-705-0283
CO	Ft. Collins, Rep. Sls.	303-226-1504
FL	Hollywood, Askland Elctrn. Corp.	305-987-1074
IL	Des Plaines, ESCO Assocs.	312-298-5310
MA	Lexington, Jodan Technlg.	617-863-8898
NJ	Wayne, Breen Assocs.	201-696-8683
NY	Williamsville, CEF Tech. Sls.	716-633-7324
PA	Huntington Valley, C M C	215-938-7057
TX	Dallas, Allied Comps. Inc.	214-238-0408
TX	Houston, Allied Comps. Inc.	713-988-1600

SENSOR SYSTEMS, INC., 8929 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-341-5366, TELEX: 69-1583; *Sls. Mgr.:* E. Schneider

SENSOTEC, INC., 1200 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-7723, TWX: 810-482-1188; FSC No.: 29927; *Sls. Mgr.:* Jack Feil

SENSYM, INC., 1255 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-744-1500, FAX: 408-734-0407; FSC No.: 5955; Empl.: 150; *Sls. Mgr.:* Fred Jones; *Dist. Mgr.:* Fred Jones

SENTRY MANUFACTURING, Crystal Park, Chickasha, OK 73018, Tel: 405-224-6780; FSC No.: 5955; Empl.: 30; *Sls. Mgr.:* Barbara Maberry

SERCO PRODUCTS DIVISION:SERCO MOLD, INC., 612 Commercial Ave., Covina, CA 91723, Tel: 818-331-0517, 800-843-8172(Calif.), FAX: 818-331-8584; Empl.: 45; *Sls. Mgr.:* Neil Reckon ..... **C•1092-1093**

Local Sales Offices & Reps

CA	Corte, Paul O'Neal & Assocs.	415-924-1691
CA	Covina, Serco Prods.	818-331-0517
CA	Valencia, Lessing & Assocs.	805-295-0225
CO	Northglenn, JBR Mktg. Svcs.	303-451-5338
GA	Norcross, Hollingsworth & Still, Inc.	404-447-1700
IL	Cary, Ellinger Sls. Corp.	312-639-1850
MA	Waltham, Gerber Sls. Corp.	617-890-3334
MO	Florissant, Delltron Co., Inc.	314-839-0033
NY	Pt. Washington, Ashtec, Inc.	516-767-0336
PA	Blue Bell, Techparts	215-628-3200
TX	Richardson, R. F. Kimball Co., Inc.	214-231-3447
Can	Ontario, Avotronics Ltd.	416-475-2024

Local Distributors

AL	Montgomery, Handey's Elctrn. Ctr. Inc.	205-262-4885
AZ	Phoenix, Capital Elctrns.	602-252-5897
AZ	Phoenix, Elctrn. Emporium Inc.	602-437-8633
AZ	Tucson, Electronic City	602-622-1173
CA	Canoga Park, Sandy's Elctrns.	818-346-0510
CA	Costa Mesa, Mar Vac Elctrns.	714-650-2001
CA	Fremont, Fry's Elctrns.	415-770-3700
CA	Fullerton, RF Elctrns.	714-447-1133
CA	Goleta, DOW Elctrns.	805-968-7272
CA	Hawiian Gardens, DOW Elctrns.	213-421-3786
CA	Hollywood, Pacific Radio Exchange	213-462-1393
CA	Inglewood, Inglewood Elctrns.	213-674-2366
CA	Oxnard, DOW Elctrns.	805-486-6353
CA	Pasadena, DOW Elctrns.	818-793-1195
CA	Pomona, DOW Elctrns.	818-966-8461
CA	Sacramento, Mar Vac California Radio	916-922-6531
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Santa Maria, Elctrn. Parts Supermart	805-925-8604
CA	Sunnyvale, Fry's Elctrns.	408-733-1770
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Delray Bch., Fastbolt FL Corp.	407-272-3100, 800-233-5036
FL	Largo, Applied Specialties of FL Inc.	800-722-4599
FL	Tampa, Sunnex Elctrn. Supp. Inc.	813-885-4074
FL	West Palm Beach, Dolphin Elctrn. Supp. Inc.	305-659-7166
IL	S. Holland, Union Elctrn. Distrs.	312-333-4100, 800-648-6657
MA	Lynn, Land Elctrns. Inc.	617-592-2220
MA	Waltham, Atlantic Comps.	617-890-3334
MI	Detroit, Elctrn. Parts Co.	313-891-7400
MN	S. Minneapolis, Tor Tec Corp.	612-866-3661
NJ	Lodi, Nidisco, Inc.	201-773-1771
NY	Hempstead, Davis Elctrns.	516-483-9200
NC	Durham, Southeastern Elctrns.	919-638-8204
NC	Greensboro, Guilford Elctrn. Supp. Inc.	919-275-1385
NC	Raleigh, Southeastern Elctrns.	919-828-2311
NC	Winston-Salem, Elctrn. Distrbg. Inc.	919-723-1097
TN	Clarksville, Randolph, Hale & Matthews Inc.	615-647-2325
TX	Austin, Electrotex, Inc.	512-454-0318
TX	Dallas, Electrotex, Inc.	214-234-0433
TX	Houston, Electrotex, Inc.	713-526-3456
WI	Fond du Lac, Fedco Elctrns. Inc.	414-922-6490
WI	Milwaukee, Marsh Elctrns. Inc.	414-475-6000
Can	Kingston, Ont., Electronic Packaging Sys. Ltd.	613-384-1142

SERIAL LAB PRODS., INC., 162 Cook Lane, P.O. Box 766, Marlboro, MA 01752, Tel: 617-481-1684, TELEX: 955318 Attn: SERIAL LAB; Empl.: 12; *Sls. Mgr.:* R. L. Wiedeman; *Dist. Mgr.:* D. Kreck

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SERVO-TEK PRODUCTS CO., 1086 Goffle Rd., Hawthorne, NJ 07506, Tel: 201-427-3100, TELEX: 130273; Empl.: 60; *Sls. Mgr.:* T. J. Daly ..... **B•1302**

SETRA SYSTEMS, INC., 45 Nagog Park, Acton, MA 01720, Tel: 508-263-1400, 1-800-25-SETRA, TELEX: 4430243, FAX: 508-264-0292; FSC No.: 53367; Empl.: 95; *Sls. Mgr.:* Ed Cope ..... **B•1990-1992**

Local Sales Offices & Reps

AL	Huntsville, Burnette Techno Metrics	205-830-2832
AK	Anchorage, Unit Process	907-522-1010
CA	Concord, QCon, Inc.	415-682-2020
CA	Downey, Dynasales Co.	213-806-1400
CA	Los Angeles, Dynasales Co.	213-268-1175
CO	Westminster, RMS Sls.	303-429-1111
FL	Tampa, Quantum Measurements Corp.	813-933-8078
GA	Atlanta, Craft Assocs.	404-256-0420
HI	Honolulu, Unit Process	808-834-7195
IL	Wheaton, Ray Knitter Assocs., Inc.	312-690-6363
IN	Ft. Wayne, Domino, Inc.	219-456-5512
IN	Indianapolis, Domino, Inc.	317-841-6159
KY	Louisville, Domino, Inc.	502-425-2848
LA	Metairie, Slaton & Assocs., Inc.	504-455-3855
MD	Columbia, Stein Instrs.	301-596-3748
MA	Ashland, J. M. Lancaster Co.	617-875-8893
MI	Hazel Park, Tiby Co.	313-547-3550
MN	Minneapolis, The Mark Co.	612-933-3026
OK	St. Louis, Adelphi, Inc.	314-821-2142
MT	Billings, Unit Process	406-252-0455

NJ Cedar Grove, KLS Assocs. 201-785-4450
NM Albuquerque, TMA, Inc. 505-345-8921
NY E. Rochester, A & D Dvcs. 716-385-2778
OH Cleveland, Tiby Co. 216-371-5335
OH Dayton, Tiby Co. 513-277-3822
OK Tulsa, Inotek Corp. 713-688-7000
OR Beaverton, Unit Process 406-252-0455
PA Cheltenham, Stein Instrm. 215-379-1990
TX Dallas, Inotek Corp. 214-243-7000
TX Houston, Inotek Corp. 918-627-1500
WA Kirkland, Unit Process 206-827-0433
WI Milwaukee, Ray Knitter Assocs. 312-690-6363
Can Ontario, Alpha Controls & Instr. 416-477-2133

SEVEN MOUNTAINS SCI. INC., P.O. Box 650, Boalsburg, PA 16827, Tel: 814-466-6559; Empl.: 4; *Sls. Mgr.:* Josephine Chesworth

SFERNICE, INC., 461 North 22nd Street, Grand Junction, CO 81502, Tel: 303-242-0810, FAX: 303-242-5917; FSC No.: 05347; *Sls. Mgr.:* G. W. (Jerry) Krebill; *Dist. Mgr.:* Danny Jagirdar

SFE TECHNOLOGIES, 1501 1st St., San Fernando, CA 91340, Tel: 818-365-9411, TWX: 910-496-1535, FAX: 818-365-5117; FSC No.: 96733; Empl.: 2000; *Sls. Mgr.:* Joe Lucia

S. F. PRODUCTS CORPORATION, P. O. Box 369, Southport, CT 06490, Tel: 203-929-6180; Empl.: 8; *Sls. Mgr.:* Norman W. Johanson; *Dist. Mgr.:* R. S. Johanson

SGS-THOMSON MICROELECTRONICS, 1000 E. Bell Road, Phoenix, AZ 85022, Tel: 602-867-6100, TELEX: 0-4654, FAX: 602-867-6102; FSC No.: 7X328; Empl.: 200; *Sls. Mgr.:* Garth Nash; *Dist. Mgr.:* Jack Dauber

Local Sales Offices & Reps

AL Huntsville 205-533-5995
AZ Phoenix 602-867-6340
AZ Phoenix 602-867-6100
CA Irvine 714-250-0455
CA San Jose 408-452-8585
CO Longmont 303-449-9000
IL Schaumburg 312-517-1890
MA Waltham 617-890-6688
NJ Voorhees 609-772-6222
TX Austin 512-339-4191
TX Carrollton 214-466-8844

Shallco

FAX: 919-934-3298

SHALLCO, INC., Box 1089, Smithfield, NC 27577, Tel: 919-934-3135; Empl.: 40; *Sls. Mgr.:* M. D. Sutton ..... **B•1836-1840; D•1053**

Local Sales Offices & Reps

AZ Fountain Hills, Westech Engrg. Sls. ... 602-837-3137
CA Irvine, Groh Assocs. 714-837-9871
CA Santa Clara, Fischer Assocs. 408-733-7350
FL Melbourne, Reynolds & Assocs., Inc. .. 305-259-7000
IN Fort Wayne, J & B Engrg. Sls. Co. 219-483-2813
IA Cedar Rapids, S & O Sls. 319-363-7323
MD Towson, Holden Engrg. Sls. 301-823-3763
MA Norwood, MPS Elctrn. 617-769-8700
MN Minneapolis, R-J Inc. 612-866-3661
NY E. Rockaway, HLJ 516-599-2999
NY Manhattan, Lothar Sanford Corp. 212-757-3881
NY Pittsford, D. Hurley Sls. 716-586-6159
OH Englewood, Allen Nace Co. 513-836-0931
OR Portland, Comp. Technig., Inc. 503-292-1518
PA King of Prussia, Freedman-Malta Assocs. 215-337-9211
TX Dallas, Oeler & Menelaides, Inc. 214-361-8876

Local Distributors

FL Jacksonville, Southeast Elctrns. 904-356-3007
OH Cincinnati, United Radio 513-761-4030
TN Bristol, Broadcast Equip. & Supp. 615-878-2531
TX Dallas, Wholesale Elctrns. 214-824-3001

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SHALLTRONIX CORP., Preston St., P.O. Box 235, Selma, NC 27576, Tel: 919-965-6346; FSC No.: 58258; *Sls. Mgr.:* Joe Deans ..... **D•1346**

Local Sales Offices & Reps

TX Arlington, Electronic Prod. Reps. 817-467-0377

SHAPE MAGNETRONICS, INC., 901 DuPage Ave., Lombard, IL 60148, Tel: 312-620-8394, 1-800-367-5811, TWX: 910-991-2352, FAX: 312-620-0784; Empl.: 110; *Sls. Mgr.:* Judy M. Madden; *Dist. Mgr.:* Judy M. Madden

SHAPIRO SCIENTIFIC INST., 3500 E. Coast Hwy., Corona del Mar, CA 92625, Tel: 714-675-1024; Empl.: 7

SHARP ELECTRONICS CORP., Microelectronics Div., Sharp Plaza, Mahwah, NJ 07430, Tel: 201-529-8757, TELEX: 71 134327, FAX: 201-529-8759; *Sls. Mgr.:* Terry Manton; *Dist. Mgr.:* Dave Matthews .. **A•1770-1773, 2200-2201; B•1110-1116, 1180-1183, 1218-1219, 1335-1346, 1623, 1995**

Local Sales Offices & Reps

AL Huntsville, Interep Assocs. 205-881-1096
AL Mobile, Interep Assocs. 205-478-1036
AZ Scottsdale, Thorson Desert State Inc. (TDSI) 602-998-2444
CA Newport Bch., Plustronics 714-476-8009
CA Ojai, Plustronics 805-646-1950
CA San Diego, Mesa Comps. 619-278-8021
CA Santa Clara, Quorum Tech. Sls. 408-980-0812
CA Sherman Oaks, Plustronics 818-995-8908
CO Denver, Seale & Assocs., Inc. 303-756-8855
CT Southington, Orion/DSA Grp. 203-621-8371
FL Boca Raton, Lawrence Assocs. 407-368-7373
FL Palm Bay, Lawrence Assocs. 407-951-0901
FL Winter Springs, Lawrence Assocs. 407-365-1945
GA Norcross, Interep Assocs. 404-449-8680
IL Des Plaines, Electron Mktg. 312-298-2330
KS Wichita, Baka Corp. 316-682-8411
MD Towson, Advanced Technlg. Sls., Inc. 301-296-9360
MA Marlborough, Orion/DSA Grp. 508-480-0516
MA Peabody, Orion/DSA Grp. 508-532-6266
MI Grand Rapids, DEM Sls., Inc. 616-364-4024
MI St. Clair Shores, DEM Sls., Inc. 313-777-1750
MN Minneapolis, Comstrand 612-788-9234
MO St. John, Baka Corp. 314-429-2252
NJ Allendale, Eastec Assocs. 201-934-7135
NY Pittsford, Noeth-Honsinger 716-586-9002
NC Raleigh, Zucker Assocs. 919-782-8433
OH Dayton, Five Star Elctrns., Inc. 513-299-1718
OH Solon, Five Star Elctrns., Inc. 216-349-1611
OR Beaverton, Blair Hirsh 503-641-1875
PA Erdenheim, Omni Sls. 215-233-4600
TN Greenville, Interep Assocs. 615-639-3491
TX Austin, Impaq Sls. Co. 512-474-1125
TX Carrollton, Impaq Sls. Co. 214-247-3300
TX Houston, Impaq Sls. Co. 713-820-0288
UT Salt Lake City, Seale & Assocs., Inc. .. 801-266-9056
VA Richmond, Advanced Technlgy. Sls. .. 804-320-8756
WA Lynwood, Blair Hirsh 206-774-8151
Can Mississauga, Ont., Hi-Tech Sls. Co., Ltd. 416-670-0284
Can Richmond, BC, Enerlec Sls. 604-273-0882

Local Distributors

CA El Monte, Marshall Inds. 818-459-5574
CA Saratoga, Western Micro Technlgy. ... 408-725-1660
CA Tustin, Added Value Elctrns. 714-259-8259
NY Farmingdale, Milgray 516-420-9800
Can Montreal, Que., Space Elctrns. 514-694-7710

SHELDAHL, INC., 1150 Sheldahl Rd., Northfield, MN 55057, Tel: 507-663-8000, TWX: 910-565-2180, FAX: 507-663-8545; Empl.: 1,257; *Sls. Mgr.:* Ed Lundstrom

SHELLY associates

FAX: 714-669-1081

SHELLY ASSOCIATES, INC., 14811 Myford Rd., Tustin, CA 92680, Tel: 714-669-9850, TELEX: 85-2263; FSC No.: 00303; Empl.: 30 ..... **B•1122**

Local Sales Offices & Reps

AZ Tempe, Spectrum Assocs., S.W. 602-966-1788
CA Mountain View, Leddy Assocs. 415-969-6313
CA San Diego, O'Donnell Assocs., Inc. 619-578-1645
CA Torrance, O'Donnell Assocs., Inc. 213-539-9664
CO Broomfield, Connors Co. 303-466-9628
FL Charlotte, Hollingsworth & Still, Inc. ... 800-241-5712
FL Plant City, Hollingsworth & Still, Inc. ... 800-241-5712
GA Norcross, Hollingsworth & Still, Inc. ... 404-447-1700
IL Skokie, Electro Tech Mktg. 312-676-3151
IN Ft. Wayne, Scott Elctrns. 219-484-7865
IN Indianapolis, Scott Elctrns. Inc. 317-841-0010
MA Sudbury, KSA of New England 508-443-5881
MI Ypsilanti, Techrep, Inc. 313-572-1950
MN Hopkins, Steve Forsythe & Assocs. ... 612-933-8267
MO Grandview, R. R. Burton & Assocs. 816-763-5385
MO Kirkwood, R. R. Burton & Assocs. 314-965-0451
NJ Boonton, TMA 201-263-2946
NY N. Syracuse, R. F. Roux Co. 315-458-9169
NY Port Washington, TMA 516-883-2432
NC Charlotte, Hollingsworth & Still, Inc. ... 800-241-5712
NC Kernersville, Hollingsworth & Still, Inc. 800-241-5712
OH Cincinnati, Scott Elctrns. 513-791-2513
OH Cleveland, Scott Elctrns. Inc. 216-473-5050
OH Kettering, Scott Elctrns., Inc. 513-294-0539
OH Reynoldsburg, Scott Elctrns. 614-863-1281
OR Beaverton, Luscombe Engrg. Co. 503-636-6664
PA Pittsburgh, Scott Elctrns. 412-963-6116
TX Dallas, de Forest Sls. Co. 214-349-3290
WA Bellevue, Luscombe Engrg. Co. 206-223-1541
WI Brookfield, Electro-Tech Mktg. Assocs. 414-785-9554
Can Scarborough, Ont., Banke Elctrns. 416-292-5152

Local Distributors

AR Ft. Smith, Radio, Inc. 501-646-5200
CA Anaheim, Bisco Inds. Inc. 714-635-0380
CA Fremont, VIC/TAL Sls. 415-651-6420
CA San Jose, Bisco Inds. Inc. 408-435-8980
CT Bridgeport, Park Distrs. Inc. 203-366-7200
CT Wallingford, Midstate Elctrns. Co. 203-265-9900
FL Bradenton, Specialty Distbg. 813-756-9571
FL Clearwater, Jenkins Supp. Co., Inc. 813-584-5252
GA Albany, Specialty Distrbg. Co., Inc. 912-435-1711
GA Athens, Specialty Distrbg. Co., Inc. 404-548-1334
GA Atlanta, A-C Equip. Co. 404-451-2747
GA Atlanta, Specialty Distrbg. Co., Inc. 404-458-6341
GA Augusta, Specialty Distrbg. Co., Inc. ... 404-772-1526
GA Brunswick, Specialty Distrbg. Co., Inc. 912-265-1927
GA College Park, Specialty Distrbg. Co., Inc. 404-763-3828
GA Columbus, Specialty Distrbg. Co., Inc. 404-327-7414
GA Macon, Specialty Distrbg. Co., Inc. 912-743-5421
GA Marietta, Specialty Distrbg. Co., Inc. ... 404-422-4333
GA Norcross, Specialty Distrbg. Co., Inc. .. 404-448-4004
GA Savannah, Specialty Distrbg. Co., Inc. 912-234-1684
IL Franklin Park, Bisco Inds. Inc. 312-451-1230

IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699
IA	Cedar Rapids, Iowa Radio Supp. Co.	313-393-4510
IA	Cedar Rapids, Iowa Radio Supp. Co.	319-393-4510
MA	Woburn, Bisco Inds.	617-938-8590
MO	Kansas City, Elctrns. Supp. Co., Inc.	816-931-0250
NJ	Cranford, Garden State Indl. Elctrns.	201-272-6400
NJ	Fair Lawn, Relay Specialties	201-797-3313
NJ	Oakland, Relay Specialties	201-337-1000
NY	Elmsford, White Plains Elctrl.	914-592-9555
NY	Huntington, Energy Elctrl. Supp.	516-549-2722
NC	Raleigh, Svc. Plus Elctrns.	919-850-9550
OH	Strongsville, Roberts Elctrns. Co., Inc.	216-238-1711
OH	Twinsburg, Advacom, Inc.	216-425-8477
OK	Tulsa, Radio, Inc.	918-587-9123
PA	McKean, Advacom	814-476-7774
TN	Chattanooga, Specialty Distbg. Co.	615-267-9531
TX	Arlington, Bisco Inds.	817-640-7046
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Houston, Wofford Elctrns.	713-847-3583
TX	Midland, ESI Supp.	915-694-9657
WI	Mequon, Lakeview Elctrns.	414-377-8250
Can	Calgary, Alberta, Memco	403-258-3399
Can	Surrey, B.C., Memco	604-590-1553

SKC

FAX: 818-764-6845

SHINANO KENSHI CORP. (SKC), 7525 Ethel Ave. Ste. I & K, N. Hollywood, CA 91605, Tel: 818-764-4266; Empl: 6; *Sls. Mgr.:* Ken Shimizu ..... **B•1303**

Local Sales Offices & Reps

AL	Madison, Benchmark	205-464-0033
CA	North Hollywood, Shinano Kenshi Corp.	818-764-4266
CA	Santa Clara, Norcomp, Inc.	408-727-7707
CO	Denver, Tech Rep Sls. Co.	303-758-7031
CT	Bloomfield, SIR Assocs.	203-243-9343
FL	Melbourne, Phoenix Comps.	407-723-4414
GA	Norcross, Benchmark	404-446-1711
MA	Westford, SIR Assocs.	508-692-2500
MI	Brighton, A.P. Assoc.	313-229-6550
MN	Eagan, REL Comp.	612-688-8006
NY	Albertson, DOL Engrg.	516-747-3944
NY	Cazenovia, D & O Engrg.	315-655-8602
NY	Youngstown, D & O Engrg.	716-754-7650
NC	Charlotte, Benchmark	704-525-2131
NC	Raleigh, Benchmark	919-881-0077
OR	Portland, Intertech Sls.	503-775-7885
TX	Dallas, Theodore Borek Assoc.	214-985-7702
UT	Sandy, Intermountain Technlg.	801-566-5000

Local Distributors

CA	N. Hollywood, Digilog Dvcs., Inc.	818-764-9777

Shindengen America, Inc.

FAX: 805-373-3710

SHINDENGEN AMERICA INC., 2649 Townsgate Road, Ste. 200, Westlake VL, CA 91361, Tel: 800-634-3654; Empl.: 10; *Sls. Mgr.:* Peter Gajewski; *Dist. Mgr.:* Peter Gajewski ..... **D•2046-2049**

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AL	Huntsville, 20th Century Mktg., Inc.	205-533-9281
CA	Huntington Beach, Mil-Com Sls., Inc.	714-840-2424
CA	San Diego, Power Assocs.	619-275-0641
CA	Santa Clara, Quorum Tech. Sls.	408-980-0812
CO	Arvada, Arrowhead/CSI	303-423-5597
FL	Land O' Lakes, A.J.'s Power Source, Inc.	813-996-2583
GA	Norcross, 20th Century Mktg., Inc.	404-446-1999
IL	Rolling Meadows, Eagle Tech. Sls., Inc.	312-991-0700
IA	Cedar Rapids, C-Tron, Inc.	319-373-2029
KS	Olathe, C-Tron	319-373-2029
MD	Randallstown, Chesapeake Indl. Mktg.	301-922-5997
MI	Lathrup VL, R. C. Nordstrom & Co.	313-559-7373
MO	St. Charles, C-Tron, Inc.	314-928-8078
NH	Nashua, Bell Controls, Inc.	603-882-6984
NJ	Parsippany, HLM Assocs.	201-263-1535
NY	Northport, HLM Assocs.	516-757-1606
NY	Pittsford, Franklin Sls. Corp.	716-248-8251
NC	Cary, 20th Century Mktg., Inc.	919-481-3370
OH	Cleveland, KT/Depco	216-777-7454
PA	Dresher, CMS Mktg.	215-885-4424
PA	Pittsburgh, KT/DEPCO	412-367-1011
TN	Knoxville, 20th Century Mktg., Inc.	615-966-2099
TX	Richardson, Jim Gray & Assocs.	214-699-9976
TX	Richmond, Jim Gray & Assocs.	713-342-1710
UT	Salt Lake City, Arrowhead/CSI	801-269-8614
Can	Concord, Ont., Votron Elctrns., Inc.	416-669-9870

Local Distributors

CO	Englewood, Displays Plus, Inc.	303-779-8053
CO	Wheat Ridge, A.V.E.D.-Rocky Mtn., Inc.	303-422-1701
IL	Schaumburg, QPS Elctrns.	312-884-6620
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MI	St. Clair Shores, Spemco	313-771-2700
NJ	Pennsauken, Alta Elctrns.	609-488-1442
OH	Cleveland, Major Elctrns.	216-442-6200
UT	West Valley, A.V.E.D.-Salt Lake, Inc.	801-975-9500

SHIN-ETSU POLYMER AMERICA, INC., 34135 7th St., Union City, CA 94587, Tel: 415-475-9000, TWX: 910-338-2229, FAX: 415-475-0613; *Sls. Mgr.:* Doug Hall

SHOGYO INTERNATIONAL CORPORATION

FAX: 516-466-0922

SHOGYO INTERNATIONAL CORP., 287 Northern Blvd., Great Neck, NY 11021, Tel: 516-466-0911, TELEX: 4758024, TWX: 12218 ..... **A•2441; B•1186, 1841; C•1525-1527, 1920-1921; D•1054-1055, 1527, 2051**

SHOKAI

FAX: 914-681-0807

SHOKAI FAR EAST, LTD., 280 North Central Ave., Hartsdale, NY 10530, Tel: 914-681-0700; Empl.: 362; *Sls. Mgr.:* Shirlee Serber; *Dist. Mgr.:* Lee Goldberg, V.P. ..... **B•1187**

SHURE BROTHERS INC., 222 Hartrey Ave., Evanston, IL 60202-3696, Tel: 312-866-2200, TELEX: 4330191, FAX: 312-866-2279; *Sls. Mgr.:* L.Z. Morgan, VP Sls.

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SHURITE METERS, A Prime Technology Co., P.O. Box 185, Twin Lakes Rd., North Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092; Empl.: 15; *Sls. Mgr.:* James L. Jamieson ..... **D•1416**

Local Sales Offices & Reps

CA	Burbank, Modco Co.	818-848-2215
CA	Fremont, Abel & Assocs.	415-792-1686
CA	Fremont, Abel & Assocs.	415-794-4030
CA	San Diego, Qualtronics	619-695-0118
CO	Denver, Nelson Co. Inc.	303-295-1017
FL	Lakeland, Munday Sls. Co.	813-858-5606
IL	Cary, Bob Burns Assocs.	312-516-3322
IN	Indianapolis, John Sukup Inc.	317-253-5501
IA	Des Moines, The Beams Co.	515-255-1148
KS	Shawnee Mission, The Beams Co.	913-631-0300
MI	E. Detroit, Jack M. Thorpe Co.	313-779-6363
MO	St. Louis, The Beams Co.	314-434-8448
NJ	Belleville, D. F. Tobias & Co.	201-751-8680
NJ	Lawrenceville, DVS Co.	609-896-1112
NY	Fayetteville, H.C. Johnson Agencies	315-637-1143
NY	Rochester, H. C. Johnson Agys., Inc.	716-586-0777
NC	Raleigh, B.T. Funderburk Inc.	919-846-2373
OH	Cleveland, John Olsen Co.	216-662-3454
OH	Columbus, John Olsen Co.	614-478-9911
OH	Goshen, John Olsen Co.	513-722-3320
RI	Coventry, Adams McGregor Inc.	401-726-1300
TX	Dallas, The Crockett Sls. Co.	214-350-3377
WA	Seattle, Evergreen Mktg. Grp.	206-633-3160
Can	Thornhill, Ont., R. C. Kahnert Sls. Ltd.	416-731-9232
Can	Winnipeg, Manitoba, Smith-Patterson & Assocs.	204-885-1376

SIDEREAL CORP., TransTechnology Corporation, 9600 S.W. Barnes Rd., Portland, OR 97225, Tel: 503-297-5531, TELEX: 36-0640, TWX: 910-464-6139, FAX: 503-292-7730; Empl.: 250; *Sls. Mgr.:* Jeff Gretz

SIECOR ELECTRO-OPTIC PRODUCTS, Siecor Corporation, P.O. Box 13625, Research Triangle Park, NC 27709, Tel: 1-800-888-LAN1, 919-481-5100, TELEX: 821353, FAX: 919-481-0753; Empl.: 50; *Sls. Mgr.:* Glenn R. Constable

SIEMENS COMPONENTS, INC., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014, Tel: 408-257-7910, TELEX: 352084, TWX: 910-338-0022; FSC No.: 50579; Empl.: 1100; *Sls. Mgr.:* Chuck Berghoff; *Dist. Mgr.:* Regina Walls

SIEMENS

FAX: 201-321-3961

SIEMENS COMPONENTS, INC., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830, Tel: 201-321-3400, TWX: 710-998-0588/0529; Empl.: 800; *Sls. Mgr.:* Curt Hozian; *Dist. Mgr.:* Dick Robert ..... **A•1171, 1331**

Local Sales Offices & Reps

AL	Huntsville, Interep assocs.	205-533-1730
AZ	Phoenix, Westrep	602-997-8899
CA	Anaheim, Westrep	714-527-2822
CA	Cupertino, Siemens Comps., Inc.	408-725-3566
CA	Cupertino, SC Sls. West	408-725-3531
CA	Orange, Siemens Comps., Inc.	714-385-1274
CA	San Diego, Varigon-San Diego, Inc.	619-576-0100
CO	Littleton, Lange Sls.	303-795-3600
FL	Apopka, G.F. Bohman Assocs.	305-886-1882
GA	Norcross, INTEREP	404-449-8680
GA	Norcross, Siemens Comps., Inc.	404-449-3981
IL	Park Ridge, Metcom Assocs.	312-696-1490
IL	Rosemont, Siemens Comps., Inc.	312-629-6000
IN	Indianapolis, Electro Reps., Inc.	317-842-7202
IA	Cedar Rapids, Cahill-Schmitz-Cahill	319-377-8219
MD	Lutherville, D.G. Reps.	301-583-1360
MA	Westborough, Anchor Engrg.	617-898-2724
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	St. Paul, Cahill-Schmitz-Cahill	612-646-7217
NJ	Special Prods. Div.	800-222-2203
NJ	Bellmawr, TAI Corp.	609-933-2600
NJ	Ft. Lee, Necco	201-461-2789
NJ	Princeton, Simens Comps., Inc.	609-987-0083
NM	Albuquerque, F-P Sls.	505-345-5553
NY	Liverpool, Gen- Tech	315-451-3480
NC	Smithfield, ADI, Inc.	919-934-8136
OH	Columbus, Siemens Comps., Inc.	614-433-7500
OH	Strongsville, Dolfuss-Root & Co., Inc.	216-238-0300
PA	Bridgeville, Dolfuss Root & Co.	412-221-4420
TN	Greenville, Interep	615-639-3491
TX	Arlington, CompTech Sls., Inc.	817-265-6007
TX	Austin, CompTech Sls., Inc.	512-331-8922
TX	Houston, CompTech Sls., Inc.	713-776-8330
UT	Salt Lake City, Lange Sls., Inc.	801-487-0843
WA	Bellevue, Micro Sls.	206-451-0568
PR	Rio Piedras, Klamco Elec.	809-752-6169

Local Distributors

AL	Huntsville, Hall-Mark	205-837-8700
AZ	Phoenix, Hall-Mark	602-437-1200

CA Canoga Park, Hall-Mark 818-716-7300
CA Irvine, Marshall 714-458-5394
CA Milpitas, Marshall Elec. 408-942-4700
CA San Jose, Hall-Mark 408-432-0900
CA Sunnyvale, Permag-Sierra Div. 408-738-1080
CO Thornton, Marshall Elec. 303-451-8444
FL Orlando, Hall-Mark 305-855-4020
GA Norcross, Marshall 404-923-5750
IL Elk Grove, Permag-Central Div. 312-956-1140
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IL Wooddale, Hall-Mark 312-860-3800
IN Indianapolis, Marshall 317-297-0483
MD Columbia, Hall-Mark 301-988-9800
MI Farmington Hills, Advent 313-477-1650
MN Plymouth, Marshall 612-559-2211
NJ Fairfield, Hall-Mark 201-575-4415
NY Rochester, Marshall 716-235-7620
NC Raleigh, Hall-Mark 919-872-0712
OH Dayton, Marshall 513-898-4480
PA McKean, Advacom 814-476-7774
TX Dallas, Hall-Mark 214-553-4300
WA Bellevue, Marshall 206-747-9100

SIERRACIN/MAGNEDYNE, 2258 Rutherford Rd., Carlsbad, CA 92008, Tel: 619-438-3321, TWX: 910-322-1391, FAX: 619-438-4987; Empl.: 150

SIERRACIN POWER SYSTEMS, See Sierra Power Systems

SIERRA MONITOR CORP., 1991 Tarob Ct., Milpitas, CA 95035, Tel: 408-262-6611, TELEX: 17-1618; FSC No.: MSGSNDR; Empl.: 23; *Sls. Mgr.:* Robert Dunkle; *Dist. Mgr.:* Gordon Arnold

SIERRA POWER SYSTEMS, See Valor Power Sys. Div., Valor Elctrns.

SIERRA WEST POWER SYSTEMS, 2615 Missouri St., Las Cruces, NM 88001, Tel: 505-522-8828; Empl.: 12

SIGMA ELECTRONICS INC., 10830 Kinghurst Dr., Houston, TX 77099, Tel: 713-933-4700, TWX: 378-7848, FAX: 713-933-9067; FSC No.: 60767; Empl.: 119; *Sls. Mgr.:* K. Johnson

SIGMA INSTUMENTS, Pacific Scientific, 90 Libbey Pkwy., Weymouth, MA 02189, Tel: 617-340-0700, TELEX: 94-0645, TWX: 710-348-1161, FAX: 617-340-0728; Empl.: 250; *Sls. Mgr.:* Joseph Damato

Local Sales Offices & Reps

CA Auburn, Ewing-Foley, Inc. 916-885-6591
CA Los Altos, Ewing-Foley, Inc. 415-941-4525
CA Westminster, West Elctrn. Sls. 714-898-0120
MA Hingham, Northeast Reps. 617-749-8700
NJ Cherry Hill, Trinkle Sls., Inc. 609-795-4200
NJ Englewood Cliffs, Maison-Esco, Inc. 201-569-8868
NY Hauppauge, Maisin-Esco, Inc. 516-273-3500
NY Rochester, H. C. Johnson Agy. 716-586-0777
NC Winston-Salem, D.G.W., Inc. 919-768-7166
PA Glenshaw, H. C. Johnson Agy. 412-487-1246

SIGMA PLASTRONICS, INC., P.O. Box 649, Whitmore Lake, MI 48189, Tel: 313-231-2871; Empl.: 3

SIGMAPOWER, INC., 20790 Leapwood Ave., Carson, CA 90746, Tel: 213-32-Sigma, FAX: 213-715-6079; FSC No.: 55196; Empl.: 145; *Sls. Mgr.:* Carl J. Marquarot

SIGMA SYSTEMS CORP., 3163 Adams Ave., San Diego, CA 92116, Tel: 619-283-3193, FAX: 619-283-6526; Empl.: 21; *Sls. Mgr.:* T. Stewart ..... **D•1207**

Local Sales Offices & Reps

CA Albany, B/P Assocs. 415-525-7605
CA San Carlos, Electronic Engrg. Assoc. .. 415-593-2189
CA San Carlos, Electronic Engrg. Assocs. 415-593-2189
CT Fairfield, Wexler-Court Sls. Co. 203-334-1122
IL Elgin, R.K. Elctrns., Inc. 312-695-8552
IL So. Elgin, RK Elctrns., Inc. 312-695-8552
MN Edina, Dytec Instrs., Inc. 612-831-7169
Intl Palaiseau, France, Salies S.A. 920-40-10

SIGNAL PROCESSING TECHNOLOGIES, 1510 Quail Lake Loop, Colorado Springs, CO 80906, Tel: 719-540-3900, TELEX: 452433, TWX: 62926148, FAX: 719-540-3716; Empl.: 68; *Sls. Mgr.:* Rick Mintle

SIGNAL RESEARCH INC., River Road, P.O. Box 357, Titusville, NJ 08560, Tel: 609-737-1917 ..... **D•1111**

SIGNAL SYSTEMS INTERNATIONAL, P.O. Box 470, Lavalette, NJ 08735, Tel: 201-741-1120, FAX: 201-747-3122; Empl.: 7; *Sls. Mgr.:* W. Kinney

SIGNAL TRANSFORMER CO., INC., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, Tel: 516-239-5777, TELEX: 96-8112, TWX: 510-225-8440, FAX: 516-239-7208; FSC No.: 08779; Empl.: 280; *Sls. Mgr.:* John Marino ..... **A•2442-2459**

Direct sales only. Inwood, NY 516-239-5777

Local Sales Offices & Reps

Can Toronto, Ont., Calbrooke Mktg. 416-346-2551

SIGNATRON, A Unit of Sundstrand Corp., 110 Hartwell Ave., Lexington, MA 02173, Tel: 617-861-1500, TELEX: 299551 (RCA GLOBCOM), FAX: 617-863-8039; FSC No.: 59371; Empl.: 120; *Sls. Mgr.:* Joseph T. McNamara

SIGNUM SYSTEMS, 1820 14th St., Ste. 203, Santa Monica, CA 90404, Tel: 213-450-6096; Empl.: 9; *Sls. Mgr.:* G. Phillips

SILICON DETECTOR CORP., 1240 Avenida Acaso, Camarillo, CA 93010, Tel: 805-484-2884, FAX: 805-484-2884; Empl.: 60; *Sls. Mgr.:* M.K. Nicklas/D. Tingley ..... **B•1348-1349**

Local Distributors

CO Westminister, Southern Engrg. 303-428-3955
CT New Haven, Swan & Assoc. 203-387-3917
FL Winter Park, McMahan Electro. Optics 407-645-1000
IL Des Plaines, Bea Electro-Optics 312-298-1420
IN Indianapolis, Bea Electro-Optics 317-247-8314
MN Bloomington, Bea Electro-Optics 612-854-0941
NM Albuquerque, Southwestern Engrg. ... 505-881-3677
OH Risingsun, Mecom, Inc. 419-457-3231
TX Dallas, Southwestern Engrg. 214-340-1741
TX Houston, Southwestern Engrg. 713-781-8710
WA Seattle, Datacom & Assocs. 206-285-2525

SILICON GENERAL

FAX: 714-893-2570

SILICON GENERAL, 11861 Western Ave., Garden Grove, CA 92641, Tel: 714-898-8121, TELEX: 692-411, TWX: 910-596-1804; FSC No.: 34333; Empl.: 250; *Sls. Mgr.:* Joe Castellano; *Dist. Mgr.:* Larry Baumgardner

SILICONIX, INC., 2201 Laurelwood Rd., Santa Clara, CA 95054, Tel: 408-988-8000, TWX: 910-338-0227; Empl.: 2600; *Sls. Mgr.:* Walter Senges; *Dist. Mgr.:* Chuck Sweet

FAX: 213-630-5338

SILICON POWER CUBE CORP., 6015 Obispo Ave., Long Beach, CA 90805, Tel: 213-634-9390, TELEX: 297340; Empl.: 350; *Sls. Mgr.:* Don Penn; *Dist. Mgr.:* Howard Saner ..... **B•1624-1627**

Local Sales Offices & Reps

AZ Scottsdale, AcTooh Comp.Sls. 602-991-6300
CA Long Bch., Silicon Power Cube 213-634-9390
CA Mtn. View, Westech Sls. 415-961-1422
CA San Diego, Manning Co. 619-565-6097
CO Parker, Parker Webster Co. 303-841-4888
FL Orlando, South Atlantic Comp. Sls. 407-857-3650
GA Lawrenceville, B. T. Funderbruk, Inc. .. 404-963-9495
IL Downers Grove, Richmar Elctrns. Corp. 312-968-0118
IN Greenwood, Valentine & Assocs. 317-888-2260
IN South Bend, Valentine & Assocs. 219-288-7070
IA Cedar Rapids, Delltron Co., Inc. 319-362-2526
IA Iowa City, Richmar Elctrns. Corp. 319-354-8894
MA Sharon, Cummings Assocs. 617-784-5606
MI Comstock, Nova Elctrl. Sls. 616-784-3535
MI Highland, Nova Elctrl. Sls. 313-887-0064
MN Bloomington, Smiley/Scott Assocs. ... 612-888-5551
MO Florissant, Delltron Co., Inc. 314-839-0033
MO Gladstone, Delltron Co., Inc. 816-435-6445
NJ Palisades Park, Janco Technlg. 201-941-4008
NY Syracuse, L. D. Allen, Inc. 315-437-8387
NC Raleigh, B. T. Funderburk, Inc. 919-846-2373
OH Brunswick, J. N. Bailey & Assocs. 216-273-3798
OH Columbus, J. N. Bailey & Assocs. 614-262-7274
OH New Lebanon, J. N. Bailey & Assocs. 513-687-1325
OR Portland, Topp Engrg. Sls. Corp. 503-244-7265
PA Philadelphia, Fite-Walker 215-233-2100
SC Landrum, B.T.Funderburk,Inc. 803-457-2343
UT Salt Lake City, Parker Webster 801-266-9939
WA Bellevue, Topp Engrg. Sls. Corp. 206-747-5400
WA Spokane, Topp Engrg. Sls. Corp. 509-534-5630
WI Butler, Richmar Elctrns. Corp. 414-781-1749
Can Burnaby, B.C., Vitel Elctrns. 604-439-1136
Can Lachine, Que., Vitel Elctrns. 514-636-5951
Can Mississauga, Ont., Vitel Elctrns 416-676-9720
Can Ottowa, Ont., Vitel Elctrns. 613-592-0090

Local Distributors

AL Huntsville, Hamilton/Avnet 205-837-7210
AZ Chandler, Hamilton/Avnet 602-961-6500
CA Chatsworth, Hamilton/Avnet 818-700-6500
CA Costa Mesa, Hamilton/Avnet 714-641-4100
CA Costa Mesa, Hamilton/Avnet 714-754-6111
CA Gardena, Hamilton/Avnet 213-217-6700
CA Long Beach, Amps Abundant 213-634-0187
CA Ontario, Hamilton/Avnet 714-989-4602
CA Sacramento, Hamilton/Avnet 916-925-2216
CA San Carlos, Logan Elctrns. 415-594-0700
CA San Diego, Hamilton/Avnet 619-571-7510
CA Sunnyvale, Hamilton/Avnet 408-743-3355
CO Englewood, Hamilton Avnet 303-740-1000
CT Danbury, Hamilton/Avnet 203-797-2800
FL Ft. Lauderdale, Hamilton/Avnet 305-971-2900
FL Hollywood, MRO Distrs. 800-237-8676
FL St. Petersburg, Hamilton/Avnet 813-576-3930
FL Winter Pk., Hamilton/Avnet 305-628-3888
GA Atlanta, Cleveland Elec. 404-696-4550
GA Norcross, Hamilton/Avnet 404-447-7507
IL Bensenville, Hamilton/Avnet 312-860-7700
IN Carmel, Hamilton/Avnet 317-844-9333
IA Cedar Rapids, Hamilton/Avnet 319-362-4757
KS Overland Pk., Hamilton/Avnet 913-888-8900
MD Columbia, Hamilton/Avnet 301-995-3580
MA Peabody, Hamilton/Avnet 617-531-7430
MI Grand Rapids, Hamilton/Avnet 616-243-8805
MI Livonia, Hamilton/Avnet 313-522-4700
MI Madison Heights, GALCO 313-542-9090
MN Minnetonka, Hamilton/Avnet 612-932-0600
MO Earth City, Hamilton/Avnet 314-344-1200
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OH Westerville, Hamilton/Avnet 614-882-7004
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OR Lake Oswego, Hamilton/Avnet 503-635-8157
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TX Austin, Hamilton/Avnet 512-837-8911
TX Irving, Hamilton/Avnet 214-550-7755
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WA Bellevue, Hamilton/Avnet 206-643-3950
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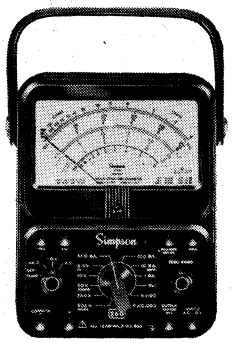

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SOLID STATE ELECTRONICS CORP., 18646 Parthenia St., Northridge, CA 91324, Tel: 818-993-8257, FAX: 818-993-8259; FSC No.: 11911; Empl.: 15

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SOLID STATE SYSTEMS, 1300 Shiloh Rd., N.W., Kennesaw, GA 30144, Tel: 404-423-2200, FAX: 404-423-2228; Empl.: 150; *Sls. Mgr.:* Max Biller; *Dist. Mgr.:* Max Biller

SOLID STATE TESTING, INC., 56 Middlesex Tpke., Burlington, MA 01803, Tel: 617-272-0972, TWX: 710-332-1620, FAX: 617-273-4896; Empl.: 150; *Sls. Mgr.:* James Roberts; *Dist. Mgr.:* James DiGiacomo

SOLITRON DEVICES, INC., Semiconductor Group, 1177 Blue Heron Blvd., Bldg. No.1, Riviera Beach, FL 33404-9978, Tel: 407-848-4311, TELEX: 51-3435, TWX: 510-952-7610, FAX: 305-863-5946; Empl.: 800; *Sls. Mgr.:* Margaret McNutt; *Dist. Mgr.:* Leah Rastrilli

SOLITRON/MICROWAVE, Solitron Devices, Inc., 1177 Blue Heron Blvd., Solitron Pk., Bldg. 2, Riviera Bch., FL 33404-9978, Tel: 407-848-4311, TELEX: 51-3435, FAX: 407-863-5946,Ext.116; FSC No.: 95077; Empl.: 200; *Sls. Mgr.:* Ray Sulzer; *Dist. Mgr.:* Deloris Martinez

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NY Victor, Net Sls. Co. 716-924-1844
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NC Winston-Salem, L. G. White Southern 919-725-3612
PA Norris Town, Rivco January Inc. 215-631-1414
SC Greenville, L. G. White Southern, Inc. .. 803-271-0630
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TX Seagoville, Delta Comps. 214-287-6333
WI Milwaukee, Beta Technlg. Sls., Inc. 414-543-6609
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CA San Diego, Tauber Elctrns. 619-459-0216
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IL	Crystal Lake, Sub-Sem	815-459-4139
IA	Atkins, The Carl Bergquist Co.	319-446-7456
MA	Canton, Comtek Assocs.	617-828-2948
MI	St. Clair Shores, Specialities Mfg.	313-771-2700
MN	Minneapolis, Carl Bergquist	612-835-2322
MO	St. Louis, Wes-Garde Comp. Grp.	314-567-7776
NH	Nashua, Wes-Garde Comp. Grp.	603-880-1971
NJ	Mt. Laurel, Wes-Garde Comp. Grp.	609-778-8190
NY	Woodside, Switches Unltd.	718-478-5000
OH	Westerville, Wes-Garde Comps. Grp.	614-885-0319
OR	Portland, Minarik Elec.	503-253-3402
SC	Columbia, Dixie Elctrns.	803-779-5332
TX	Dallas, Wes-Garde Comp. Grp.	214-357-1768
TX	San Antonio, Minarik Elec.	512-822-7097
WI	Mequon, Lake-View Elctrns.	414-377-8250
Can	Edmonton, Deskin Sls.	403-466-2106
Can	Montreal, Deskin Sls.	514-331-2860
Can	Ottawa, Deskin Sls.	613-729-1099
Can	Richmond, Vancouver, Deskin Sls.	604-324-8343
Can	Toronto, Deskin Sls.	416-475-1412
Can	Winnipeg, Deskin Sls.	403-466-2106

SOSHIN ELECTRIC CO., LTD., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, Japan, Tel: (03) 775-2111, TELEX: 246-6377, FAX: (03)775-2071; Empl.: 1,000; *Sls. Mgr.:* N. Hiraide, Foreign Trade Dept.

Local Sales Offices & Reps

CA	Chatsworth, Arco Elctrns.	818-882-8707

Local Distributors

CA	Chatsworth, Arco Elctrns.	818-882-8707
PA	Norristown, Capar Comps.	215-277-4188

SOUNDCOAT CO., INC., 1 Burt Dr., Deer Park, NY 11729-5701, Tel: 516-242-2200, TELEX: 12-5514, FAX: 516-242-2246; Empl.: 100; *Sls. Mgr.:* Mr. Carl Wolaver

SOURIAU, INC., 28309 N. Avenue Crocker, Valencia, CA 91355, Tel: 805-257-4830, TELEX: 4720328, TWX: 910-336-1553, FAX: 805-257-2383; Empl.: 79; *Sls. Mgr.:* Keith L. Olsen

SOUTH AMERICAN DEVELOPMENT CORP., Rte. 9G, R.D. 413, Hyde Park, NY 12538, Tel: 914-229-8866, FAX: 914-229-2634; Empl.: 80; *Sls. Mgr.:* C. Healy

SOUTHCO, INC., 210 N. Brinton Lake Rd., Concordville, PA 19331, Tel: 215-459-4000, TELEX: 83-1485, TWX: 710-760-1715, FAX: 215-459-4012; *Sls. Mgr.:* R. W. Dougherty

SOUTHERN COMPUTER CORP., 141 W. Wieuca Rd., Ste. 300-B, Atlanta, GA 30342, Tel: 404-252-3340, FAX: 404-252-8929; *Sls. Mgr.:* Ray Manley

SOUTHERN ELECTRONICS, F-Dyne, 726 So. Flower St., Burbank, CA 91502, Tel: 818-845-2458, FAX: 818-845-6348; Empl.: 100; *Sls. Mgr.:* Wayne Melvin

SOUTHTRONICS, INC., 1265 Kennestone Circle, Marietta, GA 30066-6029, Tel: 404-429-1000, FAX: 404-424-2000

SPACE ELECTRONICS, INC., 81 Fuller Way, Berlin, CT 06037, Tel: 203-829-0001, FAX: 203-829-0005; Empl.: 26; *Sls. Mgr.:* Richard Boynton

SPARKOMATIC, Rte. 6 & 209, Milford, PA 18337, Tel: 717-296-6444, TWX: 510-260-2682; Empl.: 400; *Sls. Mgr.:* Gary Pomes

SPECIALTY CABLE CORPORATION, P.O. Box 50, Wallingford, CT 06492, Tel: 800-456-SPEC, TWX: 510-100-4275, FAX: 203-269-5293; Empl.: 72

SPECIALTY CONNECTOR CO., 2100 Earlywood Dr., Franklin, IN 46131, Tel: 317-738-2800, TELEX: 217084

SPECIALITY ELECTRONICS, INC., 105 E. Rutherford St., Landrum, SC 29356, Tel: 803-457-3824; Empl.: 10; *Sls. Mgr.:* John Galli ..... **C•1529**

SPECO DIV., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757, Tel: 516-957-8700, 800-645-5516, TELEX: 96-7754, FAX: 516-957-9142; FSC No.: 516-957-9142; Empl.: 29; *Sls. Mgr.:* Eric Forman; *Dist. Mgr.:* Mel Hulkower

SPECTRACOM CORPORATION, 101 Despatch Drive, East Rochester, NY 14445-1484, Tel: 716-381-4827, TELEX: 9103509587, FAX: 716-381-4998

SPECTRAGRAPHICS CORP., 9125 Rehco Rd., San Diego, CA 92121, Tel: 619-450-0611, TELEX: 295439; Empl.: 250; *Sls. Mgr.:* Ray Barger, VP Sls.; *Dist. Mgr.:* Elliot Shev

SPECTRAL DYNAMICS DIVISION, Scientific-Atlanta, Inc., 4141 Ruffin Rd., San Diego, CA 92123-0575, Tel: 619-496-3400, TWX: 910-335-2022; Empl.: 250; *Sls. Mgr.:* John Anderson

SPECTRA LUX CORP., 11825 120th Ave. NE, Kirkland, WA 98034, Tel: 206-747-0560, FAX: 206-821-3193; FSC No.: 51896; Empl.: 85; *Sls. Mgr.:* Jon Dulude

SPECTRAN CORP., 50 Hall Road, Sturbridge, MA 01566, Tel: 508-347-2751, TELEX: 709816, FAX: 508-347-2747; FSC No.: 6V569; Empl.: 65

SPECTRASCAN, INC., 1110A Elkton Drive, Colorado Springs, CO 80907, Tel: 719-599-9254, TWX: 312194 SPECTRASCAN UD, FAX: 719-599-0815; Empl.: 15; *Sls. Mgr.:* Richard Schlueter

SPECTRA SONICS, 3750 Airport Rd., Ogden, UT 84405, Tel: 801-392-7531; Empl.: 35

SPECTRA-STRIP, See Amphenol Products

SPECTROL ELECTRONICS, 17070 East Gale Ave., City of Industry, CA 91745, Tel: 818-964-6565, TWX: 910-584-1314; Empl.: 600; *Sls. Mgr.:* S. Deiling

SPECTRON GLASS & ELECTRONICS, INC., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788, Tel: 516-582-5600, TELEX: 968296; FSC No.: 57349; *Sls. Mgr.:* Bob Marshall

SPECTRONICS CORP., 956 Brush Hollow Rd., Westbury, NY 11590, Tel: 516-333-4840, TWX: 510-222-5877, FAX: 516-333-4859; Empl.: 125; *Sls. Mgr.:* Gary Naftaly

SPECTRUM CONTROL, INC., 2185 W. 8th St., Erie, PA 16505, Tel: 814-455-0966, FAX: 814-455-2550; FSC No.: 33095;5733; Empl.: 450; *Sls. Mgr.:* Herb Bostrom; *Dist. Mgr.:* H. Bostrom

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Mktg., Inc.	205-536-3044
AZ	Phoenix, Westrep	602-997-8899
CA	Brea, Masco Elctrn., Inc.	714-529-0866
CA	Costa Mesa, Spectrum Control	714-432-8404
CA	Sunnyvale, Spectrum Control	408-735-9015
CO	Denver, Lindberg Co.	303-758-9033
FL	Altamonte Springs, Micro Elctrns.	305-332-7158
FL	Deerfield Bch., Micro-Elctrns. Comps.	305-426-8944
GA	Atlanta, Elctrn. Mktg. Assocs.	404-448-1215
IL	Crystal Lake, Spectrum Control	815-477-2600
KS	Overland Pk., Thomas L. Dowell & Assocs.	913-648-7373
MA	Chelmsford, Spectrum Control	617-458-9079
MN	Eagan, Spectrum Control, Inc.	612-452-9745
MO	St. Louis, Thomas L. Dowell & Assocs., Inc.	314-849-4234
NH	Nashua, Key Sls. of New England	603-888-8742
NJ	Brielle, EMC Technlgs., Inc.	201-223-6699
NJ	Clifton, Spectrum Control	201-779-7666
NY	E. Patchogue, EMC Technlgs.	516-286-5522
NC	Raleigh, Elctrn. Mktg. Assocs.	919-847-8800
PA	Erie, Spectrum Control, Inc.	814-455-0966
SC	Greenville, Elctrn. Mktg. Assocs.	803-223-4637
TX	Irving, Spectrum Control	214-929-0909
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
EXP	PA, Erie, Spectrum Control	814-455-0966

Local Distributors

AZ	Scottsdale, Cypress Elctrns., Inc.	602-256-9642
CA	Buena Pk., Cypress Elctrns.	213-744-0355
CA	San Diego, Cypress Elctrns., Inc.	619-292-5611
CA	Santa Clara, Cypress Elctrns.	800-538-5112
CO	Englewood, Cypress Elctrns.	303-792-5829
FL	Melbourne, Aschbacher Elctrns.	305-729-0628
IL	Chicago, Newark Elctrns.	312-784-5100
MN	Eden Prairie, Cypress Elctrns., Inc.	612-934-2104
MO	St. Charles, Finnigan Elctrns., Inc.	314-946-6201
NJ	Old Bridge, Metuchen Capacitors	201-679-3366
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Rochester, Summit Distrs.	716-334-8110
OH	Dayton, Aschbacher	513-252-7785
OR	Beaverton, Cypress Elctrns., Inc.	503-641-2233
TX	Dallas, Cypress Elctrns.	214-869-1435
WA	Bothell, Cypress Elctrns. Inc.	206-483-1144
Can	Buffalo, Summit Dists.	800-245-0152

SPECTRUM SIGNAL PROCESSING INC., 264 H Street, P.O. Box 8110-25, Blaine, WA 98230, Tel: 1-800-663-8986 (US), 604-438-7266 (Can.), FAX: 604-430-3046; Empl.: 14; *Sls. Mgr.:* Judy A. Bishop

Local Sales Offices & Reps

CA	Manhattan Bch., Forth, Inc.	213-372-8493
MA	Waltham, Spectrum Signal Processing	800-323-1842,617-890-3400
TX	Dallas, Hyperception	214-343-8525
Can	Vancouver, B.C., Spectrum Signal Processing	800-663-8986,604-438-7266

Spectrum Technology Inc

FAX: 805-683-3481

SPECTRUM TECHNOLOGY, INC., DATUM, Incorporated, 300 Lopez Rd., Goleta, CA 93436, Tel: 805-964-7791, TWX: 910-334-1163; FSC No.: 32464; Empl.: 80; *Sls. Mgr.:* Bill Beck ..... **A•1484-1487**

Local Sales Offices & Reps

AZ	Phoenix, Sedco Sls.	602-461-9069
CA	Los Angeles, The Thorson Co.	213-595-0361
FL	Ocala, Felcomp	904-288-2365
IL	Elgin, R.K. Elctrns.	312-695-8552
MA	Needham Hgts., Todino Engrg. Sls.	617-444-7925
TX	Dallas, Caton Sls.	214-243-4716
VA	Fairfax, Schibley Assocs.	703-591-3008

Spellman
High Voltage Electronics Corporation

FAX: 516-349-8699

SPELLMAN HIGH VOLTAGE ELCTRNS. CORP., 7 Fairchild Ave., Plainview, NY 11803, Tel: 516-349-8686, TWX: 510-221-2155; Empl.: 150; *Sls. Mgr.:* Tom Stutzbach; *Dist. Mgr.:* Eric Marko ..... **D•2057-2061**

Local Sales Offices & Reps

WA	Kirkland, Syntek	206-488-0394
Can	British Columbia, Broman Engrg.	604-254-6311

SPEMCO SWITCHES, 23425 Harper, Box 386, St. Clair Shores, MI 48080, Tel: 800-482-2828, FAX: 313-771-3491; Empl.: 12

SPERRY, A. W. INSTRUMENTS, P.O. Box 9300, Smithtown, NY 11787, Tel: 516-231-7050, 800-645-5398, TELEX: 645104, FAX: 516-434-3128; Empl.: 50; *Sls. Mgr.:* Dennis W. Carroll

SPIRA MANUFACTURING CORP., 12721 Saticoy Street South, North Hollywood, CA 91605, Tel: 818-764-8222, FAX: 818-764-9880; FSC No.: 60050; Empl.: 18; *Sls. Mgr.:* Lisa A Panzich

SPIRICON, INC., 2600 North Main, Logan, UT 84321, Tel: 801-753-3729, TELEX: 296-465 SPIR UR, FAX: 801-735-5231; Empl.: 15; *Sls. Mgr.:* Chuck Farnworth

SPRAGUE ELECTRIC COMPANY, Distbn.Div., 41 Hampden Rd., P.O. Box 9102, Mansfield, MA 02048-9102, Tel: 617-339-8900, TELEX: 928071, TWX: 7103210021; FSC No.: 56289; Empl.: 10,500; *Sls. Mgr.:* Lyle Pirnie, GM; *Dist. Mgr.:* James O'Sullivan, Sls. Mgr. ..... **A•1173**

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg., Inc. 205-830-0498
AZ Tempe, Techni-Source, Inc. 602-730-8093
CA Cupertino, Sprague Elec. Co. 408-973-7878
CA Santa Ana, Jones & McGeoy Sls., Inc. 714-547-6466,818-244-9884
CA Santa Clara, Criterion Sls. 408-988-6300
CA Torrance, Sprague Elec. Co. 213-534-1165
CA Van Nuys, Jones & McGeoy Sls., Inc. 818-994-6500
CO Englewood, William J. Purdy Assocs. 303-790-2211
CT North Haven, Kitchen & Kutchin, Inc. .. 203-239-0212
CT Southbury, Sprague Elec. Co. 203-264-9595
FL Altamonte Springs, Sprague Elec. Co. 407-831-3636
FL St. Pétersburg, Electramark Florida, Inc. 813-894-2299
FL Tampa, Sprague Elec. Co. 813-962-1882
GA Norcross, Montgomery Mktg., Inc. 404-447-6124
GA Norcross, Sprague Elec. Co. 404-263-3715
ID Boise, Bob Sickler Sls. 208-344-9588
IL Rolling Meadows, Sumer, Inc. 312-991-8500
IN Indianapolis, Sprague Elec. Co. 317-253-4247
IN Indianapolis, SAI Mktg. Corp. 317-545-1010
IA Cedar Rapids, J.R. Sls. Engrg., Inc. 319-393-2232
KS Overland Park, EPI Inc. 913-642-9118
MD Owings Mills, Sprague Elec. Co. 301-363-7600
MA Burlington, Kitchen & Kutchin, Inc. 617-229-2660
MI Ann Arbor, Sprague Elec. Co. 313-665-8900
MI Fenton, SAI Mktg. Corp. 313-750-1922
MN Minneapolis, HMR, Inc. 612-888-2122
MS Jackson, EPI Southwest 601-856-6251
MO St. Louis, EPI Inc. 314-962-1411
NH Salem, Sprague Elec. Co. 603-893-0016
NJ Cherry Hill, Trinkle Sls., Inc. 609-795-4200
NJ Fairfield, Astrorep, Inc. 201-808-0025
NY Babylon, Astrorep, Inc. 516-422-2500
NY East Syracuse, Ossmann Assocs., Inc. 315-437-7052
NY Hauppauge, Sprague Elec. Co. 516-231-8090
NY Henrietta, Ossmann Assocs., Inc. 716-359-1200
NC Charlotte, Sprague Elec. Co. 704-527-1306
NC Raleigh, Montgomery Mktg., Inc. 919-851-0010
OH Columbus, SAI Mktg. Corp. 614-451-0778
OH Dayton, SAI Mktg. Corp. 513-435-3181
OH Warrensville Heights, SAI Mktg. Corp. 216-591-0530
TX Austin, Sprague Elec. Co. 512-458-2514
TX Dallas, Sprague Elec. Co. 214-235-1256
TX Richardson, Bonser-Philhower Sls. 214-234-8438
WA Vancouver, Sprague Elec. Co. 206-892-0361
WI Brookfield, Sumer, Inc. 414-784-6641
PR Rio Piedras, Elctrn. Sls. Assocs. 809-762-6707
Can Burnaby, B.C., Vitel Elctrns. 604-439-1136
Can Kanata, Ont., Vitel Elctrns. 613-592-0090
Can La Chine, Que., Vitel Elctrns. 514-636-5951
Can Mississaugo, Ont., Vitel Elctrns. 416-676-9720
Can Toronto, Ont., Sprague Elec. of CAN, Ltd 416-766-6123

Local Distributors

CA Culver City, Hamilton/Avnet Elctrns. .. 213-558-2000
CA El Monte, Marshall Inds., Inc. 818-459-5500
CA Santa Clara, Wyle Labs/EMG 408-727-2500
CA Sunnyvale, Acacia/VWR Elctrns. 408-745-7200
CA Tustin, Projections Unltd., Inc. 714-544-2700
CT Milford, Falcon Elctrns., Inc. 203-878-5272
FL Tampa, Reptron Elctrns., Inc. 813-855-4656
IL Chicago, Newark Elctrns. Corp. 312-784-5100
IN Indianapolis, Graham Elctrn. Supp., Inc. 317-634-8202
MD Timonium, Zebra Elctrns. 301-252-6576
MA No. Adams, Elctrn. Supp. Ctr. 413-664-1086
NY Buffalo, Summit Distrs. 716-887-2800
NY Mamaroneck, New Yorker Elctrns., Inc. 914-698-7600
NY Melville, Arrow Elctrns. Distbn. Div. 516-391-1300
NY Port Chester, Zeus Comps., Inc. 914-937-7400
NY Ronkonkoma, Tri-Start Elctrns. 516-737-2200
NY Westbury, Schweber Elctrns. Corp. 516-334-7555
OK Tulsa, Radio, Inc. 918-587-9123
PA Montgomeryville, Pyttronic Inds., Inc. .. 215-643-2850
PA Philadelphia, Almo Elctrns., Inc. 215-698-4003
TX Ft. Worth, TTI, Inc. 817-831-8300
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, Sterling Elctrns. 713-623-6600
WI Milwaukee, Marsh Elctrns., Inc. 414-475-6000
Can Pointe Claire, Montreal, Future Elctrns., Inc. 514-694-7710

SPRAGUE ELECTRIC COMPANY:THICK FILM PRODUCTS, 267 Lowell Road, Hudson, NH 03051, Tel: 603-881-7200, FAX: 603-881-3168

See Sprague Electric World Headquarters listing for list of sales offices and reps.

SPRAGUE ELECTRIC COMPANY:THE COMPONENTS GROUP, 267 Lowell Rd., Hudson, NH 03051, Tel: 603-881-7200

See Sprague Electric World Headquarters listing for list of sales offices and reps.

SPRAGUE ELECTRIC COMPANY, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, Tel: 619-575-9353, TWX: 619-575-9425, FAX: 619-575-4081; FSC No.: 56289; *Sls. Mgr.:* Lindo Sorrentino

See Sprague Electric World Headquarters listing for list of sales offices and reps.

SPRAGUE ELECTRIC COMPANY, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036, Tel: 617-853-5000, TWX: 710-340-6304, FAX: 617-853-5049; *Sls. Mgr.:* Brad Marshall, VP Sls. & Mktg., Semiconductor Grp.

See Sprague Electric World Headquarters listing for list of sales offices and reps.

SPRAGUE GOODMAN

FAX: 516-746-1396

SPRAGUE-GOODMAN ELCTRNS., INC., 134 Fulton Ave., Garden City Pk., NY 11040, Tel: 516-746-1385, TELEX: 14-4533; FSC No.: 52769; Empl.: 80; *Sls. Mgr.:* Michael Trubowitsch ..... **A•1174-1175**

Local Sales Offices & Reps

AL Huntsville, Interep Assocs. 205-533-1730
AZ Mesa, System Sls. of Arizona 602-464-9989
CA Cupertino, Dura Elctrn. Sls. 408-255-2084
CA Garden Grove, ELSCO Elctrns. 714-891-4621
CO Denver, West Inc. 303-477-8180
CT Beacon Falls, KSA Connecticut 617-443-5881
FL Clearwater, Beacon Elctrn. Assocs. 813-796-2378
GA Norcross, Interep Assocs., Inc. 404-449-8680
IL Chicago, B.N.I. Elctrns. 312-775-1717
IN Ft. Wayne, Denton Mktg., Inc. 219-486-0665
IA Marion, M.S.B. Assocs. 319-377-6261
KS Shawnee Mission, M.S.B. Assocs. 913-432-2131
MD Monkton, Imagitron Sls. 301-374-5600
MA Sudbury, KSA of New England 617-443-5881
MI Brighton, A.P. Assocs. 313-229-6550
MO St. Charles, M.S.B. Assocs. 314-946-5577
NJ Chatham Township, Richman/Waterview Tech. Sls. 201-635-1839
NM Albuquerque, SSA of New Mexico 505-889-2901
NY Commack, Richman Sls. Co. 516-543-5532
NY Utica, Upstate Engrg. Sls. 315-797-6721
NC Raleigh, Micro Sls. Inc. 919-881-0007
OH Cincinnati, Stegman Blaine Mktg. 513-729-1969
OR Portland, Harry Levinson 503-245-1902
PA Maple Glen, Imagitron/Pennsylvania .. 800-638-3592
TN Greenville, Interep Tennessee 615-639-3491
TX Seagoville, Delta Comps. 214-287-6333
WA Seattle, Harry Levinson Co. 206-382-1300
PR Rio Piedras, Elctrn. Sls. Assocs. 809-762-6459
Can Toronto, Ont., Norgay Entprs. 416-259-9663

Local Distributors

CA Chatsworth, TTI, Inc. 818-709-1010
CA Garden Grove, Natl. Elctrns. 714-892-7749
AL Huntsville, Comp. Dists. 205-883-7501
CA Irvine, Kelex Elctrns. 714-863-1230
CA Milpitas, Projections Unltd. 408-942-1717
CA Milpitas, TTI, Inc. 408-943-9155
AZ Phoenix, Arizona Comps. 602-269-5655
CA San Diego, Neumann Elctrns. 619-695-3005
CA San Diego, Projections Unltd. 619-453-7900
CA Tustin, Projections Unltd. 714-544-2700
CO Westminster, TTI, Inc. 303-429-6806
FL Ft. Lauderdale, Bros. Elctrns. of FL 305-561-6700
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Melbourne, Comp. Dists. 305-724-9910
FL Orlando, Hammond Elctrns. 305-849-6060
FL Orlando, TTI, Inc. 305-859-1000
IL Skokie, Kellner Elctrns., Inc. 800-323-0460
IN Indianapolis, Pioneer/Indiana ..... 317-849-7300 (x 350)
KS Overland Pk., Schweber Elctrns. 913-492-2922
MD Columbia, TTI, Inc. 301-995-1331
MA Woburn, Sterling Elctrns. 617-938-6200
MA Woburn, TTI, Inc. 617-938-8800
MN Eden Prairie, TTI, Inc. 612-944-5080
MO Earth City, Schweber Elctrns. 314-739-0526
NJ Morganville, Varitech Elctrns., Inc. 201-591-8801
NY Buffalo, Summit Dists., Inc. 716-887-2835/2836
NY Mamoroneck, New Yorker Elctrns. 914-698-7600
AZ Phoenix, TTI, Inc. 602-966-1616
NY Ronkonkoma, Tri-Start Elctrns. 516-737-2200
NY Ronkonkoma, TTI, Inc. 516-737-2000
OH Columbus, TTI, Inc. 614-848-5770
OH Dayton, Pioneer/Dayton 513-236-9900
PA Harrisburg, Adtech 717-939-8337
PA Pittsburgh, Schweber Elctrns. 412-782-1600
TX Dallas, Comp. Dists. 214-644-0373
TX Ft. Worth, TTI, Inc. 800-433-7637
TX Garland, J & S 214-487-8808
VT Charlotte, Kellner Elctrns., Inc. 800-323-0460
WA Redmond, TTI, Inc. 206-882-0291
WA Seattle, Kam Elctrns. 206-382-1300
WI Milwaukee, Marsh Elctrns., Inc. 414-475-6000

SPRAGUE SEMICONDUCTOR GROUP:SPRAGUE ELECTRIC CO., 363 Plantation St., Worcester, MA 01605, Tel: 508-795-1300, TELEX: 476-1101, TWX: 510-661-7267, FAX: 508-792-9024; FSC No.: 31019,0CVK3,2D532; Empl.: 2000; *Sls. Mgr.:* B. Marshall

SPRUCE PINE MICA CO., Mtn. Laurel Dr., Spruce Pine, NC 28777, Tel: 704-765-4241, FAX: 704-765-7192; Empl.: 45; *Sls. Mgr.:* Bill Pittman

SPS INC. (MUIRHEAD VACTRIC), 51 Commerce St., Springfield, NJ 07081, Tel: 201-376-1222, TELEX: 13-8275; FSC No.: 0BKV4; Empl.: 60; *Sls. Mgr.:* Bob Conroy

SPS SOFTWARE PRODUCTS & SERVICES, INC., 14 E. 38th Street, 14th Fl, New York, NY 10016, Tel: 212-686-3790, TELEX: 852616, FAX: 212-481-7464; *Sls. Mgr.:* Peter Voletsky

SPUR PRODUCTS CORP., 13649 Beach Ave., Marina Del Rey, CA 90292, Tel: 213-822-7100, FAX: 213-578-0370; Empl.: 19; *Sls. Mgr.:* Ray Lorenz

SQUARE D CO., Executive Plaza, Palatine, IL 60067, Tel: 312-397-2600, TELEX: 247-119, FAX: 312-397-8814; Empl.: 20,500; *Sls. Mgr.:* C. N. Thompson, VP; *Dist. Mgr.:* E.P. Mazzetta

SR ENGINEERING, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643, Tel: 714-554-4200, TELEX: 364412INTR-871, FAX: 714-554-1069; FSC No.: 21441; *Sls. Mgr.:* Coleman W. Conrad

Local Sales Offices & Reps

AL Huntsville, Hughes Assocs., Inc. 205-533-9108
AZ Phoenix, The Knight Co. 602-994-1311
CA Hayward, Liaison, Inc. 415-783-1131
CA Los Angeles, The Knight Co. 714-833-8250
CA Mesa, Protech-Mktg. 602-832-7113
MA Hingham, Shain Assocs., Inc. 617-740-2334
FL Orlando, Hughes Assocs., Inc. 305-774-7117
IL La Grange Pk., Bierhaus Sls. Inc. 312-354-5100
IA Cedar Rapids, Howard R. Brown Sls. Co. 319-366-6635
NH Nashua, Shain Assocs., Inc. 603-881-4881
NY Roslyn Hgts., Travco Assocs. 516-621-3223
OH Dayton, Frederic L. Ohmer & Assoc. .. 513-434-1454
PA Glenside, Koebert Assoc., Inc. 215-887-2310
WA Seattle, Liaison, Inc. 206-767-3870

SRITEK, INC., 8705 Freeway Dr., Macedonia, OH 44056, Tel: 216-468-3380; Empl.: 40; *Sls. Mgr.:* Dennis Vinci

SSAC INCORPORATED, P.O. Box 1000, Baldwinsville, NY 13027, Tel: 315-638-1300, TELEX: 64-6221, FAX: 315-638-0333; FSC No.: 16-0985719; Empl.: 250; *Sls. Mgr.:* G. Weeks

STACKBIN CORP., Albion Road, P.O. Box 397, Lincoln, RI 02865, Tel: 401-333-1600, 800-333-1603, FAX: 401-333-1952; Empl.: 75; *Sls. Mgr.:* Valerie Baxter; *Dist. Mgr.:* Timothy J. O'Leary

STACKPOLE, CARBON DIV., 201 Stackpole St., St. Marys, PA 15857, Tel: 814-781-1234, TELEX: 914-514, TWX: 510-693-4511; *Sls. Mgr.:* R.E. Braund

STACKPOLE COMPONENTS CO., See Ark-les Special Products Grp., Div. of Stackpole Switches

STACKPOLE, MAGNET DIV., 201 Stackpole St., St. Marys, PA 15857, Tel: 814-781-1234, FAX: 814-781-8560; *Sls. Mgr.:* G.A. Olson Sr., Mktg. Mgr.

STACO, INC., See Staco Transpower

STACO ENERGY PRODUCTS CO.

FAX: 513-253-1723

STACO ENERGY PRODUCTS CO., 301 Gaddis Blvd., Dayton, OH 45403, Tel: 513-253-1191, TELEX: 288-032; FSC No.: 83008; Empl.: 146; *Sls. Mgr.:* Robert Simpson ..... **A•2460-2461; D•2234**

Local Sales Offices & Reps

CA	Costa Mesa, Stacoswitch	714-549-3041
CO	Wheat Ridge, Cluff	303-425-6604
FL	Maitland, H & H	305-831-2474
GA	Atlanta, Millar	404-634-3350
IL	Chicago, Saffro	312-677-9720
IN	Indianapolis, EMCI	317-921-3452
KS	Shawnee Mission, MSB	913-432-2131
MA	Lexington, Hathaway	617-861-1010
MI	Detroit, Shalco	313-547-4771
MN	St. Paul, Kencotronics	612-645-7717
NM	Albuquerque, Carlberg	505-836-1448
NY	Northport, LSC	516-266-5020
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Local Distributors

AL	Birmingham, JLS	205-322-2486
CO	Arvada, Denver Beta Wintronics	303-431-7161
CO	San Francisco, Stevens Engrg.	415-588-9200
CT	Wallingford, Sager Elctrns.	203-265-4600
FL	Miami, Elctrn. Equip.	305-871-3500
GA	Atlanta, Cleveland Elec.	404-696-4550
HI	Honolulu, Victor Kim	808-841-6266
IL	Chicago, Newark Elctrns.	312-784-5100
IN	Indianapolis, Bell Elctrns.	317-875-8200
KY	Louisville, Peerless	502-637-7674
LA	Lafayette, Ralph's	318-234-4507
MA	Somerville, Electro Sls.	617-666-0500
MI	Madison Hgts., Galco	313-542-9090
MN	Minneapolis, Elctrn. Center	612-378-2442
MS	Jackson, Ellington Elctrns.	601-355-0561
MO	St. Louis, Chelsea Elctrns.	314-997-7709
NJ	Kenilworth, Federated Purchaser	201-272-0505
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Dayton, Stotts Friedman Elctrns.	513-298-5555
PA	Drexel Hill, Kass Elctrns.	215-449-2300
SC	Charleston, Wholesale Elctrns.	803-722-2634
TN	Knoxville, Indl. Elctrns.	615-573-7135
TX	Ft. Worth, Allied Elctrns.	817-336-5401
VA	Charlottesville, VA Elctrns.	804-296-4184
WA	Seattle, Radar Elec.	206-282-2511
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Scarborough, Decade Elctrns.	416-439-9921

STACOSWITCH, 1139 Baker St., Costa Mesa, CA 92626, Tel: 714-549-3041, TWX: 910-595-1507, FAX: 714-549-0930; FSC No.: 12522;Multiple; Empl.: 115; *Sls. Mgr.:* D. Sugg

STACO TRANSPOWER, 610 W. 6th St., Mt. Carmel, IL 62863, Tel: 618-262-5555, TELEX: 510-525-2254, FAX: 618-263-3150; FSC No.: 83008; Empl.: 100; *Sls. Mgr.:* Jim Anderson

STAFFALL INC., 1468 Elmwood Ave., Cranston, RI 02910, Tel: 401-461-5554, TWX: 710-381-6964; Empl.: 25

STAINLESS, INC., 3rd St., N. Wales, PA 19454, Tel: 215-699-4871, TWX: 510-661-8097, FAX: 215-699-9597; Empl.: 80; *Sls. Mgr.:* Jess C. Rodriguez

STANCOR PRODUCTS, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, Tel: 219-722-2244, TWX: 810-295-0699, FAX: 219-722-5189; FSC No.: 80089; Empl.: 400; *Sls. Mgr.:* Terry D. Smith; *Dist. Mgr.:* Terry D. Smith

STANDARD CONDENSER CORP., 8151 N. Ridgeway, Skokie, IL 60076, Tel: 312-675-3133; FSC No.: 97419; *Sls. Mgr.:* B. P. McLean

STANDARD CRYSTAL CORPORATION, 9940 E. Baldwin Pl., El Monte, CA 91731, Tel: 818-443-2121, TELEX: 4998755, FAX: 818-443-9049; FSC No.: 30149; *Sls. Mgr.:* Tom Valasek; *Dist. Mgr.:* Betty Longwell ..... **A•1488**

Local Sales Offices & Reps

AZ	Phoenix, CPS Assocs., Inc.	602-246-1097
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
IL	Berkeley, ESA Tech. Mktg.	312-544-0120
IL	Northbrook, Allied Comp. Reps., Inc.	312-498-6658
MI	Grand Rapids, R.P. Urban & Assocs.	616-245-0511
OR	Togard, LD Elctrns.	503-684-8221
TX	Dallas, Allied Comps., Inc.	214-238-0408
UT	Salt Lake City, Sage Sls.	801-467-5451

STANDARD ENVIRONMENTAL SYSTEMS, INC., 383 Minnisink Rd., Totowa, NJ 07512, Tel: 201-256-2200, TWX: 710-988-5722, FAX: 201-256-2820; Empl.: 50

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Local Sales Offices & Reps

AZ	Scottsdale, Heath & Assocs.	602-945-9546
CA	Laguna Hills, Jack Fitch & Assoc.	714-951-0196
CO	Englewood, D.M. Harthun & Assoc.	303-792-5050
CT	Madison, Focus Elctrn. Sls.	203-245-2097
FL	Casselberry, Dyne-A-Mark Corp.	407-629-5557
IL	Schaumburg, Tech Tron Sls.	312-843-7530
IA	Cedar Rapids, Rep Assocs.	319-373-0152
KS	Parker, S.W. Wollard	913-898-6556
MD	Baltimore, Hagy Corp.	301-529-2022
MA	Taunton, Focus Elctrn. Sls.	617-824-3840
MI	Grand Rapids, JFCO (Finnegan & Co.)	616-949-1020
MN	Bloomington, Murnco	612-854-4161
NJ	Manville, Dynorep, Inc.	201-685-0135
NM	Albuquerque, Heath & Assocs.	505-296-8084
NY	Pittsford, Andres Comp. Sls.	716-381-3818
OH	Vandalia, JFCO (Finnegan & Co.)	513-890-8322
OR	Beaverton, Micro Sls.	503-645-2841
PA	Dresher, CMS Mktg.	215-885-4424
PA	Pittsburgh, JFCO (Finnegan & Co.)	412-823-5400
Can	Scarborough, Ont., Cantronics, LTD.	416-297-8668

STANDARD GRIGSBY INC., W. Gunther GMBH, Vimsberger Strasse 51, D 8500 Nurnberg 82, West Germany, Tel: 0911-65521, TELEX: 622351, FAX: 0911/6552-239

STANDARD INSERT CO., Penn Engrg. & Mfg. Corp., 419 Sargon Way, Horsham, PA 19044, Tel: 215-956-0350, FAX: 215-956-0366; Empl.: 7; *Sls. Mgr.:* Richard J. Kull

STANDARD MICROSYSTEMS, 35 Marcus Blvd., Hauppauge, NY 11788, Tel: 516-273-3100, TWX: 510-227-8898; FSC No.: 53848; Empl.: 500; *Sls. Mgr.:* William Seifert

STANDARD REFERENCE LABS, INC., See Koep Precision Standards, Inc.

STANDARD WIRE & CABLE CO., 1959 E. Cashdan St., Rancho Dominguez, CA 90220, Tel: 213-609-1811, 800-447-0006/821-527, TELEX: 65-3423, ESYLNK: 62931655, FAX: 213-609-1862; Empl.: 110; *Sls. Mgr.:* Dan Varvais; *Dist. Mgr.:* Jerry Gaither

STANDEX ELECTRONICS, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, Tel: 513-871-3777, TELEX: 212066, FAX: 513-871-3779; FSC No.: 56402; Empl.: 450; *Sls. Mgr.:* Charles C. Johnson, VP Sls. ..... **A•1298; B•1629, 1844-1845**

Local Sales Offices & Reps

AL	Huntsville, R. W. Mitscher Co.	205-882-6050
AZ	Mesa, Sedco Sls.	602-461-9069
CA	Cupertino, Codella Mktg. Grp., Inc.	408-257-2561
CA	Granada Hills, C & W Comp. Sls.	818-368-4032
CO	Longmont, Butler Tech. Sls.	303-651-7703
CT	Beacon Falls, KSA of New England	203-729-6285
FL	Boca Raton, R. W. Mitscher Co.	305-368-3841
GA	Lawrenceville, R. W. Mitscher Co.	404-923-3239
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
IN	Granger, Gregory Sls. Co.	219-272-9626
MD	Edina, Jay Borman Sls. Co.	612-922-5525
MD	Laurel, R. W. Mitscher Co., Inc.	301-498-6090
MA	Sudbury, KSA of New England	617-443-5881
MI	Farmington Hills, W. R. Hummon & Assocs., Inc.	313-474-0661
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
NY	Red Hook, R. W. Mitscher Co., Inc.	914-758-8375
NY	Rochester, R. W. Mitscher Co., Inc.	716-227-0839
NY	Utica, R. W. Mitscher Co., Inc.	315-738-0383
NC	Raleigh, R. W. Mitscher Co., Inc.	919-848-0941
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Portland, Components Technig.	503-292-1518
PA	Wynnewood, Metz-Benham Assocs., Inc.	215-896-7300
TN	Johnson City, R. W. Mitscher Co., Inc.	615-929-7258
TX	Houston, B & R Elctrn. Sls. Corp.	713-682-5448
TX	Plano, B & R Elctrn. Sls. Corp.	214-985-0028
VA	Richmond, R. W. Mitscher Co., Inc.	804-264-6883
WI	Waukesha, Brainard-Wilson Mktg.	414-797-7940
Can	Toronto, Ont., Anbak Sls. Canada, Ltd.	416-253-0243

STANFORD APPLIED ENGRG. INC., 3520 De La Cruz Blvd., Santa Clara, CA 95054, Tel: 408-988-0700, TELEX: 408-727-6438; Empl.: 425; *Sls. Mgr.:* Donall J. Hogan; *Dist. Mgr.:* Leon Vermont

STANFORD RESCH. SYS., INC., 1290 D. Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-744-9040, TELEX: 706891 SRS UD, FAX: 408-744-9049; *Sls. Mgr.:* Daniel R. Melick

STANFORD TELECOMMUNICATIONS, INC., 2421 Mission College Blvd., Santa Clara, CA 95054, Tel: 408-748-1010, TWX: 910-339-9531, FAX: 408-980-1066; FSC No.: 61362; Empl.: 750; *Sls. Mgr.:* Patti Laakso, Custom Prods. Mktg. Ad

STANGENES INDUSTRIES, INC., 1052 East Meadow Circle, Palo Alto, CA 94303, Tel: 415-493-0814, FAX: 415-855-9926; FSC No.: 62709; Empl.: 56; *Sls. Mgr.:* Magne Stangenes

STANLEY ELECTRONICS DIV., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, Tel: 914-699-2000; FSC No.: 61544; Empl.: 12 ..... **A•1068-1069**

Local Sales Offices & Reps

CA	San Jose, P & M Elctrns., Inc.	408-578-4878
CA	Tarzana, High Voltage Sls.	213-881-9194
IL	Elmhurst, Scott Assocs.	312-279-5681
MA	Burlington, Tritek	617-272-4550
OH	Dayton, L. D. Bruno Co.	513-434-1847
PA	Ardmore, Martin Assocs.	215-649-6332

STANLEY HARDWARE DIV., Stanley Works, 195 Lake St., New Britain, CT 06050, Tel: 800-622-HDWE, 203-225-5111; *Sls. Mgr.:* Jack Gauthier

STANLEY-VIDMAR, Stanley Works, 11 Grammes Rd., Allentown, PA 18103, Tel: 215-797-6600, TELEX: 847-345; Empl.: 5000; *Sls. Mgr.:* Ernie Gitlin, Vic Joliat; *Dist. Mgr.:* Frank Casey

STANPAT PRODS., 366 Main St., Port Washington, NY 11050, Tel: 516-883-8400, FAX: 516-883-6577; Empl.: 25; *Sls. Mgr.:* Mark Barbone

STANTON MAGNETICS, INC., Terminal Dr., Plainview, NY 11803, Tel: 516-349-0235, TWX: 510-221-1845, FAX: 516-349-0230; Empl.: 300; *Dist. Mgr.:* Jack O'Donnell, Natl. Sls. Mgr.

STANTRON

FAX: 818-841-8892

STANTRON, Unit of Zero Corporation, 6900-6918 Beck Ave., P. O. Box 9156, N. Hollywood, CA 91605, Tel: 818-841-1825; FSC No.: 06514; Empl.: 125; *Sls. Mgr.:* G. A. Tessier ..... **C•1098**

Local Sales Offices & Reps

AZ	Phoenix, Shefler/Kahn	602-257-9015
CA	Los Angeles, Landa & Assocs.	213-879-0770
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CA	San Diego, Qualtronics	619-695-0118
CA	Santa Ana, Landa & Assocs.	714-543-7805
CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	Farmington, Ray Perron & Co.	203-673-4825
CT	Farmington, Ray Perron Co.	203-673-4825
CT	New Milford, Ray Perron Co.	203-354-2569
FL	Bradenton, T G & Assocs.	813-753-4158
FL	Long Wood, Southern Mktg. Assocs.	305-682-7317
IL	Elmhurst, FF/Hill-Gray	312-832-4101
MA	Needham, Ray Perron Co.	617-449-6162
MO	St. Charles, Buckman & Assocs.	314-947-4727
NH	Dover, Ray Perron Co.	603-742-2321
NM	Albuquerque, Shefler/Kahn	505-345-3591
NY	Smithtown, T & K Sls.	516-724-3456
NY	Whitney Point, Tae-Rep ...	607-692-3705/772-6952
OH	Cincinnati, Ken Hoffman Co.	513-931-1686
OH	Kettering, Ken Hoffman Co.	513-299-8448
OR	Beaverton, Evergreen Mktg. Grp.	503-643-8020
PA	West Conshocken, Eastern Component Sls. Corp.	215-825-8610
TX	Austin, Barry Sls.	512-837-3616
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
WA	Seattle, Evergreen Mktg. Grp.	206-633-3160
WI	Madison, FF/Hill-Gray	608-246-8155

star MICRONICS·INC COMPONENTS DIVISION

FAX: 201-572-5095

STAR MICRONICS, INC., OEM Division, 70-D Ethel Rd. W., Piscataway, NJ 08854, Tel: 201-572-9512; Empl.: 120; *Sls. Mgr.:* John Hurley; *Dist. Mgr.:* Chris Duffy ..... **D•1058-1063, 1112-1113**

Local Sales Offices & Reps

CA	Irvine, Star Micronics	714-768-7203,
IL	Itasca, Star Micronics	312-773-3717,

Local Distributors

AZ	Tempe, Cypress Elec.	602-966-2256
CA	Buena Park, Cypress Elec.	714-521-5230
CA	Gardena, Cal Switch	213-770-2330
CA	Los Angeles, Elec. Switches, Inc.	213-660-1310,
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	Sunnyvale, Penstock / Waltronics	408-730-0300
CO	Englewood, NEP Elctrns.	303-799-9898
FL	Davie, Arco Dist., Inc.	305-473-2550
GA	Norcross, Applied Power	404-263-0421
IL	Wood Dale, NEP Elctrns.	312-595-8500
IL	Wheeling, Hawk Elctrns.	312-459-4030
KY	Florence, URI Elctrns.	606-371-4423
MA	Sharon, Adcour	617-784-8123
MI	Brighton, Applied Power	313-227-3604
MI	Grand Rapids, S. F. Elec. Supp., Inc.	616-459-0216
MN	Fridley, Voyager Elctrns.	612-571-7766
MO	St. Louis, Beckwith Computers & Elec.	314-343-6463,
NJ	Sparta, Instrument & Equip.	201-729-4293
NY	Hewlett, Metropolitan Sls.	516-599-7900,
OH	Cincinnati, U.R.I. Elctrns.	513-761-4030
OR	Portland, U.R.S. Elec.	503-233-7151
TX	Channelview, R. T. Henry Elctrns.	713-452-4451
WA	Bothell, Cypress Elec.	206-483-1144
WI	New Berlin, NEP Elctrns.	414-785-9100
EXP	Markham, Ont., Birde Mktg.	416-477-7722

STAR PORCELAIN, 71 Muirhead Ave., Trenton, NJ 08638, Tel: 609-392-3154; Empl.: 70; *Sls. Mgr.:* Art Weigold

STATEK

FAX: 714-997-1256

STATEK CORP., 512 N. Main St., Orange, CA 92668, Tel: 714-639-7810, TELEX: 67-8394, TWX: 910-593-1355; FSC No.: 51791; Empl.: 200; *Sls. Mgr.:* E. Feldman; *Dist. Mgr.:* S. Schaefer ..... **A•1489**

Local Sales Offices & Reps

AL	Huntsville, ACM Inc.	205-881-5493
AZ	Phoenix, Eltron	602-266-2164
CA	Fallbrook, Chilcoate Assocs.	619-728-7678
CA	Laguna Hills, H-Tech. Sls.	714-583-1488
CA	San Jose, H-Tech. Sls.	408-279-2443
CO	Denver, Elcom	303-337-2300
FL	Ft. Lauderdale, Mackay Smith & Assocs.	305-467-3888
FL	Madeira Beach, MacKay, Smith & Assocs.	813-530-1873
FL	Orlando, MacKay, Smith & Assocs.	305-423-4353
GA	Doraville, ACM Inc.	404-448-7025
IL	Rolling Meadows, Eagle Tech. Sls.	312-991-0700
IN	Fort Wayne, M/S Sls. & Assocs.	219-436-3023
IN	Indianapolis, M/S Sls. & Assocs.	317-257-8916
IA	Des Moines, SPS Assocs.	515-225-0607
KS	Olathe, SPS Assocs.	913-764-4460
MD	Columbia, Robert Elctrn. Sls.	301-995-1900
MA	Woburn, Radian Assocs.	617-933-7386
MI	Southfield, Gehrke & Assocs.	313-559-5363
MN	Bloomington, Murnco Inc.	612-854-4161
MO	Earth City, SPS Assocs.	314-291-0520
NE	Panama, SPS Assocs.	913-764-4460
NJ	Bellmawr, TAI Corp.	609-933-2600
NJ	Manhasset, Win-Cor Elec. Sls. Corp.	516-627-9474
NY	Fairport, Net Sls.	716-223-1030
NC	Charlotte, Prime Comps.	704-522-1150
NC	Raleigh, Prime Comps.	919-850-9866
OH	Centerville, Omega Sls. Inc.	513-434-5507
OH	Shaker Hgts., Omega Sls. Inc.	216-751-9600
OK	Tulsa, Norcom Inc.	918-832-7747
TN	Doraville, ACM Inc.	404-448-7025
TX	Austin, Norcom	512-451-2757
TX	Dallas, Norcom	214-386-4888
TX	Houston, Norcom	713-778-0392
UT	Salt Lake City, Elcom	801-486-4233
WA	Redmond, Halbar Assocs.	206-882-0990
WA	Vancouver, Halbar Assocs.	206-696-0170

Local Distributors

CA	Orange, Ryno Elctrns.	714-637-0200
CA	San Diego, Ryno Elctrns.	619-453-8430
CA	Sunnyvale, Target Elctrns.	408-734-5611
CO	Englewood, Indl. Elctrns.	303-694-9444
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Norcross, Reptron Elctrns.	404-446-1300
IL	Palatine, OHM Elctrns.	312-359-5500
IL	Schaumberg, Reptron Elctrns.	312-882-1700
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699
MD	Columbia, Aztech Elctrns.	301-995-6800
MA	Woburn, First Frequency	617-935-3885
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MO	Maryland Hgts., Chelsea Inds.	314-997-7709
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Mt. Vernon, QAR Indl. Elctrn. Sls.	914-699-2224
OH	Solon, Reptron Elctrns.	216-349-1415
OH	Worthington, Reptron Elctrns.	614-436-6675
TX	Richardson, Ewing Elctrns., Inc.	214-231-6725
WA	Kent, Pyramid Elctrns.	206-872-5800

STATE OF THE ART, INC., 2470 Fox Hill Rd., State College, PA 16803-1797, Tel: 814-355-8004, TELEX: 866633, FAX: 814-355-2714; Empl.: 100; *Sls. Mgr.:* Joseph J. Curcio ..... **A•2044-2047**

Local Sales Offices & Reps

AZ	Phoenix, Eltron, Inc.	602-266-2164
CA	La Miranda, Select Elctrns.	714-739-8891
CA	Saratoga, EMS	408-446-3833
CT	New Haven, Masten-Wright, Inc.	203-288-1638
FL	Altamonte Springs, Micro Mktg., Inc.	305-788-0886
FL	Seminole, Micro Mktg. Inc.	813-391-4336
IL	Glenview, Crimson Engrg. Sls., Inc.	312-470-0024
IN	Indianapolis, Hi-Tech Sls.	317-887-2564
MA	Newton, NormellAssocs.,Inc.	617-969-5478

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NJ	Marlton, Analectro, Inc.	609-983-1088
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Can	Edmonton, Alberta, Dycor Indl. Resch.	403-486-0091

SUN-FLEX CO., INC., 20 Pimentel Ct., Novato, CA 94947, Tel: 415-883-1221, TELEX: 172-208; *Sls. Mgr.:* David Render; *Dist. Mgr.:* David Render

SUN RESEARCH, INC., Box 210, Old Bay Rd., New Durham, NH 03855, Tel: 603-859-7110, TWX: 510-297-4444; *Sls. Mgr.:* Paul A. Blaisdell

SUNRISE ELECTRONICS, INC.

FAX: 818-914-1583

SUNRISE ELECTRONICS, INC., 524 S. Vermont Ave., Glendora, CA 91740, Tel: 818-914-1926, TWX: 910-584-3847; Empl: 10; *Sls. Mgr.:* Allan V. Carey ..... **D•1348**

BRILL ELECTRONICS
(415) 834-5888
610 E. 10th St., Oakland, CA 94606
SUPERIOR
(213) 452-8002
1220 Olympic Bl., Santa Monica, CA 90404

BRILL ELECTRONICS
(415) 834-5888
610 E. 10th St., Oakland, CA 94606
Switchcraft
A Raytheon Company
(213) 452-8002
1220 Olympic Bl., Santa Monica, CA 90404

Local Sales Offices & Reps

MN	Minneapolis, Berndt	612-546-2021
UT	Salt Lake, Aztec	801-355-9256
WA	Renton, West Coast Reps	206-235-7042

Distributor

SUNSHINE
THE SOURCE FOR INSTRUMENTS

FAX: 215-673-5609

SUNSHINE SCIENTIFIC INSTRUMENTS, 1810 Grant Ave., Philadelphia, PA 19115, Tel: 215-673-5600; Empl: 35; *Sls. Mgr.:* Al Stiles 688, 698, 730, 795, 807, 830

SUPERIOR CARBON PRODUCTS, INC., 101 HWY 35, Superior Pl., Walnut Grove, MS 39189, Tel: 601-253-2442, FAX: 601-253-2430; Empl: 61; *Sls. Mgr.:* Paul Merrill Kling

SUPERIOR ELECTRIC, 383 Middle St., Bristol, CT 06010, Tel: 203-582-9561, TELEX: 962-446, TWX: 710-454-0682; FSC No.: 58474; Empl: 800; *Sls. Mgr.:* Charles Ritter/James Hayden; *Dist. Mgr.:* Edward Crofton/Michael Miga ... **A•2462-2463; B•1306-1307; C•1532; D•2233**

Local Sales Offices & Reps

MS	Jackson, Doby Assocs.	601-981-1138
NM	Albuquerque, Fry Gates, Inc.	505-262-1525

SUPERTEK

FAX: 312-981-9076

SUPERTEK ELECTRONICS, INC., 543 W. Algonquin Rd., Arlington Heights, IL 60005, Tel: 312-981-5655, TELEX: 910-687-2847; Empl: 10; *Sls. Mgr.:* Pat Morito; *Dist. Mgr.:* Pat Morito ..... **D•2063-2065**

Local Sales Offices & Reps

AZ	Scottsdale, SMS & Assocs.	602-998-0831
CA	Redwood City, Sales One	415-369-3677
CA	Sunnyvale, Esco Assocs.	408-745-1410
CO	Parker, TMA/Colorado	303-841-3435
FL	Largo, Stellmach Elctrns. Sls.	813-593-0319, 904-288-2365
GA	Lawrenceville, Tek-Rep Mktg.	404-963-1600
IL	Palatine, Golbeck Milota Assocs., Inc.	312-705-0602
IN	Richmond, Preston Mktg., Inc.	317-935-0141
MI	Livonia, Megatronix Intl. Corp.	313-462-2100
NH	Londonderry, Bennetron	603-432-9092
NC	Pinehurst, Tek-Rep Mktg.	919-295-2432
PA	Harleysville, Thomas Jackson Assoc., Inc.	215-256-8877
TX	Austin, John B. Guenther, INc.	512-258-0004
TX	Dallas, John B. Guenther, Inc.	214-691-8500

SUPER VEXTA®

FAX: 213-515-2879

SUPER VEXTA, 2701 Plaza Del Amo, Ste. 702, Torrance, CA 90503-7395, Tel: 213-515-2264, TELEX: 664231; Empl: 4 ..... **B•1290, 1293**

Local Sales Offices & Reps

AZ	Phoenix, Indl. Elctrns. & Controls	602-894-2375
CA	El Toro, Distributed Motion	714-855-9902
CA	San Carlos, Campbell & George	415-594-1994
CA	Santa Clara, Oriental Motor U.S.A. Corp.	408-988-2655
CO	Wheatridge, Control Dvcs.	303-424-9332
FL	Altamonte Springs, Automation Sls. Inc.	305-869-6535
IL	Elk Grove VL, General Controls Inc.	312-595-2152
IL	Rolling Meadows, Oriental Motor U.S.A. Corp.	312-577-0310
IN	Indianapolis, Farrel-Argasta Elec. Co.	317-546-4041
IA	W. Des Moines, Ramco Elec. Co.	515-225-6933
MA	N. Andover, Bagley Intl.	617-688-0062
MI	Troy, Axis Sys.	313-689-7575
MN	Minnetonka, Vericom Corp.	612-933-0520
MO	St. Louis, Neff Power Inc.	314-727-6200
NJ	Clifton, Faber Equip.	201-773-8900
NJ	Fairfield, Oriental Motor U.S.A. Corp.	201-882-0480
NY	Rochester, John M. Forster Co.	716-232-5410
NC	Charlotte, EMCO Inc.	703-372-8281
OH	Cincinnati, Tapco Prods. Inc.	513-683-4481
PA	Broomall, Controlled Drives, Inc.	215-328-9515
TX	Denton, Texonics Inc.	214-260-3403
Can	Mississauga, Ont., Waffle's Elec.	416-672-0822

SUPPORT SYSTEMS INTL. CORP., 150 South Second St., Richmond, CA 94804, Tel: 415-234-9090, TWX: 910-382-8130, FAX: 415-233-8888; Empl: 105; *Sls. Mgr.:* Richard St. John; *Dist. Mgr.:* Richard St. John

SURGEONICS LIMITED, One Sullivan Parkway, Fort Edward, NY 12828, Tel: 518-747-2156, FAX: 518-747-2607; Empl: 20; *Sls. Mgr.:* R. Thomas

SURON MAAGAN MICHAEL, Kibbutz Maagan-Michael, D.N. Menashe 37805, Israel, Tel: 06-394211, TELEX: 471468 SURON IL, FAX: 063-90296; Empl: 38; *Sls. Mgr.:* Gershon Peleg

SUSCO ELCTRNS., 70D Carolyn Blvd., Farmingdale, NY 11735, Tel: 516-249-4848, FAX: 516-249-4865

SUTTON DESIGNS, INC., 300 N. Tioga St., Ithaca, NY 14850, Tel: 607-277-4301, FAX: 607-277-6983; FSC No.: 6625; Empl: 16; *Sls. Mgr.:* Adrienne Letson

SWISS JEWEL COMPANY, 406 Lafayette Building, Philadelphia, PA 19106, Tel: 215-925-2867, 800-922-0118, TELEX: 831-368, FAX: 215-922-3055; Empl: 5; *Sls. Mgr.:* P. N. Steel, Jr.

Switchcraft
A Raytheon Company

FAX: 312-792-2129

SWITCHCRAFT, INC., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, Tel: 312-792-2700, TWX: 910-221-5199; FSC No.: 82389;multiple; Empl.: 1100; *Sls. Mgr.:* Ken Kline; *Dist. Mgr.:* Dennis Warszona ..... **B•1847-1849; C•1533-1537**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg.	205-722-0440
AZ	Phoenix, Moss Mktg.	602-957-2065
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-453-9018
CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CO	Denver, Moss Mktg.	303-455-7205
CT	Stamford, Unesco/Genex	203-322-9308
GA	Atlanta, DHR Mktg. Inc.	404-451-9848
IL	Chicago, Switchcraft Inc.	312-792-2700
IN	Indianapolis, Marketing Engrs.	317-872-5665
KS	Overland Park, Thomas L. Dowell & Assoc.	913-648-7373
MA	Waltham, Unesco/Genex	617-890-1535
MI	Farmington Hills, Carter, McCormic & Peirce	313-477-7700
MN	Edina, Mel Foster Tech. Sls.	612-941-9790
MS	Jackson, Doby Elctrns.	601-981-1138
MO	St. Louis, Thomas L. Dowell & Assoc.	314-849-4234
NJ	Cherry Hill, Trinkle Sls.	609-795-4200
NJ	Englewood Cliffs, Masin-Esco	201-569-8868
NM	Albuquerque, Moss Mktg.	505-292-7505
NY	Hauppauge, Masin-Esco	516-273-3500
NY	Rochester, Apex Assocs.	716-272-7040
NC	Raleigh, DHR Mktg., Inc.	919-829-1970
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Milwaukee, Comtec	503-654-6626
SC	Greenville, DHR Mktg. Inc.	803-235-3594
TN	Memphis, Doby Elctrns.	901-365-9575
TX	Austin, J. Y. Schoonmaker Co.	512-327-5274
TX	Dallas, J. Y. Schoonmaker Co.	214-349-1650
TX	Houston, J. Y. Schoonmaker Co.	713-738-2427
UT	Salt Lake City, Moss Mktg.	801-363-5875
WA	Bellevue, Comtec	206-453-1188
WI	Burlington, Switchcraft	414-763-2100
Can	Toronto, Atlas	416-789-7761

SWITCHES UNLIMITED, INC., 34-11 56th St., Woodside, NY 11377, Tel: 718-478-5000, 800-221-0487, FAX: 718-672-6370; Empl: 20; *Sls. Mgr.:* Douglas King

SWITCHING POWER INC., 3601 Veterans Hwy., Ronkonkoma, NY 11779, Tel: 516-981-7231, TWX: 510-220-1528, FAX: 516-981-7266; Empl: 200

SSI

FAX: 714-996-2753

SWITCHING SYSTEMS INTERNATIONAL, 500 Porter Way, Placentia, CA 92670, Tel: 714-996-0909; Empl.: 85; *Sls. Mgr.:* Guy Lacerte ..... **D•2066-2067**

Local Sales Offices & Reps

AZ	Phoenix, Holder Hauer	602-242-4025
CA	Los Alamitos, Power Specialists	213-594-9418
CA	Placentia, Switching Sys. Intl.	714-996-0909
CA	San Jose, Nelson Elctrns. Sls.	408-437-9300
CO	Denver, Holder Hauer	303-427-3443
CT	North Haven, Power Conversion Sys.	203-281-7270
GA	Athens, ADI Inc.	404-548-0788
IL	Chicago, Utronix	312-834-1100
IL	Elmhurst, Utronix	312-834-1100
MD	Randallstown, Beacon North Inc.	800-877-3747
VA	Sterling, Beacon North, Inc.	703-478-2480
MA	Woburn, Power Conversion Sys.	617-938-0839
MI	Ann Arbor, KRW Sls.	313-769-0056
NH	Londonderry, Power Conversion Sys.	603-434-2371
NJ	Marlton, Beacon North Inc.	609-596-9456
NM	Albuquerque, Holder Hauer	505-888-9614
NC	Smithfield, ADI Inc.	919-934-8136
OH	Cleveland, KRW Sls. Inc.	216-871-7521
OH	Columbus, KRW Sls. Inc.	614-885-2598
PA	Collegeville, Beacon North	215-287-5479
PA	Pittsburgh, KRW Sls. Inc.	412-828-1490
UT	Salt Lake City, Holder Hauer	801-532-2111

SYLVANIA GTE CONTROL DEVICES, Rte. 35, Standish, ME 04084, Tel: 207-642-4535, TWX: 710-365-0145; Empl.: Over 1,000; *Sls. Mgr.:* M. L. Lyons; *Dist. Mgr.:* M. L. Lyons

SYLVANIA ELECTRONIC COMPONENTS, See Philips ECG, Amperex Electronics Corp., A North American Philips Co.

SYLVANIA MINIATURE LIGHTING, GTE Corporation, W. Main St., Hillsboro, NH 03244, Tel: 603-464-5533, TWX: 710-366-0387, FAX: 603-464-0259; FSC No.: 88204; Empl.: 1011; *Sls. Mgr.:* Frank St. Onge, Natl. Sls. Mgr. ..... **B•1152-1157**

Local Sales Offices & Reps

AZ	Scottsdale, Bill Earl & Assocs.	602-994-3813
AR	Little Rock, Cartwright & Bean	901-362-8345
CA	El Toro, English/Damco Sls. Assocs.	714-837-3801
CA	Sunnyvale, W.W. Posey Co.	408-746-0771
CT	No. Haven, Coakley, Boyd & Abbett	203-239-6217, 800-225-8402
FL	Maitland, Hutto, Hawkins Assocs.	407-831-2474
FL	Pompano Beach, Hutto, Hawkins Assocs.	305-979-0330
FL	Tampa, Hutto, Hawkins, Assocs., Inc.	813-251-2970
GA	Atlanta, Millar Elctrns.	404-634-3350
IL	Skokie, LRJ	312-967-8430
IN	Ft. Wayne, R.O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R.O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R. O. Whitesell	317-457-9127
IA	Cedar Rapids, R. W. Kunz	319-396-5386
KS	Prairie Village, R.W. Kunz	913-648-3535
KY	Peewee Valley, R.O. Whitesell & Assocs.	502-241-1441
LA	Covington, Cartwright & Bean	504-892-1780
MA	Needham, Coakley, Boyd & Abbett	617-444-5470
MI	Grand Rapids, R.O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R. O. Whitesell	313-559-5454
MI	St. Joseph, R.O. Whitesell & Assocs.	616-983-7337
MN	Minneapolis, Stoss & Assocs.	612-925-2757
MS	Jackson, Cartwright & Bean	601-981-1170
MO	St. Louis, R.W. Kunz	314-966-4977
NJ	Long Valley, Paul A. Sweeney	201-852-1434
NY	Rochester, Electra Sls.	716-427-7860
NY	Syracuse, Electra Sls.	315-463-1248
NC	Raleigh, Millar Elctrns.	919-828-8840
OH	Cincinnati, R.O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R.O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R.O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R.O. Whitesell & Assocs.	513-298-9546
OR	Beaverton, Electronic Sources Inc.	503-684-0838
PA	Pittsburgh, R.O. Whitesell & Assocs.	412-963-6161
PA	Trevose, P.S.A. Inc.	215-245-0513
TN	Memphis, Cartwright & Bean	901-362-8345
TX	Dallas, Erickson Sales	214-739-5833
TX	Houston, Erickson Sales	713-266-1604
TX	Round Rock, Erickson Sls.	512-244-3068
CO	Wheatridge, Cluff & Assocs.	303-423-9354
WA	Bellevue, Electronic Sources Inc.	206-451-3500
WI	Milwaukee, F.C. DuBois & Assocs.	414-774-3100

SYMBICON, 89 Route 101A, Amherst, NH 03031, Tel: 603-673-8898, FAX: 603-673-1372; *Sls. Mgr.:* S. Harrington; *Dist. Mgr.:* S. Buzzell

SYM-TEK SYS., INC., 3912 Calle Fortunada, San Diego, CA 92123, Tel: 619-569-6800, TELEX: 249036, FAX: 619-569-8296; Empl.: 350; *Sls. Mgr.:* Roger Hopkins

SYMTRON CORP. DIV. DICEON ELCTRNS., 2415 E. Charleston Rd., Mountain View, CA 94043, Tel: 415-965-4500, TWX: 910-379-5002; Empl.: 350; *Sls. Mgr.:* Don Atkins

SYNEKTRON
THE MOTION CONTROL COMPANY

FAX: 503-639-5453

SYNEKTRON CORPORATION, 12000 S. W. Garden Place, Portland, OR 97223, Tel: 503-684-3090, TELEX: 517441; Empl.: 60 ..... **B•1308-1309**

SYNTEST CORP., 40 Locke Dr., Marlboro, MA 01752-9973, Tel: 508-481-7827, FAX: 508-481-5769; Empl.: 26; *Sls. Mgr.:* Curtis P. Hoffman ..... **D•1114**

Local Sales Offices & Reps

FL	Altamonte Springs, Carter Assocs.	305-260-5566
IL	Arlington Heights, Coombs Assocs.	312-439-9810
MA	Marlboro, Data Reps.	617-481-0333
MI	Rockford, Hal C. Heym Assocs.	616-874-7443
NY	Canandaigua, Mamula Sls.	716-394-5560
NY	White Plains, Channel Corp.	914-694-9234
OH	Centerville, EMA Inc.	513-433-2800
PA	Montgomeryville, Eastern Sci. Mktg.	215-368-4570
WA	Beaverton, Seltech Elctrns.	503-629-9254

Local Distributors

WV	Ravenswood, Valtronics, Inc.	304-273-5356

SYNTRONIC INSTRUMENTS, INC., 100 Industrial Rd., Addison, IL 60101, Tel: 312-543-6444, FAX: 312-543-0287; FSC No.: 99409; Empl.: 125; *Sls. Mgr.:* Paul Evans

SYRACUSE ELCTRNS. DIV. OF PASS & SEYMOUR, P.O. Box 4770, Syracuse, NY 13221, Tel: 315-488-4911, TELEX: 937-232; Empl.: 150; *Sls. Mgr.:* Dennis Conard

SYRACUSE ELECTRONICS, Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221, Tel: 315-468-6211, TELEX: 93-7232; Empl.: 125; *Sls. Mgr.:* Dennis Conard

SYSCON INTL., INC., 1108 So. High St., So. Bend, IN 46618-1096, Tel: 219-232-3900, TWX: 810-299-2523, FAX: 219-287-5916; Empl.: 80; *Sls. Mgr.:* Richard Metken

SYSTEMS DATA, INC., 2830 Copley Road, P.O. Box 4297, Akron, OH 44321, Tel: 216-666-0085; Empl.: 12; *Sls. Mgr.:* John C. Hall

SYSTEMS PLUS, 500 Clyde Ave., Mtn. View, CA 94043, Tel: 415-969-7047, TWX: 910-373-2096; Empl.: 20

SYSTEMS RESEARCH LABOROTORIES, Arvin/Calspan, 2800 Indian Ripple Rd., Dayton, OH 45440, Tel: 513-426-6000, TWX: 810-450-2621; FSC No.: 14590; Empl.: 1300

SYSTRON-DONNER INERTIAL DIV., 2700 Systron Dr., Concord, CA 94518, Tel: 415-671-6400, TWX: 910-481-9478, FAX: 415-671-6590; Empl.: 370; *Sls. Mgr.:* G. W. Felsing

SYSTRON-DONNER INSTRUMENT DIV., 2727 Systron Dr., Concord, CA 94518, Tel: 415-676-5000, TELEX: 171996, TWX: 910-481-9479; FSC No.: 52542; Empl.: 100; *Sls. Mgr.:* N. J. Susner, Gen. Mgr.

SYSTRON-DONNER MICROWAVE DIV., 14844 Oxnard St., Van Nuys, CA 91409, Tel: 818-786-1760, TWX: 910-495-1786; Empl.: 160; *Sls. Mgr.:* Ashvin K. Sheth

TAB BOOKS, Blue Ridge Summit, PA 17294-0850, Tel: 717-794-2191, TELEX: 820562, FAX: 717-794-2080; Empl.: 250; *Sls. Mgr.:* John P. Bohman

TACHONICS CORPORATION, Grumman Corp., 107 Morgan Ln., Plainsboro, NJ 08536, Tel: 609-275-2550, FAX: 609-275-2591; Empl.: 75; *Sls. Mgr.:* Kevin Townsend; *Dist. Mgr.:* Kevin Townsend

TADIRAN
ELECTRONIC INDUSTRIES, INC.

FAX: 516-621-4517

TADIRAN ELEC. INDS. INC., 40 Seaview Blvd., Port Washington, NY 11050, Tel: 516-621-4980, TWX: 230-697-3370; Empl.: 6300; *Dist. Mgr.:* Avi Timor, Sls. Mgr. ..... **A•1774; D•1530-1531**

TAFA, INC., 146 Pembroke Rd., Concord, NH 03301, Tel: 603-224-9585, TELEX: 94-3424, FAX: 603-225-4342; Empl.: 50; *Sls. Mgr.:* Bob Unger; *Dist. Mgr.:* Leon Grant

TAIYO YUDEN (USA) INC., 714 W. Algonquin Rd., Arlington Heights, IL 60005-4493, Tel: 312-364-6104, FAX: 312-870-7828; Empl.: 63; *Sls. Mgr.:* Mahiko Tomita

telemia

FAX: 314-364-6320

TALEMA ELECTRONIC, INC., 301 N. Highway 63, Rolla, MO 65401, Tel: 314-364-0882; Empl.: 27; *Sls. Mgr.:* Jeff Goff ..... **A•2464-2465**

Local Sales Offices & Reps

AL	Huntsville, Naylor Assocs., Inc.	205-881-5955
AZ	Scottsdale, Harris & Croy	602-951-9121
AZ	Tucson, Harris & Croy Mfg. Reps.	602-575-5109
CA	Newark, Jacobson & Assocs.	707-552-4412
CO	Englewood, Dynatech, Inc.	303-773-2830
FL	Boca Rotan, Naylor Assocs., Inc.	407-482-5649
IL	Wheaton, Archie Joyner Assocs., Inc.	312-665-6222
IN	Columbus, John H. Weaver Co.	812-372-3625
IN	Indianapolis, John H. Weaver Co.	317-257-7661
KS	Wichita, Buckman & Assocs.	316-267-2052
MA	Billerica, Dynamic Engrg.	508-667-0111
MA	Chelmsford, Dynamic Engrg.	508-250-0200
MI	Plymouth, Leading Edge Sls.	313-420-3344
MN	Minneapolis, RK Sls. Assocs., Inc.	612-571-1001
MO	St. Charles, Buckman & Assocs.	314-946-6201
NY	Commack, R.C. Engrg. Sls.	516-543-3325
NC	Research Triangle Park, Naylor Assocs., Inc.	919-544-6630
OR	Beaverton, Luscombe Engrg.	503-636-6664
PA	Rydal, Espy Sls. Co.	215-576-0780
TX	Lewisville, Elctrn. Prod. Reps.	214-436-4772
UT	Layton, Dynatech, Inc.	801-546-4837
WA	Bellevue, Luscombe Engrg.	206-643-1463

TALIQ CORP., 1277 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-745-0750, FAX: 408-745-1820; Empl.: 90; *Sls. Mgr.:* John Polley

TAMA ELECTRIC CO., LTD., See Raltron Electronics Corp.

tamura

FAX: 213-638-9956

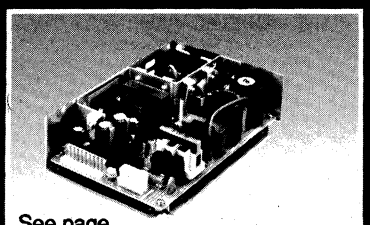
TAMURA CORPORATION OF AMERICA, 1150 Dominguez St., Carson, CA 90746-3518, Tel: 213-638-1790; *Sls. Mgr.:* Doug Henderson ..... **A•1299-1301, 1673-1675, 2376, 2466-2474; D•2068-2079**

Local Sales Offices & Reps

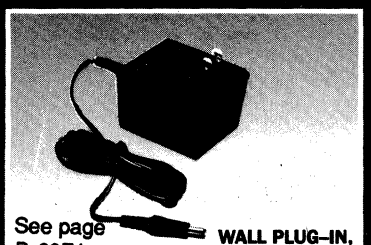
AL	Huntsville, Hughes Assocs.	205-533-9108
AZ	Scottsdale, E.D.P. & Assocs.	602-991-6119
CA	Irvine, Groh Assocs.	714-837-9871
CA	Mtn. View, Thorson West	415-964-9300
CO	Golden, J. F. Hurlbut Co.	303-279-7796
FL	Maitland, Hughes Assocs.	305-629-5933

TAMURA

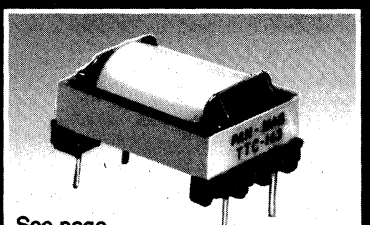
DELIVERS FROM STOCK



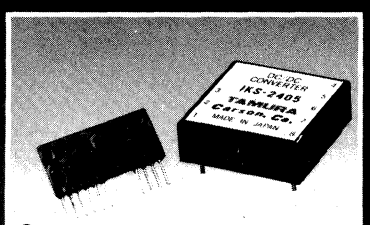
See page D•2075 **SINGLE AND MULTI–OUTPUT SWITCHERS**



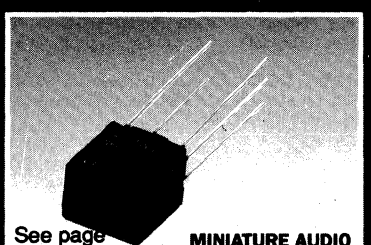
See page D•2074 **WALL PLUG–IN, AC & DC POWER**



See page A•2467 **FCC PART 68 TELCOM LINE COUPLING**

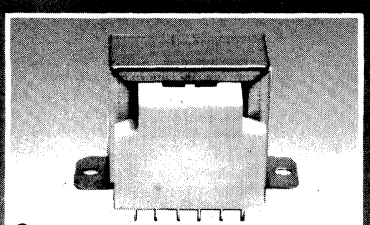


See page D•2071 **DC/DC CONVERTERS SIP & DIP PKG**

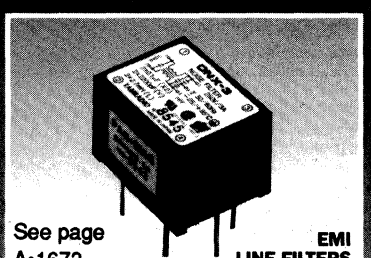


See page A•2469 **MINIATURE AUDIO & PART 68 COUPLING**

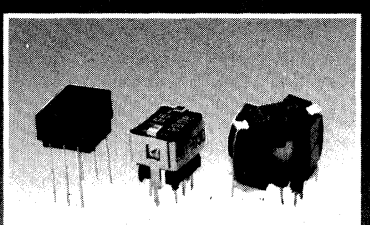
CONTACT FACTORY **COMPUTER NETWORKING BALUNS**



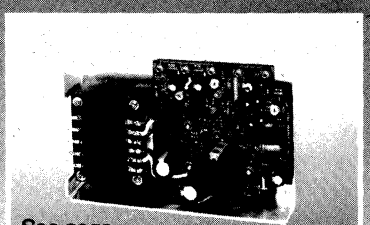
See page A•2471 **INT'L PCB POWER– UL 1411, IEC, VDE, & CSA**



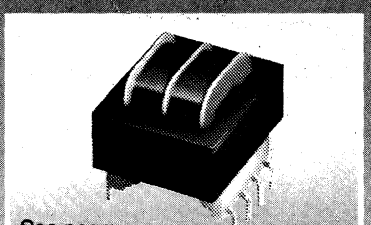
See page A•1673 **EMI LINE FILTERS**



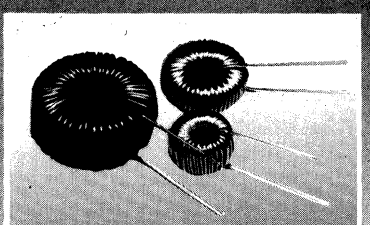
See page A•2468 **WIDE BAND PULSE– T1 & DIGITAL**



See page D•2077 **LINEAR POWER SUPPLIES**



See page A•2472 **UL/CSA PCB POWER**



See page A•1301 **NOISE, COMMON MODE & POWER COILS**

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MD Baltimore, Callas Elctrns. 301-744-7711
NM Albuquerque, Syntech 505-266-7951
NY Fairport, TAC Assoc. 716-377-2250
NY Jericho, J. Square Mktg. 516-935-3200
OH Akron, Augnat Assocs. 216-239-2499
FL Seminole, Q-Rep 813-393-6393
PA Easton, The Kendon Co. 215-253-3100
TX Dallas, M-Rep 214-484-5711
TX Houston, M-Rep 713-261-0798
WA Redmond, General Technlg., Inc. 206-881-6456
Can Quebec, Elcom GbM, Inc. 514-668-3361

Local Distributors
AL Huntsville, Advanced Comps. Mktg. ... 205-881-5493
GA Norcross, Advanced Comps. Mktg. 404-448-7025

TECHNO, INC., 7803 Lemona Ave., Van Nuys, CA 91405, Tel: 818-781-1642, FAX: 818-781-8647; FSC No.: 05347; Empl.: 150; *Sls. Mgr.:* Joe Catrambone; *Dist. Mgr.:* Danny Jagirdar

TECHNO, A DSG Company, 2101 Jericho Tunpike, New Hyde Park, NY 11040, Tel: 516-328-3970, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 85 ..... **B•1310-1311**

TECHNOLOGY DYNAMICS inc.

FAX: 201-385-0702

TECHNOLOGY DYNAMICS INC., 100 School St., Bergenfield, NJ 07621, Tel: 201-385-0500; Empl.: 50; *Sls. Mgr.:* Mark S.Jacobus ..... **D•2082**

Local Sales Offices & Reps
CA Lennox, Dae Joon Elctrns. 213-674-0219
CT Branford, Abbott- Allison Co.,Inc. 203-481-0405
MD Hagerston, Stinson Assocs., Inc. 301-790-1193
NY Rochester, A.J. Electro Mktg. 716-426-3598
VA Reston, Stinson Assocs., Inc. 703-620-0088

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TECHRON DIV., Crown Intl., Inc., 1718 W. Mishawaka Rd., Elkhart, IN 46517, Tel: 219-294-8300, TWX: 810-294-2160; FSC No.: 06306; Empl.: 450; *Sls. Mgr.:* Bill Landow ..... **D•1021-1025**

Local Sales Offices & Reps
CA Manhattan Bch., Basic Trade, Inc. 714-634-2629
CA Milpitas, IFM Inc. 408-945-5920
CO Commerce City, Williams Assocs. 303-289-5647
CT Woodbridge, Electronic Marketing Assoc. 203-397-1461
FL Melbourne, Reynolds & Assocs., Inc. .. 305-259-7000
IL Chicago, Berndt Assocs. 312-283-0713
IA Cedar Rapids, MAI Assocs. 319-396-8030
MI Livonia, Lowell-Wendt Mktg. Co. 313-464-2722
MN St. Paul, Timewave Technlgy., Inc. 612-451-7575
NY Syracuse, Labtronics Inc. 315-455-7314
OH Brecksville, Audio Mktg. Assoc. 216-526-2426
PA Montogomeryville, Eastern Sci. Mktg. 215-368-4570

TECH SPRAY, INC., Box 949, Amarillo, TX 79105, Tel: 806-372-8523, TELEX: 738450, FAX: 806-372-8750; Empl.: 52; *Sls. Mgr.:* Richard G. Russell; *Dist. Mgr.:* Jack Swanson

TECHTROL CYCLONETICS, INC., 815 Market St., New Cumberland, PA 17070, Tel: 717-774-2746, FAX: 717-774-6799; FSC No.: 58792; Empl.: 25; *Sls. Mgr.:* James M. Griffith

TECKNIT a TWP company
EMI SHIELDING PRODUCTS

FAX: 201-272-2741

TECKNIT (EASTERN FACILITY), 129 Dermody St., Cranford, NJ 07016, Tel: 201-272-5500, TELEX: 6853079 TCKNT; FSC No.: 07700; Empl.: 300; *Sls. Mgr.:* Thomas McCreery ..... C•1749

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AL	Toney, Dixie Tech. Mktg.	205-830-0808
AZ	Tempe, Elctm. Dev. & Sls.	602-438-1547
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-566-6580
CA	Santa Barbara, Tecknit (Western Facility)	805-963-5811
CA	Santa Clara, Nova-Tronix	408-727-9530
FL	Clearwater, Tech-Rep Assocs.	813-572-9900
GA	Duluth, Dixie Tech. Mktg., Inc.	404-381-5592
IL	Palatine, Technlg. Sls., Inc.	312-991-6600
IA	Cedar Rapids, Dy-Tronix Inc.	319-377-8275
MD	Rockville, Mechtronics Sls. Inc.	301-340-2130
MN	St. Paul, Repco	612-642-2828
MO	Bridgeton, Dy-Tronix Inc.	314-291-4777
NH	Hudson, EMC Sales	603-889-5751
NY	Binghamton, Empire Tech. Assocs., Inc.	607-772-0651
NY	Fairport, Empire Tech. Assoc.	716-425-3775
NY	Great Neck, Trionics Assocs.	516-466-2300
NY	Skaneateles, Empire Tech. Assoc.	315-685-5703
OH	Broadview Hgts., Jay Engrg.	216-838-4840
OH	Dayton, Jay Engrg.	513-253-2151
PA	Huntingdon Valley, Omega Elctm. Sls. Inc.	215-947-4135
TX	Austin, Kruvand Assocs.	512-441-6777
TX	Dallas, Kruvand Assocs.	214-437-3355
WI	Milwaukee, Technlg. Sls. Inc.	414-786-5015
Can	Montreal, Que., Norgay Entprs., Ltd.	514-932-3233
Can	Ottawa, Ont., Norgay Entprs., Ltd.	613-723-1858
Can	Toronto, Norgay Entprs. LTD.	416-234-8966

TECNETICS, See Computer Products, Inc.

TECNETICS, Computer Products/Tecnetics, 6287 Arapahoe Ave., Boulder, CO 80306, Tel: 303-442-3837, FAX: 303-444-9437

Refer to Computer Products, Inc., Pompano Beach, FL for sales offices, Reps. and Distributors.

TECO CORP., Bay Rd., P. O. Box A, Winnisquam, NH 03289, Tel: 603-524-1998, FAX: 603-524-1899; Empl.: 40-50; *Sls. Mgr.:* Sandra Murphy

TECOM INDUSTRIES, INC., 9324 Topanga Canyon Blvd., Chatsworth, CA 91311, Tel: 818-341-4010, TELEX: 69 8476, FAX: 818-718-1402; FSC No.: 59850001; Empl.: 134

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TECTROL, INC., 39 Kodiak Cres., Downsview, Ontario, Canada M3J 3E5, Tel: 416-630-8108; Empl.: 320; *Sls. Mgr.:* Len Klebanoff ..... D•2083-2085

Local Sales Offices & Reps

CA	Los Altos, PEI Assocs.	415-968-1803
CT	Framingham, Int'l Mktg. Grp.	508-788-0316
MA	Westboro, Bay Colony Reps.	617-870-1930
NJ	Ho-Ho-Kus, Alto Assocs.	201-447-1770
NY	Buffalo, Lynn Assocs.	716-631-0054
PA	Pittsburgh, Lynn Assocs.	412-443-3670
TX	Richardson, Interactive Comp. Sls.	214-669-2277
WI	Wauwatosa, Larsen Assocs., Inc.	414-258-0529
Can	Downsview, Ont., Tectrol Inc.	416-630-8108

TEGAL SCIENTIFIC, INC., Box 5905, Concord, CA 94524, Tel: 415-827-1054, TELEX: 380053, FAX: 415-827-1189; *Sls. Mgr.:* L. Rigali

TEGAM, INC., 7230 N. Ridge Rd., Madison, OH 44057, Tel: 216-428-7505, TELEX: 205188 TEGAM MSON, FAX: 216-428-1068; Empl.: 25; *Sls. Mgr.:* Robert A. Rodella

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TEKA INTERCONNECTION SYSTEMS, 45 Salem Dr., Providence, RI 02907, Tel: 401-785-4110, TWX: 710-381-1606; Empl.: 89; *Sls. Mgr.:* Barry Manchester; *Dist. Mgr.:* Barry Manchester ..... C•1538-1541

Local Sales Offices & Reps

CA	Downey, Management Mktg. & Sls.	213-560-5584
CA	Sunnyvale, W. W. Posey Co.	408-746-0771
CO	Boulder, R.G. Entprs., Inc.	303-447-9211
IL	St. Charles, May Assocs., Inc.	312-377-2320
MA	Danvers, C.H. Burnham Assoc.	508-774-0111
MN	Wayzata, Cardinal Sls.	612-475-0041
NJ	Pompton Plains, T. A. Adamo Sls.	201-835-5344
TX	Houston, Mil-Rep Assocs.	713-444-2557

Local Distributors

CA	Hayward, KEA Elctms.	415-887-2900
CA	Irvine, Mann Southwest	714-380-4170
CA	Santa Ana, Norstan Elctms.	800-854-8344
CA	Santa Clara, Cypress Elctms.	408-980-2500
MA	Andover, Aved Elctms.	617-688-3800
MA	Canton, E.P.C., Inc.	617-821-2111
MI	Roseville, Madsion Elctms.	313-778-7640
MN	St. Paul, Shelley-Ragon, Inc.	612-642-2844
NY	Farmingdale, Pride Elctms.	516-293-4020
NY	Ronkonkoma, Conco Elctms.	516-467-8200
NC	Raleigh, Resco Raleigh	919-781-5700
OH	Centerville, LP.D., Inc.	513-435-2086
TX	Allen, Prime Distbn.	214-231-0170
TX	Dallas, Cypress Elctms.	214-869-1435
WA	Seattle, Shelley Ragon, Inc.	206-241-1980

TEKTRONIX, INC., P.O. Box 500, 76/260, Beaverton, OR 97077, Tel: 800-835-9433, TELEX: 151754, FAX: 503-657-5502; FSC No.: 80009; Empl.: 16,000

TEKTRONIX, INC., Display Devices Operation, P. O. Box 500, Beaverton, OR 97077, Tel: 503 627 6868

TEKTRONIX-SIGNAL ANALYSIS UNIT, 1350 Dell Ave., No. 104, Campbell, CA 95008, Tel: 408-374-6464, FAX: 408-374-6467; *Sls. Mgr.:* Rick Wills

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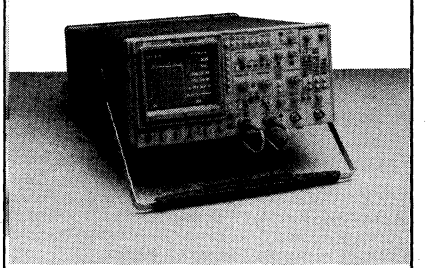

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TEKNATIONAL INDS., INC., 430 S. Clinton Ave., Rochester, NY 14620-1103, Tel: 716-232-1291, FAX: 716-232-1295; FSC No.: 24227; Empl.: 15; *Sls. Mgr.:* J. D. Hochheimer

TEKTONE SOUND & SIGNAL, 1331 S. Killian Dr., Lake Park, FL 33403, Tel: 407-844-2383, FAX: 407-845-1587; FSC No.: 59-1500771; Empl.: 70; *Sls. Mgr.:* Tom Hendricks; *Dist. Mgr.:* Tom Hendricks

TEKWORKS, INC., 72 Redner Rd., Morristown, NJ 07960, Tel: 201-540-1096, FAX: 201-540-9412; Empl.: 2; *Sls. Mgr.:* David A.H. Robinson ..... **D•1351**

Local Sales Offices & Reps

PA Doylestown, Technical Instr. Sls. 215-345-4110

TELCOM INTERNATIONAL, INC., See Hadron, Inc.

TELEBYTE TECHNOLOGY, INC., 270 East Pulaski Road, Greenlawn, NY 11740, Tel: 516-423-3232, 800-835-3298, TWX: 510-226-0449, FAX: 516-385-8184; Empl.: 48; *Sls. Mgr.:* J. Kramer; *Dist. Mgr.:* R. Nazario

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MD Rockville, Spectro Assocs. 301-294-9770
MN Wayzata, Comtel Midwest 612-476-1551
TX Ft. Worth, GMA Mktg. 817-834-2258
Can Nepean, Ont., Multitek, Inc. 613-226-2365

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AL Birmingham, Mid South Data 205-942-2453
CA San Rafael, Diversified Data Resources 415-499-8870
FL Melbourne, Data Link Ready 305-676-0500
GA Alpharetta, Codaram 404-664-3510
IL Palatine, Comprehensive Comm. Sys. 312-934-0580
MD Hanover, Vertex-CCP 301-796-5000
MN Minneapolis, On-Line Intl. 612-888-4444
MO St. Louis, Micro Prod. Sls. 314-576-7355
NJ Northvale, Glasgal Comms. 201-768-8082
NY Hauppauge, Data Path Prods. 516-273-3527
OH New Carlisle, R.W. Bowen 513-845-1880
OH Westlake, Arc Elctrn. 800-362-6883
OK Tulsa, Engrg. Design Grp. 918-622-1388
TN Memphis, Hitech Data 901-373-6041
Can Vancouver, CD Nova 604-430-5612

TELECOMMUNICATIONS TECHNIQUES CORP., 20410 Observation Drive, Germantown, MD 20874, Tel: 301-353-1550, FAX: 301-353-0734

TELECTRO SYSTEMS CORP., 96-18 43rd Ave., Corona, NY 11368, Tel: 718-651-8900, TWX: 510-601-8607 TELECTRO, FAX: 718-651-4103; FSC No.: 30040; Empl.: 50; *Sls. Mgr.:* H. Sussman

TELEDYNE AEROSPACE SYS., 1007 E. 10th St., Fairmont, MN 56031, Tel: 507-235-3355, TWX: 910-565-2120, ESYLNK: 62899301; FSC No.: 24600; Empl.: 230; *Sls. Mgr.:* Robert L. Johnson

TELEDYNE ANSONIA, Solderless Connector Div., One Riverside Dr., Ansonia, CT 06401, Tel: 203-735-9311, TELEX: 963408, ESYLNK: 62877180; FSC No.: 19724

TELEDYNE CRYSTALONICS, Teledyne Industries, Inc., 147 Sherman St., Cambridge, MA 02140, Tel: 617-491-1670, TWX: 710-320-1196, FAX: 617-547-6119; FSC No.: 12498;Multiple; *Dist. Mgr.:* W. J. Kilgarriff

TELEDYNE/GEOTECH, 3401 Shiloh Rd., Garland, TX 75041, Tel: 214-271-2561, TELEX: 170584; FSC No.: 99019; Empl.: 175

TELEDYNE GURLEY, 514 Fulton St., P.O. Box 88, Troy, NY 12181, Tel: 518-272-6300, TWX: 710-443-8156, FAX: 518-274-3660; *Sls. Mgr.:* G. S. Gordon

Local Sales Offices & Reps

CA Ventura, Collette Assocs. 805-658-7506
CT Hamden, JBL Assocs. 203-281-3161
IL Hillside, Cadre Tech. Reps. 312-449-3900
IN Indianapolis, Ron Schafer & Assocs. .. 317-848-2702
MD Columbia, Stein Instr. 301-596-3748
MA Holbrook, McLellan Assocs. 617-767-4771
MI Livonia, Lowell-Wendt Mktg. 313-464-2722
MN St. Paul, Northstar Motion & Control .. 612-770-5311
NY Buffalo, Good Comps. 716-634-4400
OR Portland, Fry Controls 503-244-3313
PA Cheltenham, Stein Instr. 215-379-1990
TX Richardson, Barger Engrg. 214-349-6171
Can Ottawa, Ont., Tech-Trad 613-727-1272

TELEDYNE INET, Teledyne, Inc., 1901 Avenue Of the Stars, Century City, Los Angeles, CA 90067, Tel: 213-325-5040, TELEX: 67-7228, FAX: 213-534-2274; FSC No.: 90911; Empl.: 485; *Sls. Mgr.:* Bruce Brady

TELEDYNE KINETICS, Div. of Teledyne, Inc., 410 S. Cedros Ave., Solana Beach, CA 92075, Tel: 619-755-1181, TELEX: 62877770; FSC No.: 06928; Empl.: 100; *Sls. Mgr.:* John Schuler

TELEDYNE MICROELECTRONICS, 12964 Panama St., Los Angeles, CA 90066, Tel: 213-822-8229, 213-870-9831, TWX: 910-343-7436; FSC No.: 16170; Empl.: 1500; *Sls. Mgr.:* W. Kennedy

TELEDYNE MICROWAVE, 1290 Terra Bella Ave., Mountain View, CA 94043, Tel: 415-968-2211, TWX: 910-379-6939, FAX: 415-966-1521; FSC No.: 24022; Empl.: 500; *Sls. Mgr.:* M. Lee

TELEDYNE RELAYS

FAX: 213-779-9161

TELEDYNE RELAYS, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, Tel: 213-777-0077, TWX: 910-321-4610; FSC No.: 11532; *Sls. Mgr.:* Tom Garland ..... **B•1640-1650**

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AL Huntsville, Advanced Comps. Mktg. ... 205-881-5493
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FL Clearwater, HHP Assocs., Inc. 813-797-4447
FL Pompano Beach, HHP Assocs., Inc. ... 305-971-5750
FL Winter Pk., HHP Assocs., Inc. 305-740-0320
GA Doraville, Advanced Comps. Mktg. 404-448-7025
IL Glen Ellyn, Teledyne Relays 312-858-1090
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IA Cedar Rapids, Stan Clothier Co. 319-365-1717
KS Olathe, C-Tron 913-829-0073
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MA Marlborough, Vista Assoc. 617-481-9277
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Can Ottawa, Ont., Deskin Sls. 613-729-1099
Can St. Laurent, Que., Deskin Sls. 514-331-2860
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Can Vancouver, Deskin Sls. 604-324-8343

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AL Huntsville, Time Elctrns. 205-721-1133
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CA Agoura Hills, Time Elctrns. 818-707-2890
CA Anaheim, Time-Anaheim 714-937-0911
CA Calabasas, Wyle 818-880-9000
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CA Chatsworth, Time 818-998-7200
CA Irvine, Wyle Dist. Grp. 714-863-9953
CA Rancho Cordova, Wyle 916-638-5282
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CA Torrance, Time-West 213-320-0880
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MO St. Louis, Time Elctrns. 314-391-6444
NJ Marlton, Milgray/Delaware Valley 609-983-5010
NJ Pinebrook, Time Elctrns. 201-882-4611
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NY E. Syracuse, Time Elctrns. 315-432-0355
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OH Dayton, Pioneer/Dayton 513-236-9900
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Can Vancouver, BC, Deskin Sls. 604-324-8343
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TELEDYNE ROTOLITE, P.O. Box 398, Owen, WI 54460, Tel: 800-524-0105, TWX: 710-986-3017; *Sls. Mgr.:* J. F. Stickel

TELEDYNE RYAN ELECTRONICS, 8650 Balboa Ave., San Diego, CA 92123, Tel: 619-560-6400, TELEX: 695-028, TWX: 910-335-1174; Empl.: 600; *Sls. Mgr.:* J.E. Wallin

TELEDYNE SEMICONDUCTOR, 1300 Terra Bella Ave., PO Box 7267, Mountain View, CA 94039-7267, Tel: 415-968-9241, TWX: 910-379-6494, FAX: 415-967-1590; FSC No.: 15818; Empl.: 200

Local Sales Offices & Reps

AZ Phoenix, Sun State Tech. 602-220-0595
CA Agoura, Northern Tech. Sls. 818-991-0091
CA Fountain Valley, Dyna Rep. Inc. 714-545-3255
CA Mountain View, Teledyne Semiconductor 415-968-9241
CA San Diego, Bestronics 619-693-1111
CO Lakewood, CANDAL 303-935-7128
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CT Norwalk, Park Distr. 203-853-2010
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FL Miami Bch., B. Frank Inc. 305-861-8227
GA Macon, Giga Corp. 912-745-2897
IL Skokie, Sargent Welch Inc. 312-677-0600
LA New Orleans, Bailey Distr. 504-943-2461
MD Bethesda, Albee Sls. 301-897-8088
MA Revere, Sozio's 617-547-6900
NJ Newark, Cotrapex, Inc. 201-589-1416

NJ Newark, Pinto Trading 201-344-7748
NY Long Island City, H. L. Dalis, Inc. 212-361-1100
NY New York, Gelb Sls. 212-475-7940
NY New York, Rosetta Elec. 212-233-9088
OH Dayton, K. Elctrns. 513-426-1877
PA Philadelphia, H & Z Sls. 215-912-2500
TX Houston, Cross & Co. 713-673-3100
TX Houston, Western Sls. 713-869-6671
VA Bailey's Crossroads, Arya Corp. 703-845-0800
WA Seattle, ForeigN Elctrns. 206-682-2761
WA Seattle, Pearl Elctrns. 206-622-6200
EXP NY, New York, Able Intl, Ltd. 212-696-5300

TOKIN AMERICA, INC., 155 Nicholson Ln., San Jose, CA 95134, Tel: 408-432-8020, FAX: 408-434-0375; Empl.: 15; *Sls. Mgr.:* Anthony R. Costarella; *Dist. Mgr.:* Anthony R. Costarella

TOKO AMERICA, INC., 1250 Feehanville Dr., Mt. Prospect, IL 60056, Tel: 312-297-0070, FAX: 312-699-7864; Empl.: 75; *Sls. Mgr.:* Jim Onodera; *Dist. Mgr.:* Mark Sullivan ..... **A•1276-1277, 1725; D•2132-2133**

Local Sales Offices & Reps
AL Huntsville, Toko America, Inc. 205-830-0952
CA Campbell, Kottmeier Assocs. 408-371-8700
CA Cupertino, Toko America, Inc. 408-996-7575
CA Irvine, Mission Ridge Mktg. 714-253-4626
CA San Diego, Varigon-San Diego 619-576-0100
CT Danbury, Toko America, Inc. 203-748-6871
IL Mt. Prospect, Toko America, Inc. 312-297-0070
MA Needham Hgts., The Newscott Co., Inc. 617-444-1923
MA Newton, Elctrn. Comp. Mktg. 615-828-4243
TN Rutledge, E.C.M. 615-828-5741

Local Distributors
CA Orange, Inductor Supp. 714-978-2277
MA Wilmington, Northstar Elctrns. 508-657-5155
MN Thief River Falls, Digi-Key Corp. 800-344-4539

TONG HSING ELCTRN. INDS. LTD., 31 E. 400 St, Orem, UT 84058, Tel: 801-226-1383, TWX: 453161 EPHYCERAM, FAX: 801-226-1437; Empl.: 321; *Sls. Mgr.:* Frederick R. Hyatt

TOPAZ, INC., 9192 Topaz Way, San Diego, CA 92123-1165, Tel: 619-279-0831, TWX: 910-335-1556, FAX: 619-569-8427; FSC No.: 06049; Empl.: 350; *Sls. Mgr.:* Dan Mathews, Dir. of Sls.; *Dist. Mgr.:* Dan Mathews, Dir. of Sls.

Please refer to Topaz' sales representatives for distributor information.

TOPFLIGHT, 160 East 9th Ave., York, PA 17404, Tel: 717-843-9901, 800-233-9386, TWX: 510-657-4849, FAX: 717-845-6087; Empl.: 250; *Sls. Mgr.:* Bill Ciabattoni

TOPWARD INSTRUMENTS, Div. of Hauman, Inc., 2031 Ringwood Avenue, San Jose, CA 95131, Tel: 408-434-0888, TWX: 510-101-2820, FAX: 408-434-9832; Empl.: 1000; *Dist. Mgr.:* Thomas C. Trieu

TORAD COIL CO., INC., 283 Linden Rd., Wayne, NJ 07470, Tel: 201-835-6195; *Sls. Mgr.:* Dan Gupta

TORELCO, INC., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111, Tel: 201-374-8641; Empl.: 20; *Sls. Mgr.:* Stewart H. Cook

TOREMA TRANSFORMERS

FAX: 713-977-5031

TOREMA U.S.A., INC., 3911 Fairhill Dr., Houston, TX 77063, Tel: 713-977-2500; FSC No.: QB2R8; Empl.: 10; *Sls. Mgr.:* David P. Snelling ..... **A•2477-2479**

Toroid SUPERIOR TRANSFORMERS

FAX: 301-464-4657

TOROID CORP. OF MARYLAND, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, Tel: 301-464-2100, TWX: 710-826-0414; *Sls. Mgr.:* David Gibson ... **A•2484-2488**

Local Sales Offices & Reps
AZ Phoenix, Saguaro Sls. 602-870-9242
CA San Jose, Marketing Co. 408-259-7376
CA San Jose, Texel North 408-272-6836
CA Seal Beach, Texel 213-596-9411
IL Wheeling, Ed Joyner & Co. 708-520-1200
MA Southboro, Sullivan Tech. Sls. 508-485-2215
MA Southboro, STS 508-485-2215
NY Great Neck, F & F Metro 516-482-4080
NY Ludlow, Verro & Assoc. 802-228-5240
PA Huntingdon Valley, Ed Leiby & Assocs. 215-659-8938
PA Huntington, Ed Leiby & Assoc. 215-659-8076
VA Alexandria, Ed Leiby & Assocs. 703-360-9039

TOROTEL PRODUCTS INC.

FAX: 816-763-2278

TOROTEL PRODS. INC., 13402 S. 71 Hwy., Grandview, MO 64030-3199, Tel: 816-761-6314; Empl.: 250; *Sls. Mgr.:* H. Foland ..... **A•1303-1323, 2491-2496**

Local Sales Offices & Reps
AZ Tempe, Gassner & Clark Co. 602-968-9037
CA Redwood City, Hickey Ind. Sls. 415-594-9978
CA Santa Ana, California Elctrn. Mktg. 714-835-2702
FL Orlando, Perrott Assocs. 407-830-0094
MN Minneapolis, QDC Inds. 913-341-2214
IL Chicago, Tristar Grp.,Inc. 312-593-0200
IN Greenwood, Valentine & Assocs. 317-888-2260
IA Hiawatha, Gassner & Clark Co. 319-393-5763
MD Towson, Dickison Sls. Co. 301-823-0923
MA Weston, John Goode Assocs. 617-235-3900
GA Atlanta, L&D, Inc. 404-395-7079
MO St. Louis, Abrams & Assocs. 314-569-0447
NY New Hyde Park, R. P. Luce & Co., Inc. 516-437-4550
NY Syracuse, Rep Tech. Inc. 315-437-2845
NC Raleigh, L & D, Inc. 919-876-5301
OH New Lebanon, J. N. Bailey & Assocs. 513-687-1325
CO Boulder, Stratford Grp. 303-530-3194
TX Dallas, Tycom Sls. Co. 214-960-7368
WI Brookfield, Tristar Grp., Inc. 414-782-2670
Can Toronto, Ont., Strategic Elctrns. 416-620-5381

TOROTRON CORP., 519 South Fifth Ave., Mt. Vernon, NY 10550, Tel: 914-664-2050; Empl.: 14; *Sls. Mgr.:* Miriam Zanger ..... **D•1357**

TORQ CORP., 32 W. Monroe St., Bedford, OH 44146, Tel: 216-232-4100, FAX: 216-232-4104; Empl.: 50; *Sls. Mgr.:* Lee Seabeck

TORWICO ELECTRONICS INC

FAX: 201-363-6234

TORWICO ELCTRNS. INC., 410 Oberlin Ave. South, Lakewood, NJ 08701, Tel: 201-364-1800, TWX: 710-723-8343; Empl.: 200 ..... **A•2498-2499**

Local Sales Offices & Reps
CA Burlingame, Long and Assocs. 415-342-6544
CA El Cajon, KCE Corp. 619-588-1198
FL Orlando, Gra-Mar 305-658-1971
IN Noblesville, Patco & Assocs. 317-877-5986
IA Blue Grass, Ensco Rep 319-381-1466
IA Marion, Ensco Rep 319-377-8551
KS Countryside, Ensco rep 913-384-0840
KS Wichita, Ensco Rep 316-683-1070
MD Riderwood, W. S. Warrington & Assoc. 301-823-8759
MA Hingham, N.E. Reps. 617-749-8700
MO Maryland Heights, Ensco Rep 314-423-3935
NJ Marlton, BGR Assocs. 609-983-1020
NY Albany, Lynn Assocs. 518-459-1239
NY Buffalo, Lynn Assocs. 716-631-0054
NY Great Neck, Trionic 516-466-2300
OH Akron, Eljay Assoc. 216-666-3774
OR Portland, Abacus Sls. 503-777-8111
PA Pittsburgh, Lynn Assocs. 412-935-1466
TX Irving, Kite Elctrns. Sls. Co. 214-986-0321

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TOTAL POWER INTERNATIONAL, INC., 418 Bridge St, Lowell, MA 01850, Tel: 508-453-7272, TELEX: 948617; Empl.: 15 ..... **D•2115-2117**

Local Sales Offices & Reps

AZ	Tempe, Thor Engrg.	602-438-8494
CA	Goleta, Thorson Co. of S. Cal.	805-964-8751
CA	La Jolla, Thorson Co. of S. Cal.	619-292-8525
CA	Signal Hill, Thorson Co. of S.Cal.	213-595-0361
CO	Denver, W.E.S.T.	303-477-8180
FL	Ft.Lauderdale, Rainbow Sls.	305-733-9876
GA	Lilburn, The Phillip-Matthew Corp.	404-381-1662
IL	Schaumburg, Delta Tech. Sls.	312-310-0280
IN	Indianapolis, Mohrfield Mktg.	317-546-6969
IA	Cedar Rapids, Complete Sls.	315-393-7610
MA	Framingham, JDS Reps.	508-872-5876
MI	Brighton, A.P. Assocs.	313-229-6550
MN	Oakdale, Complete Sls.	612-731-2923
NJ	Mountain Lakes, Components for Elctrns.	201-625-0900
NC	King, The Phillip- Matthew Corp.	919-983-9790
OH	Bedford, A.P. Assocs.	216-475-0485
PA	Gibsonia, Lynn Assocs.	412-443-3670
UT	Salt Lake City, W.E.S.T.	801-292-8787
WI	Brookfield, Delta Tech.	414-781-4775
Can	Weston, Ont., Willagen Elctrns.	416-748-3538

Local Distributors

FL	Orlando, GMI Dists.	305-658-1082
GA	Norcross, Applied Power Inc.	404-263-0421
MI	Brighton, Applied Power Inc.	312-227-3604

TOWER ELECTRONICS, INC., 281 S. Commerce Circle, Fridley, MN 55432, Tel: 612-571-3737, FAX: 612-571-5605; *Sls. Mgr.:* Blase Des Marais

TOYOCOM USA INC., 617 E. Golf Rd, Ste. 112, Arlington Heights, IL 60005, Tel: 312-593-8780, FAX: 312-593-5678; Empl.: 10; *Sls. Mgr.:* Selichi Omoto ..... **A•1491**

TOYO SPECTRUM CORP., 2934 Corvin Drive, Santa Clara, CA 95051, Tel: 408-720-8877, TELEX: 297584 TEAM UR, FAX: 408-720-9643; *Sls. Mgr.:* Bo Bjarno

TRACEWELL ENCLOSURES, INC., 567 Enterprise Dr., Columbus, OH 43081, Tel: 614-846-6175, 800-848-4525, FAX: 614-846-4450; Empl.: 30; *Sls. Mgr.:* Walter G. Waldron ..... **C•1110-1112**

Local Sales Offices & Reps

AZ	Phoenix, Hannah-Hill	602-431-1771
CA	Garden Grove, Advanced Digital Grp.	714-897-0319
CA	Mountain View, Thorson West	415-964-9300
CO	Broomfield, Hannah-Hill	303-460-0602
CT	Hartford, OEM Mktg. & Sls.	203-241-1612
ID	Idaho Falls, Hannah-Hill	208-529-0671
IL	Chicago, Computer & Sys. Sls.	312-830-7711
MA	Franklin, OEM Mktg. & Sls.	508-528-4983
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NM	Albuquerque, Hannah-Hill	505-292-4098
OH	Cleveland, Five Star Elctrns.	216-349-1611
TX	Irving, Space Elctrns.	214-251-3636
UT	Salt Lake City, Hannah-Hill	801-364-0606
WI	Waukesha, Computer & Sys. Sls.	414-544-1411

TRA-CON, INC., 55 North St, Medford, MA 02155, Tel: 617-391-5550; Empl.: 55; *Sls. Mgr.:* Dan Romanow

TRACOR FLIGHT SYSTEMS, INC., Tracor, Inc., A Westmark Co., 1241 E. Dyer Rd, Santa Ana, CA 92705, Tel: 714-662-0333, TWX: 510-601-1467 FSI HDQT; FSC No.: 6B468; Empl.: 550; *Sls. Mgr.:* A. Mallamo/J. Stempson

TRACOR INSTRUMENTS, 6500 Tracor La., Bldg. 27, Austin, TX 78725-2100, Tel: 512-929-2051, TWX: 910-874-1366, FAX: 512-929-2747; Empl.: 10,800; *Sls. Mgr.:* William R. Murphy; *Dist. Mgr.:* Will Hoover

TRACOR PAKTRONICS, Westronics, Inc., 2441 Northeast Pkwy., Ft. Worth, TX 76106, Tel: 817-625-2311, 800-433-2880, TELEX: 629 00631, FAX: 817-625-1068; Empl.: 30; *Sls. Mgr.:* W. C. Preston

FAX: 813-886-2794

TRAK MICROWAVE CORP., 4726 Eisenhower Blvd, Dept. E-9, Tampa, FL 33634, Tel: 813-884-1411, TELEX: 52-827, TWX: 810-876-9140; FSC No.: 12855; *Sls. Mgr.:* Toby Gant ..... **A•1855-1859**

Local Sales Offices & Reps

AZ	Mesa, Fetty/Schoenduve	602-241-9009
CA	El Segundo, Fetty/Schoenduve	213-322-4991
CA	Mountain View, Disman Bakner	415-969-3010
CA	San Diego, Fetty/Schoenduve	619-292-5136
CO	Parker, Howard Assocs.	303-841-5755
FL	Melbourne, Jerry Williams, Inc.	407-259-7700
GA	Lawrenceville, M. Lader Co.	404-985-8057
IN	Ft. Wayne, TX Sls. Indiana	219-489-4447
IA	Cedar Rapids, J.R. Sls. Engrg.	319-393-2232
MD	Columbia, M. Lader Co.	301-381-1550
MD	Conowingo, M. Lader Co.	301-378-3449
MA	Andover, Bee Assoc.	508-475-2124
MO	Maryland Heights, Ensco-Rep Inc.	314-423-3935
NY	Liverpool, R&D Assocs.	315-457-0100
NY	New Rochelle, Ascor Elctrns.	914-235-8838
NC	Greensboro, M. Lader Co.	919-674-8970
PA	Lafayette Hill, M. Lader Co.	215-825-3177
TX	Austin, Thorson Co.	512-345-1985
TX	Dallas, Thorson Co.	214-233-5744
TX	Houston, Thorson Co.	713-558-8205
WA	Seattle, Datacom Assocs.	206-285-2525
Can	Nepean, Ont., Norgay Entprs.	613-723-1858
Can	Richmond, B.C., Norgay Entprs.	604-275-1121
Can	Toronto, Ont., Norgay Entprs.	416-259-9663
Can	Westmount, Que., Norgay Entprs.	514-932-3233

Local Distributors

CA	Mtn. View, Comstock Distrs., Inc.	415-969-3010
IL	Des Plaines, Compucon Distr., Inc.	312-827-9444
MA	Reading, Compucon Distr., Inc.	617-944-6875
NY	Ronkonkoma, Compucon Distr., Inc.	516-499-1211
PA	Conshohocken, MLC Distrs., Ltd.	215-825-3177

TRAK MICROWAVE LTD., TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, Scotland DD2 1TY, Tel: 44-382-561509, TELEX: 76266, FAX: 44-382-562643; Empl.: 30

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FAX: 813-886-2794

TRAK SYSTEMS, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E-9, Tampa, FL 33634-6391, Tel: 813-884-1411, TELEX: 52-827, TWX: 810-876-9140; FSC No.: 11165; *Sls. Mgr.:* Thomas L. Roberts ..... **D•1197-1201**

Local Sales Offices & Reps

AL	Huntsville, Magaro & Assocs.	205-882-0827
AZ	Phoenix, J. Smith Assocs.	602-267-0981
CA	Mtn. View, Tech Mktg. Assocs. Inc.	415-968-0102
CA	San Diego, L. L. Stoakes, Inc.	619-452-1600
CO	Parker, Howard Assocs.	303-841-5755
FL	Sarasota, Bass Assocs.	813-922-9538
GA	Atlanta, Magaro & Assocs.	404-451-8862
IN	Ft. Wayne, TX Sls. Indiana	219-489-4447
MD	Annapolis, Blackwood Assocs.	301-268-3669
MA	Wayland, High-Tech Sls., Inc.	617-653-3838
NM	Albuquerque, J. Smith Assocs.	505-345-6501
NC	Raleigh, M. Lader Co.	919-848-3253
PA	Philadelphia, Rabal Assocs.	215-922-6914
TX	Arlington, J. T. Houston Assocs.	817-265-2931
WA	Bellevue, Tasco, Inc.	206-453-1414
Can	Nepean, Ont., Norgay Entprs.	613-723-1858
Can	Richmond, B.C., Norgay Entprs.	604-275-1121
Can	Toronto, Ont., Norgay Entprs.	416-234-8966
Can	Westmount, Que., Norgay Entrps.	514-932-3233

TRANCOR, 108 N. High St, P.O. Box 907, San Saba, TX 76877, Tel: 915-372-6127; Empl.: 6; *Sls. Mgr.:* William F. Mayfield

TRANSAMERICA DELAVAL, INC., See IMO Delaval, Inc., CEC Instruments Div.

TRANSAMERICA DELAVAL, See IMO Delaval, Inc., Gems Sensors Div.

Trans American Transformer, Inc.

FAX: 516-928-0852

TRANS AMERICAN TRANSFORMER, 26 Hulse Rd, E. Setauket, NY 11733, Tel: 516-928-0762; FSC No.: 61619; Empl.: 30 ..... **A•2489**

TRANSCO PRODUCTS, INC., 1001 Flynn Rd., Camarillo, CA 93011-6003, Tel: 805-987-8007, TELEX: 857579, FAX: 805-484-0830; FSC No.: 82152; Empl.: 325; *Sls. Mgr.:* Jerry Fricke, Dir. of Mktg.

TRANSDUCERS & SYSTEMS

FAX: 203-481-8937

TRANSDUCERS & SYSTEMS, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092; Empl.: 60; *Sls. Mgr.:* J. L. Jamieson ..... **B•1996**

Local Sales Offices & Reps

CA	Huntington Beach, Transducer Sys.	714-969-7690
CA	Santa Clara, Tech-Ser, Inc.	408-496-1004
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs., Inc.	317-293-5437
IA	Marion, Marsland Assocs.	319-373-0566
MD	Joppa, Electra-Tech	301-877-0344
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-991-1399
NJ	Hillsdale, CB Assocs., Inc.	201-644-6230
NY	Rochester, TAE-REP	716-586-8710
NY	Schenectady, TAE-REP, Inc.	607-692-3705
NY	Whitney Point, TAE-REP, Inc.	607-692-3705
OH	Dayton, RIXAN Assocs.	513-278-4216
OH	Stow, Rixan Assocs., Inc.	216-686-2909
PA	Bensalem, Electra-Tech	215-245-7455
TX	Houston, Electric Control Assocs.	713-771-5944
TX	Lewisville, Electric Control Assocs.	214-221-3143
VA	Dumfries, Electra-Tech	703-670-6962
WI	New Berlin, Marsland Assocs., Inc.	414-786-6611

TRANSDUCER SYSTEMS, INC., 1510 Delp Dr., Kulpsville, PA 19443, Tel: 215-256-4611, FAX: 215-256-4214; Empl.: 310

TRANSDUKTOR, INC., See Ulveco, Inc.

TRANSENE, Rte. 1, Rowley, MA 01969, Tel: 508-948-2501, FAX: 508-948-2206; Empl.: 21; *Sls. Mgr.:* H. Femino

TRANSFORMER DESIGN, INC., 7901 W. Clinton, Milwaukee, WI 53223, Tel: 414-358-5300; *Sls. Mgr.:* Fred A. Lewis

TRANSFORMER TECHNOLOGIES, INC., 52 Putnam St., Mt. Vernon, NY 10550, Tel: 914-668-1600, FAX: 914-668-4794; Empl.: 10; *Sls. Mgr.:* Thomas Quaglieri ..... **A•2501**

TRANSICOIL, INC., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990, Tel: 215-277-1300, TWX: 510-660-0132; FSC No.: 82686; Empl.: 290; *Sls. Mgr.:* P. Schoenacker

TRANSICOIL INC., Penn Airborne Products, 950 Industrial Hwy., Southampton, PA 18966, Tel: 215-355-3400, TELEX: 834-759, FAX: 215-322-2194; FSC No.: 25805; Empl.: 41; *Sls. Mgr.:* Claude Mercier

TRANSISTOR DEVICES, INC., 274 S. Salem St, Randolph, NJ 07869, Tel: 201-361-6622; FSC No.: 09004; Empl.: 600; *Sls. Mgr.:* J. A. Gilson ..... **D•1358-1362, 2164-2165**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs., Inc.	205-533-9108
AZ	Scotsdale, Dave Menegay & Assocs.	602-994-9519
AR	El Dorado, Kemp Engrg. Co. Inc.	501-862-5869
CA	Bakersfield, FLW, Inc.	805-398-0720
CA	Campbell, SMA	408-370-6900
CA	Canoga Pk, FLW, Inc.	805-984-0167
CA	Carlsbad, FLW, Inc.	619-434-5251
CA	Costa Mesa, FLW Inc.	714-751-7512
CO	Denver, Elcom, Inc.	303-337-2300

CT Cheshire, MECO 203-271-0026
GA Norcross, Hughes Assocs., Inc. 404-622-1587
GA Warner Robins, Hughes Assocs., Inc. 912-477-1889
IL Wheeling, Ed Joyner & Co. 312-520-1200
IN Carmel, Fred Dorsey & Assoc., Inc. 317-844-4842
IA Des Moines, The Beams Co. 515-255-1148
KS Shawnee Mission, The Beams Co. 913-631-0300
MA Lexington, E. F. Delfino, Inc. 617-862-1118
MA Lowell, Klaasing Elctrns. 508-453-7272
MA Reading, MECO 617-944-6660
MI Ann Arbor, Ashby Assocs., Inc. 313-995-4082
MN Bloomington, IP Sls. Co. 612-881-0549
MS Corinth, Hughes Assocs., Inc. 601-287-2915
MO St. Louis, The Beams Co. 314-434-8448
NJ Englewood Cliffs, Power Conversion & Control (PC2) 201-569-0015
NJ Franklin Lakes, Power Conversion & Control (PC2) 201-848-8900
NM Albuquerque, Brytech Sls., Inc. 505-884-1123
NY Roburn Agencies, Inc. 914-968-1016
NY Clinton, Advanced Comps. Corp. 315-853-6438
NY Endicott, Advanced Comps. Corp. 607-785-3191
NY New York, Power Conversion & Control (PC2) 212-239-3133
NY North Syracuse, Advance Components 315-699-2671
NY Northport, Data Logic Sls. 516-754-3333
NY Port Jefferson Station, Power Conversion & Control (PC2) 516-474-5696
NY Rochester, Advanced Comps. Corp. ... 716-544-7017
NY Scottsville, Advanced Comps. Corp. ... 716-889-1429
NC Cary, Hughes Assocs., Inc. 919-467-7029
OH Arcanum, Ashby Assocs., Inc. 513-461-2668, 513-692-8713
OH Lyndhurst, Ashby Assocs., Inc. 216-461-0826
OK Tulsa, Kemp Engrg. Co., Inc. 918-663-4501
OR Portland, Topp Engrg. Sls. Corp. 503-244-7265
PA Pittsburgh, Ashby Assocs. 412-343-5105
PA Southampton, Campbell Assoc. 215-322-6630
TN Jonesboro, Hughes Assocs. 615-753-2719
TN Nashville, Hughes Assocs. 615-871-0908
TX Lewisville, Jim Hughes Co. 214-221-1536, 214-221-1538
VA Alexandria, Dyna-Rep Co. 703-354-1222
WA Bellevue, Topp Engrg. Sls. Corp. 206-747-5400
WA Greenacres, Topp Engrg. Sls. Corp. ... 509-928-4177

TRANSKINETIC SYS., 110 Shawmut Rd., Canton, MA 02021, Tel: 617-828-3000; Empl.: 17; *Sls. Mgr.:* D. Pettijohn

TRANSMAGNETICS, 210 Adams Blvd., Farmingdale, NY 11735, Tel: 516-293-3100, TWX: 510-224-6420, FAX: 516-293-3793; FSC No.: 17755; Empl.: 44; *Sls. Mgr.:* Fred Haber ..... **D•1202-1205**

Local Sales Offices & Reps
MI Livonia, Lowell Wendt Mktg. 313-464-2722
MI Wyoming, Lowell Wendt Mktg. 616-531-4499
PA Doylestown, T I S (Tech. Instr. Sls.) ... 215-345-4110
TX Carrollton, Seaton Corp. 214-380-0414
WA Bellevue, Scientific Dvcs. NW 206-747-5169

TRANSMET CORP., 4290 Perimeter Dr., Columbus, OH 43228, Tel: 614-276-5522, 800-245-5253, TWX: 810-493-2368, FAX: 614-276-FAXX; *Sls. Mgr.:* Ronald A. Crossman; *Dist. Mgr.:* Amy L. Holbrook

TRANS METRICS, INC., 5325 Naiman Pkwy Ste.E, Solon, OH 44139, Tel: 216-248-2229, TWX: 620 332 14, FAX: 216-248-7780; FSC No.: 6625; Empl.: 20; *Sls. Mgr.:* James N. Dietrich

TRANSTECTOR SYSTEMS, INC., P.O. Box 300, Hayden Lake, ID 83835, Tel: 800-635-2537, TELEX: 150-077TRANSTECPFLS, FAX: 208-772-9016; FSC No.: 30992; Empl.: 150; *Sls. Mgr.:* Bruce Braskich; *Dist. Mgr.:* Shawn Thompson

TRANS-TEK, P.O. Box 338, Rte. 83, Ellington, CT 06029, Tel: 203-872-8351, TELEX: 99207, FAX: 203-872-4211; FSC No.: 27109; Empl.: 40; *Sls. Mgr.:* William R. Padin

TRAN-TEC CORP., Box 1044, Columbus, NE 68601, Tel: 402-564-2748, FAX: 402-564-4946; Empl.: 46; *Sls. Mgr.:* Cliff Schroeder

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CA Redwood City, Woodworth Co. 415-365-0252
CA Tustin, Sierra-Pacific Engrg. Co. 714-731-3411
CO Lafayette, Pierce-Robbins Assocs. 303-665-3296
FL Palm Bch. Gardens, Russell Assocs. .. 305-627-1503
GA Atlanta, Russell Assocs. 404-255-8422
IN Ft. Wayne, Scott Elctrns, Inc. 219-489-5690
IA Hiawatha, Ard Sls. Co. 319-393-6392
MD Bel Air, Russell Assocs. 301-879-9180
MA Wakefield, H.C. Jappe Co. 617-245-9359
PA Westchester, Russell Assocs. 215-696-0700
NY Bay Shore, Russell Assocs. 516-666-6500
NY Morrisville, Naylor Elec. Co. 315-684-9620
OH Cleveland, D. Steffen & Assocs. 216-461-8333
TX Dallas, Russell Assocs. 214-699-0383
WA Bellevue, Russell Assocs. 206-455-3694

TREND CIRCUITS, 44358 Old Warm Springs Blvd., Fremont, CA 94536, Tel: 415-651-1150; Empl.: 35; *Sls. Mgr.:* Mike Gunion

TRENT, INC., 201 Leverington Ave., Philadelphia, PA 19127, Tel: 215-482-5000, FAX: 215-482-9389; Empl.: 55

TRIAC ELECTRONIC SYSTEMS, INC., 87-27 Myrtle Ave., Glendale, NY 11385, Tel: 718-441-4759, TWX: 221500 ASAS ATT TRIAC; Empl.: 35; *Sls. Mgr.:* Victor Botnick

TRIAD POWER SYSTEMS, See Fiskars Electronics Corporation

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TRICON INDUSTRIES, INC., Brazing Alloys & Chemical Products Div., 5000 Chase St., Downers Grove, IL 60515-4012, Tel: 312-963-0220, FAX: 312-963-0269; Empl.: 15; *Sls. Mgr.:* T. R. Boedeker

TRICON INDUSTRIES, INC., Electromechanical Division, 2325 Wisconsin Avenue, Downers Grove, IL 60515-4076, Tel: 312-964-2330, FAX: 312-964-5179; Empl.: 260; *Sls. Mgr.:* Robert Stevens

TRIDAK, 1120 Federal Rd., Brookfield, CT 06804, Tel: 203-775-1287, TELEX: 62009593, FAX: 203-775-4376; Empl.: 20; *Sls. Mgr.:* F. C. Herot

TRI-DATA SYSTEMS, INC., 1450 Kifer Road, Sunnyvale, CA 94086-5306, Tel: 408-746-2900, TELEX: 172282, FAX: 408-746-2074; Empl.: 90

TRIDYNE PROCESS SYSTEMS, DBI Industries, 80 Allen Rd., So. Burlington, VT 05401, Tel: 802-863-6873, FAX: 802-860-1591; Empl.: 35; *Sls. Mgr.:* Jean Garin

TRIGON/ADCOTECH, Dynatech, 100 S. Milpitas Blvd., Milpitas, CA 95035, Tel: 408-946-4300, FAX: 408-263-9217; Empl.: 100; *Sls. Mgr.:* Gary Dotzler

TRILOBYTE COMPUTER CORPORATION, 14477 Catalina St., San Leandro, CA 94577, Tel: 415-895-1100, TWX: 910-350-0171, FAX: 415-895-2244; Empl.: 15

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TRI-MAG, INC., 8210 West Doe Ave., Visalia, CA 93291, Tel: 209-651-2222, TELEX: (ITT) 4994462; FSC No.: 64771; Empl.: 80 ..... **A•1678-1680; D•2118-2119**

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AL Huntsville, EPI, Inc. 205-534-3747
CA Laguna Hills, Electro-Venture 714-581-9244
CA Santa Clara, C. B. King & Assocs. 408-988-7551
FL Plantation, EMS, Inc. 305-587-7146
IL Arlington Hgts., Coombs Assocs., Inc. 312-439-9810
KS Overland Pk., EPI, Inc. 913-642-9118
MD Lisbon, W.R. Hartmaier Assoc., Inc. 215-643-6691
MS Jackson, EPI, Inc. 601-856-6251
MO St. Louis, EPI, Inc. 314-962-1411
NH Nashua, Bell Controls 603-882-6984
OH Beachwood, Elctrn. Sismasters 216-831-9555
OK Tulsa, Cunningham Comps. 918-665-3562
OR Beaverton, W. J. Purdy Co. 503-641-9373
PA Monroeville, W.R. Hartmaier Assoc. Inc. 215-643-6691
PA Willow Grove, W.R. Hartmaier Assocs., Inc. 215-643-6691
TX Austin, Cunningham Comps. 512-258-1744
TX Dallas, Cunningham Comps. 612-454-3086
TX Houston, Cunningham Comps. 713-461-4197
WI Milwaukee, Coombs Assocs., Inc. 414-351-6123

TRIMM, INC., Div. of Newton Instr. Co., 400 W. Lake St., Box 489, Libertyville, IL 60048, Tel: 312-362-3700, TELEX: 728452, FAX: 312-680-3888; Empl.: 50; *Sls. Mgr.:* Nancy Calkins

TRIM-TRONICS, INC., Rte. 20 East, Cazenovia, NY 13035, Tel: 315-655-9528, FAX: 315-655-2149; Empl.: 20; *Sls. Mgr.:* James E. Dowd

TRINETICS INC., 55807 Currant Rd., Mishawaka, IN 46545-4899, Tel: 219-259-8535, FAX: 219-259-8552; FSC No.: 3677; Empl.: 100; *Sls. Mgr.:* P. L. Kamerer

TRIO LABORATORIES, INC., 80 Dupont St., Plainview, NY 11803, Tel: 516-349-0400, TWX: 510-221-1861; FSC No.: 00638; Empl.: 60; *Sls. Mgr.:* Richard Frerking, Dir. of Sls. & Mktg.

TRIONICS, INC., P.O. Box 225, St. Charles, IL 60174, Tel: 312-232-9117, FAX: 312-232-0820; Empl.: 50

TRIO-TECH INTERNATIONAL, 355 Parkside Dr., San Fernando, CA 91340, Tel: 818-365-9200, TELEX: 194811(TTI INTL SFDO), FAX: 818-365-8210; Empl.: 266; *Sls. Mgr.:* Ron Nelson

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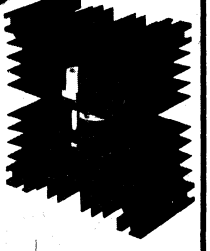

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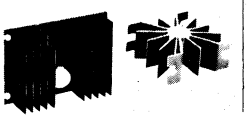

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AZ	Phoenix, Shefler-Kahn	602-257-9015
CA	Burlingame, Polach & Bensinger	415-697-2525
FL	Deerfield Beach, Jack Krutek & Assocs.	305-427-4202
FL	Maitland, Jack Krutek & Assocs.	305-628-4837
GA	Atlanta, Millar Elctrns.	404-261-6160
KS	Olathe, SPS Assocs., Ltd.	913-764-4460
MI	Grosse Point Woods, A & D Elctrn. Sls.	313-884-1956
NJ	Englewood Cliffs, Masin Esco	201-569-8868
NY	Hauppauge, Masin Esco	516-273-3500
NY	Mendon, Marchese Marsey Barden	716-582-2240
NC	Raleigh, Millar Elctrns.	919-828-8840
RI	Lincoln, Adams-McGregor	401-726-1300
RI	West Warwick, Adams McGregor, Inc.	401-821-1320
TX	Dallas, Elcom Mktg. Inc.	214-241-2166

Local Distributors

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AL	Mobile, Brownell-Electro	205-479-8581
AZ	Phoenix, Metermaster Div.	602-437-1425
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CA	Irvine, Meter Craft/Larson	714-261-7135
CA	Los Angeles, Metermaster Div.	213-685-4340
CA	Palo Alto, Metermaster	415-960-8500
CA	San Diego, Metermaster Div.	619-560-4841
CA	Santa Clara, Dynametron	408-727-6531
CO	Denver, Meter-master	303-722-5766
FL	Hialeah, Kimball Elctrn. Lab.	305-822-5792
FL	Miami, Brownell-Electro	305-884-3072
FL	Orlando, Brownell-Electro	305-843-6770
GA	Atlanta, Brownell-Electro	404-762-5181
GA	Atlanta, Process Meas. Control	404-696-7481
IL	Countryside, Pacific Indicator	312-352-3500
IL	Elk Grove Village, Meter-Makers	312-439-5050
IN	Evansville, Electro-Lab Svcs.	812-423-5211
IN	Indianapolis, E.I.L. Instrs.	317-545-1373
KS	Overland Park, Brooks Elec.	913-648-3131
LA	New Orleans, Indl. Instr. Works	504-733-8355
MD	Gaithersburg, Pioneer/Inst.	301-948-2242
MD	Savage, Pytronic	301-792-0780
MA	Waltham, Calibron	617-894-6440
MI	Ferndale, Ram Meter	313-398-6767
MN	Minneapolis, Instr. Control	612-871-2514
MO	St. Louis, ISL Corp.	314-535-5760
NJ	Belleville, Marshall Inst.	201-751-1190
NJ	New Foundland, Hosica Labs	201-697-6111
NY	Clarence, Trott Elctrns.	716-634-8500
NY	L.I.C., Metermod Instr.	718-726-4850
NC	Charlotte, Brownell-Electro	704-597-1270
NC	Raleigh, Brownell-Electro, Inc.	919-876-6524
NC	Raleigh, Meter-Meterics, Div. of I.T.R.	919-872-5456
NC	Raleigh, Speed Instr. Div. Owen-Barbot	919-876-4919
OH	Cleveland, Pioneer/Instrmn.	216-587-3600
OH	Cleveland, Weschler Elec.	216-238-2550
OH	Dayton, Pioneer/Dayton	513-236-9900
OK	Tulsa, Tri-State Instr.	918-836-0286
PA	Philadelphia, Sunshine Sci.	215-673-5600
PA	Pittsburgh, CAM/RPC	412-963-1885
TN	Knoxville, Brownell-Electro	615-966-3441
TN	Memphis, Brownell-Electro	901-795-8487
TN	Memphis, Instrument Repair Svc.	901-278-0762
TN	Nashville, Brownell-Electro	615-889-8230
TX	Beaumont, Straughn Elec.	409-838-4563
TX	Dallas, Ultra Instr.	214-357-0297
TX	Garland, Metermaster	214-271-5671
TX	Houston, Meters & Instrs.	713-644-1631
TX	Houston, Quality Instr.	713-524-0528
TX	Odessa, Whitlock Instr.	915-337-3412
VA	Richmond, Meter Metrics (I.T.R.)	804-275-1431
WA	Seattle, Eicher-Richards	206-523-7888
WI	Milwaukee, E-M Instrs.	414-272-7799

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TRIRIDGE CORPORATION, 1116 W. Main St., Leesburg, FL 32748, Tel: 904-728-0799

FAX: 603-627-6025

TRM, INC., 401 Kelly Ave., Grenier Field, Manchester, NH 03103, Tel: 603-627-6000; Empl.: 40; *Sls. Mgr.:* A. Butts ..... **A•1861-1864**

Local Sales Offices & Reps

CA	Palo Alto, RF Assoc.	415-494-3331
CA	Santa Ana, Youngewirth & Olenick	714-852-0788
MD	Laurel, Mid-Atlantic Sls.	301-725-3955
MA	Chelmsford, Matrix Sls.	508-459-4000
NJ	Keansburg, Reps Five	201-495-3625
TX	Dallas, McDonald Assoc.	214-239-3293
VA	Sterling, Beacon North	703-478-2480

TROMPTER ELECTRONICS, INC., Sterling Holding, 31186 La Baya Dr., P.O. Box 5069, Westlake Village, CA 91359-5069, Tel: 818-707-2020, TWX: 910-494-1210, FAX: 818-706-1040; FSC No.: 14949; Empl.: 180; *Sls. Mgr.:* Dick Coleman; *Dist. Mgr.:* Hap Gladish ..... **C•1554**

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak and Frazier	205-536-1506
AZ	Phoenix, Aztec Entprs.	602-944-9185
CA	Colton, Knight Co.	619-452-7196
CA	Los Angeles, Knight Co.	213-670-2833
CA	Santa Clara, ISG	408-980-1166
CO	Denver, Aztec Entprs.	303-779-5285
CT	Fairfield, L & M Assocs.	203-334-5005
CT	Waterbury, Underwood Sls.	203-756-7566
CT	Wethersfield, Underwood Sls.	203-563-3046
FL	Melbourne, Currie, Peak & Frazier	407-724-6795
FL	Orlando, Currie, Peak & Frazier	407-855-0843
FL	Pace, Currie, Peak & Frazier	904-994-0599
FL	Tampa, Currie,Peak, & Frazier	813-963-1076
GA	Duluth, Currie, Peak & Frazier	404-497-9404
IL	Arlington Heights, Berndt Assocs.	312-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Wichita, Baka	316-682-8411
MD	Lanham, Sel-Tronics	301-731-8080
MA	Lowell, Underwood Sls.	617-256-8191
MI	Sterling Hgts., Geotronix	313-254-0520
MN	Edina, Engineering Prods. Assoc.	612-835-9002
MO	St. Johns, Baka	314-429-2252
NJ	Elmwood Park, L & M Assoc. Eng. Rep.	201-797-0441
NM	Albuquerque, Aztec Entprs.	505-262-1688
NY	Clifton, T.A.E. Reps.	518-371-3117
NY	Getzville, T.A.E. Reps.	716-688-5008
NY	New York, L & M Assocs. Eng. Rep.	212-243-6155
NY	Rochester, T A E Reps.	716-586-8710
NY	Whitney Point, T.A.E. Reps.	607-692-3705
NC	Charlotte, Currie, Peak & Frazier	704-846-1702
NC	Greensboro, Currie, Peak & Frazier	919-273-6308
OH	Richfield, Geotronix	216-659-6100
OH	Trotwood, Geotronix	513-854-5939
OR	Beaverton, Evergreen Mktg. Co.	503-643-8020
PA	Allison Park, Geotronix	412-487-1331
PA	Andalusia, L & M Assocs.	215-245-6658
TN	Smyrna, Currie, Peak & Frazier	615-459-0743
TX	Argyle, Milestek	817-455-7444
UT	Ogden, Aztec Entprs.	801-621-1655
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WI	Milwaukee, Berndt Assocs.	414-545-8400
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Can	St. Laurent, Que., Componetics, Ltd.	514-331-9930
Can	St. Laurent, Que., Promark Elctrns.	514-733-5344

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CA	Los Angeles, Knight Co.	213-670-2833
CA	Santa Clara, ISG Sls.	408-980-1166
MD	Lanham, Sel-Tronics	301-731-8080
MA	Lowell, Underwood Sls.	508-256-8191
MN	Minneapolis, Bortech Sls.	612-835-9002
NJ	Elmwood Pk., L & M Assocs.	201-797-0441
TX	Argyle, Milestek	817-455-7444

TRONTECH, INC., 63 Shark River Rd., Neptune, NJ 07753, Tel: 201-922-8585, TELEX: 132445, FAX: 201-922-3903; Empl.: 40

TRULINE CORPORATION, P.O. Box 1469, Visalia, CA 93279-1469, Tel: 209-747-1261, FAX: 209-747-0280; Empl.: 85; *Sls. Mgr.:* R. W. Aubery

TRW LSI PRODUCTS INC., PO Box 2472, La Jolla, CA 92038, Tel: 619-457-1000, TELEX: 697957, TWX: 910-335-1571, FAX: 619-455-6314; FSC No.: 59621; Empl.: 290; *Sls. Mgr.:* Al Jonas, Dir. Sls.; *Dist. Mgr.:* Ron Courtois

TRW MICROWAVE, See FEI Microwave

TRW RESISTIVE PRODUCTS DIV., See International Resistive Co.

TRW TECHNAR, INC., TRW, Inc., 5462 Irwindale Ave., Irwindale, CA 91706, Tel: 818-334-0250, FAX: 818-969-4781; Empl.: 500; *Sls. Mgr.:* George R. Downs

TS PRODUCTS, INC., 12455 Branford St., Bldg. 22, Arleta, CA 91331, Tel: 818-896-6676; Empl.: 8; *Sls. Mgr.:* Gene Samuel; *Dist. Mgr.:* Gene Samuel ..... **D•2248**

Local Sales Offices & Reps

CA	Corona Del Mar, Motion Control, Inc.	714-675-0211
CA	Los Angeles, TS Products, Inc.	818-896-6676
CA	Montebello, TUCUL Engrg.	213-728-7397

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FAX: 213-312-1055

TTE, INCORPORATED, 11652 W. Olympic Blvd., Los Angeles, CA 90064, Tel: 213-478-8224; FSC No.: 07766; Empl.: 30; *Sls. Mgr.:* S. J. Sodaro ..... **A•1726-1735**

Local Sales Offices & Reps

MA	Woburn, Cygnus Sls., Inc.	617-935-1395
MD	Laurel, CSDS, Inc.	301-953-7884

TTS-TELECOM TERMINAL SYSTEMS, Box 66369, Los Angeles, CA 90066, Tel: 213-390-9494, TELEX: 3715831; Empl.: 18; *Sls. Mgr.:* L. Winters

TUCKER ELECTRONICS, Box 461966, Garland, TX 75046, Tel: 214-348-8800, 800-527-4642, TELEX: 79-1726, TWX: 62812862, FAX: 214-348-0367; Empl.: 43; *Sls. Mgr.:* Don Stabeno

TUNGSTONE BATTERIES, INC., 18 Billings St., Sharon, MA 02067, Tel: 617-784-2000, FAX: 617-784-5563; Empl.: 23; *Sls. Mgr.:* William O'Connell

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AZ	Tucson, Tusonix, Inc.	602-744-0400
CA	San Jose, Tusonix, Inc.	415-657-7110
CA	Santa Ana, Tusonix, Inc.	714-633-3257
IL	Aurora, Tusonix, Inc.	312-851-7180
NY	Ontario, Tusonix, Inc.	315-524-7147
NC	Greensboro, Tusonix, Inc.	919-292-4286
TX	Plano, Tusonix, Inc.	214-985-9335

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AZ	Tempe, TTI	602-431-1191

CA Chatsworth, TTI 818-709-1010
CA Milpitas, TTI 408-946-5577
CA San Diego, TTI 619-587-4888
CA Santa Ana, TTI 714-641-9393
CA Sunnyvale, Penstock, Inc. 408-730-0300
CO Denver, TTI 303-429-6806
CO Englewood, Penstock, Inc. 303-792-0777
CT Wallingford, TTI 203-284-7474
FL Orlando, TTI 407-859-1000
GA Norcross, TTI 404-662-0911
IL Chicago, Newark Elctrns. 312-638-4411
IL Des Plaines, Compucon Distrs. 800-345-0632
IL Palatine, Penstock, Inc. 312-934-3700
IN Indianapolis, Penstock, Inc. 317-784-3870
MD Baltimore, Compucon Distrs. 800-426-7746
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NJ Teterboro, Penstock, Inc. 201-288-7313
NY Hauppauge, Fairmont Elctrn. Sls. 516-231-3313
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WA Bellevue, Penstock, Inc. 206-454-2371
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TWP, INC., 2133 4th St., Berkeley, CA 94710, Tel: 415-548-4434, TELEX: 171-267, FAX: 415-548-3073; Empl.: 10; *Sls. Mgr.:* G. Reed

TYCO INSTR. DIV., See Data Instrs.

TYCOR INTERNATIONAL INC., 6107-6 Street S.E., Calgary, Alberta, Canada T2H 1L9, Tel: 403-259-3200, TELEX: 03 825842, FAX: 403-253-0663; *Sls. Mgr.:* Scott Lee, Canadian

TYTON CORP., Box 23055, 7930 N. Faulkner Rd., Milwaukee, WI 53223, Tel: 414-355-1130, TWX: 910-262-3094, FAX: 414-355-7341; *Sls. Mgr.:* Jim Campion, VP Sls.

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AZ Tempe, Semper Fi Sls., Inc. 602-730-9553
CA Chatsworth, Raltech 818-700-0933
CA Del Mar, Chapman & Chapman 619-755-0412
CA Glendale, Mission Mktg. Grp. 818-247-9110
CA Santa Clara, I Squared Inc. 408-988-3400
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CT Bloomfield, F. S. I. 203-243-3122
FL St. Petersburg, J.C.J. Assocs. 813-343-2679
IL Downers Grove, Richmar Elctrn. 312-968-0118
IN Ft. Wayne, Denton Mktg. 219-486-0665
IA Hiawatha, Ard Sls. 319-393-6392
MA Lowell, F.S.I. 617-449-7920
MI Jackson, T.P.S. & Assocs. 517-783-1722
MN Minneapolis, Dunlop Consits. 612-933-9070
NJ Piscataway, R. P. Luce & Co. 201-752-8750
NY Chappaqua, Micrel, Inc. 914-238-4961
NY New Hyde Pk., R. P. Luce & Co. 516-437-4550
NY Rochester, Fritz Dasson 716-338-1699
OH Wooster, T.P.S. & Assocs. 216-264-0971
PA Wynnewood, Metz-Benham Assocs., Inc. 215-896-7300
TX Richardson, Pro Comp. Sls. Co. 214-669-1500
UT Salt Lake City, West, Inc. 801-292-8787
WA Bellevue, Olson Tech. Sls. Corp. 206-883-7792
WI Butler, Richmar Elctrn. 414-781-1730
Can Mississauga, Ont., Source Elctrn. 416-676-0830
Can Winnipeg, Manitoba, Smith-Paterson & Assoc. 204-885-1376

Local Distributors

CA Chatsworth, Petell/Passive Comp., Inc. 818-341-1745
CA San Diego, Neumann Elec. 619-695-3005
CA San Jose, Zeus Comps. 408-998-5121
CA Westlake Vl, Distel, Inc. 805-495-9998
CO Denver, IEC Integrated Elctrn. 303-843-2040
FL Oviedo, Zeus Comp. 305-365-3000
FL Tampa, Impala Elctrns. 813-885-4747
MD Columbia, Aztech Elctrns. 301-995-6800
MD Columbia, Zeus Comps. 301-997-1118
MA Burlington, TLC Elctrns. 617-273-0140
MA Lexington, Zeus Comps. 617-863-8800
NY Bohemia, Justin Elec. 516-589-4000
NY Hauppauge, Jaco, Inc. 516-273-5500
NY Melville, SAI, Inc. 516-293-2710
NY Port Chester, Zeus Comps. 914-937-7400
NY Valley Stream, L & S Elec. 516-561-2474
OH Cincinnati, Eclipse of Ohio 513-661-7733
OH Cincinnati, G & A Sls. 513-521-8800
OH Dayton, Televox, Inc. 513-454-1225
OR Beaverton, IEC Integraed Elctrn. 503-641-1690
TX Dallas, EPIC 214-503-1414
TX Richardson, Jaco, Inc. 214-235-9575
TX Richardson, Zeus Comps. 214-783-7010
WA Bellevue, IEC Integrated Elctrn. 206-455-2727

ULVAC NORTH AMERICA CORPORATION, P.O. Box 799, 105 York Street, Kennebunk, ME 04043, Tel: 207-985-2973, TELEX: 46-9045, FAX: 207-985-4459; Empl.: 50; *Sls. Mgr.:* Susan Zilaro; *Dist. Mgr.:* Harold Baum

Ulveco

FAX: 415-573-7562

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Local Sales Offices & Reps

AL Huntsville, BCI, Inc. 205-539-4411
CA Arcadia, Van Gott & Assocs. 818-445-9728
CA Escondido, Van Gott & Assocs. 619-489-0893
CA Santa Clara, Gagner-Toomey Assocs., Inc. 408-244-2200
CO Littleton, MRC 303-794-4684
CT Avon, Tom Maguire Assocs. 203-673-3019
FL Margate, EPM Corp. 305-977-0331
MA Norwood, Tom Maguire Assocs. 617-551-0500
MN Minneapolis, Electro-Serv Co. 612-338-3475
NH Windham, Tom Maguire Assocs. 603-432-0363
NY Clark Mills, KLM Garner 315-853-6126
NY Pittsford, KLM Garner 716-381-8350
NY Plainview, Robert Smith Assocs. 516-681-3155
NC Charlotte, Electro-Rep Assocs. 704-527-2530
PA Exton, Linear Sls. 215-524-8080
VA Richmond, Glassock Assocs. 804-740-0063
WA Seattle, Northmar, Inc. 206-524-5170
Can Markham, Ont., Stetron Intl, Inc. 416-475-6202

UNADILLA ANTENNA MFG. CO., Ballardvale Station, P.O. Box 4215, Andover, MA 01810, Tel: 508-475-7831, FAX: 508-474-8949; Empl.: 6; *Sls. Mgr.:* P. Jannini

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Local Sales Offices & Reps

AZ Tempe, Rich Sls. Co. 602-968-7787
CA Gardena, Ungar Sls. Assocs. 213-532-6837
CA San Clemente, Diversitech Reps. 714-240-7720
CA Sunnyvale, Techworld Inc. 408-291-8701
CO Denver, Remington/USA 303-752-1986
FL Lauderdale Lakes, PSR Technlgs. Inc. 305-753-5732
GA Lithia Springs, Effective Mktg. Force 404-948-6023
HI Compton, Ungar 213-774-5950
IL Itsaca, LTD Technlgs. 312-773-2900
IN Indianapolis, Robert Milsk Co. 317-842-3400
MA N. Reading, Yankee Tech 508-664-0865
MI Southfield, R. Milsk Co. 313-354-3310
MN Minneapolis, Milt Westlund Assocs. 612-866-5002
MO St. Louis, Thomas L. Dowell & Assocs. 314-849-4234
PA York, Classen & Doolittle Assocs. 717-741-1689
NY Oceanside, Bittan Assocs. 516-678-6222
NY Orchid Pk., Davis-Callahan Co. 716-662-5988
OH Monroe, Wiethe & Young Assoc. 513-539-7436
OR Portland, Joseph V. Belusko Co. 503-222-4279
TX Dallas, Rich Sls. 214-257-0761
TX Round Rock, Rich Sls. 512-244-0205
EXP Inglewood, Eldon Industries, Inc. 213-642-7716

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UNICORP

FAX: 201-674-3803

UNICORP, 291 Cleveland St., Orange, NJ 07050, Tel: 201-674-1700; FSC No.: 04729; Empl.: 82; *Sls. Mgr.:* B. Levine ..... **C•1628-1629**

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UNIPOWER CORPORATION

FAX: 305-971-1837

UNIPOWER CORPORATION, 2981 Gateway Dr., Pompano Bch., FL 33069-4803, Tel: 305-974-2442; FSC No.: 62125; Empl.: 52; *Sls. Mgr.:* Warren Peters, Mgr. Tech. Sls. ..... **D•2120-2125**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech Sls.	205-880-0592
AZ	Tempe, Westrep	602-820-9932
CA	Anaheim, Westrep	714-527-2822
CO	Aurora, Electrodyne, Inc.	303-695-8903
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Westrep	408-988-8833
FL	Margate, EPM Corp.	305-977-0331
FL	Orlando, EPM Corp.	407-425-6149
GA	Norcross, Electro-Mech Sls.	404-447-6478
IL	Glendale Heights, Beta Technlg. Sls.	312-790-9886
IA	Cedar Rapids, Delltron Co., Inc.	319-393-0075
MD	Annapolis, CMS Mktg.	301-269-1898
MA	Arlington, Interstate Sls.	617-646-3914
MA	Chelmsford, Interstate Sls.	508-256-2287
MI	Livonia, Lowell-Wendt Mktg.	313-464-2722
MI	Wyoming, Lowell-Wendt Mktg.	616-457-0900
MN	Minneapolis, Comstrand, Inc.	612-788-9234
MO	Florissant, Delltron Co., Inc.	314-839-0033
MO	Kansas City, Delltron Co., Inc.	816-436-6445
NJ	Parsippany, HLM Assocs., Inc.	201-263-1535
NY	Binghamton, Empire Tech. Assoc.	607-772-0651
NY	Nortport, HLM Assocs., Inc.	516-757-1606
NY	Rochester, Empire Tech. Assoc.	716-381-8500
NY	Skaneateles, Empire Tech. Assoc.	315-685-5703
NC	Raleigh, Electro-Mech Sls.	919-790-9300
OH	Columbus, McFadden Sls. & Mktg.	614-761-3177
OK	Tulsa, Ammon & Rizos	918-749-6116
PA	Dresher, CMS Mktg.	215-885-4424
OR	Tigard, Electronic Comp. Sls.	503-245-2342
TX	Austin, Ammon & Rizos	512-454-6483
TX	Houston, Ammon & Rizos	713-781-6240
TX	Richardson, Ammon & Rizos	214-644-5591
UT	Salt Lake City, Electrodyne, Inc.	801-264-8050
WA	Mercer Island, Electronic Comp. Sls.	206-232-9301
WI	Milwaukee, Beta Technlg. Sls.	414-543-6609
Can	Montreal, Que., Electro Source, Inc.	514-630-7486
Can	Ottawa, Ont., Electro Source, Inc.	613-592-3214
Can	Toronto, Ont., Electro Source, Inc.	416-675-4490
Can	Vancouver, B.C., Electro Source, Inc.	604-888-2412

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UNIT DESIGN, 1140 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-526-0800, TWX: 910-250-0136, FAX: 714-871-4164; Empl.: 8; *Sls. Mgr.:* Bill Potter

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FAX: 312-640-6341

UNITED CHEMI-CON INC., 9801 W. Higgins Rd., Rosemont, IL 60018, Tel: 312-696-2000, TELEX: 28-3557, TWX: 910-253-2964; Empl.: 50; *Sls. Mgr.:* R. Donham ..... **A•1182-1183**

Local Sales Offices & Reps

NJ	Bellmawr, TAI Corp.	609-933-2600
AL	Huntsville, R. D. Whitesell	205-883-5110
CA	El Toro, English/Damco Sls.	714-837-3801
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assocs. Mountain States, Inc.	303-426-0890
FL	Altamonte Springs, Semtronic Assocs., Inc.	407-831-8233
FL	Clearwater, Semtronic Assocs., Inc.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs., Inc.	305-731-2484
GA	Norcross, R. O. Whitesell	404-449-9190
IL	Chicago, M. Gottlieb Assocs.	312-775-1151
IN	Fort Wayne, R. O. Whitesell	219-432-5591
IN	Indianapolis, R. O. Whitesell	317-359-9283
IN	Kokomo, R. O. Whitesell	317-457-9127
KS	Shawnee Mission, Lowell Kangas & Assocs., Inc.	913-631-3515
KY	Peewee Valley, R. O. Whitesell	502-241-1441
MD	Columbia, Pro-Rep, Inc.	301-381-7460
MA	Hingham, Northeast Reps.	617-749-8700
MI	Grand Rapids, R. O. Whitesell	616-942-5420
MI	Southfield, R. O. Whitesell	313-559-5454
MI	St. Joseph, R. O. Whitesell	616-983-7337
MN	Eden Prairie, Twist Co.	612-941-2040
NY	Bohemia, Aurora Mktg.	516-563-3131
NJ	Fort Lee, Caravan Sls., Corp.	201-944-9555
NY	Pittsford, Franklin Sls. Corp.	716-248-8251
NC	Greensboro, Caravan Sls.	919-271-2668
NC	Raleigh, Tingen Tech Sls., Inc.	919-878-4440
OH	Cincinnati, R. O. Whitesell	513-521-2290
OH	Cleveland, R. O. Whitesell	216-447-9020
OH	Columbus, R. O. Whitesell	614-888-9396
OH	Dayton, R. O. Whitesell	513-298-9546
OR	Beaverton, Earl & Brown	503-643-5500
PA	Pittsburgh, R. O. Whitesell	412-963-6161
TN	Knoxville, R. O. Whitesell	615-694-9476
TX	Austin, Mil-Rep	512-346-0331
TX	Houston, Mil-Rep	713-444-2557
TX	Richardson, Mil-Rep	214-644-6731
UT	Salt Lake City, Straube Assocs. Mountain States, Inc.	801-263-2640
WA	Redmond, Earl & Brown	206-885-5064
Can	Richmond Hill, Renmark Elctrns.	416-881-8844

Local Distributors

AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tempe, Elctrn. Supp.	602-258-4769
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Agoura Hills, Time Elctrns.	818-707-2890
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Chatsworth, Passive Tech.	213-882-2277
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Riverside, Elctrn. Supp.	714-787-9220
CA	San Diego, Elctrn. Supp.	619-693-8222
CA	San Diego, Time Elctrns.	619-586-1331
CA	San Jose, Compass Comps.	408-432-7575
CA	Sunnyvale, S.A.I.	408-745-0800
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CA	Tustin, Projections Unltd.	714-544-2700
CO	Englewood, Nep Elctrns.	303-799-9898
CO	Englewood, Time Elctrns.	303-799-8851
CO	Wheatridge, Bell Inds.	303-424-1985
CT	Cheshire, Time Elctrns.	203-271-3200
FL	Altamonte SPrings, S.A.I.	407-841-6565
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Ft. Lauderdale Reptron Elctrns.	305-735-1112
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
FL	Orlando, Hammond Elctrns.	305-849-6060
FL	Orlando, Time Elctrns.	305-841-6565
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Norcross, Hammond Elctrns.	404-449-1996
GA	Norcross, Reptron Elctrns.	404-446-1300
GA	Norcross, Time Elctrns.	404-448-4448
IL	Chicago, Nep Elctrns.	312-625-8400
IL	Northbrook, Classic Comps.	312-272-9650
IL	Rolling Meadows, RM Elctrns.	312-358-0300
IL	Schaumburg, Reptron Elctrns.	312-882-1700
IL	Wood Dale, Time Elctrns.	312-350-0610
IN	Indianapolis, RM Elctrns.	317-291-7110
MD	Columbia, Time Elctrns.	301-964-3090
MA	Burlington, TLC Elctrns.	617-273-0140
MA	Hopkinton, Interface Elctrns.	617-435-6858
MA	Peabody, Time Elctrns.	617-532-6200
MA	Wilmington, J.V. Elctrns.	617-657-6523
MA	Woburn, S.A.I.	617-938-5460
MI	Grand Rapids, RM Elctrns.	616-531-9300
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Edina, Time Elctrns.	612-835-1250
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MO	St. Louis, Time Elctrns.	314-391-6444
NJ	Clifton, J-Mar Elctrns.	201-772-6400
NM	Albuquerque, Bell Inds.	505-292-2700
NY	E. Syracuse, Time Elctrns.	315-432-0355
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Hauppauge, Time Elctrns.	516-434-3344
NY	Melville, S.A.I.	516-293-2710
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Ronkonkoma, Prime Comps.	516-737-1730
NC	Charlotte, Time Elctrns.	704-522-7600
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Service Plus	919-850-9550
OH	Dublin, Time Elctrns.	614-761-1100
OH	Worthington, Reptron	614-436-6675
OR	Lake Oswego, Bell Inds.	503-241-4115
OR	Portland, Time Elctrns.	503-684-3780
PA	Exton, VSH	215-363-2250
PA	King of Prussia, Time Elctrns.	215-337-0900
PA	York, E.C.I.	717-846-5334
SC	Greensville, Hammond Elctrns.	803-233-4121
TX	Austin, Kent Elctrns.	512-834-1900

TX Carrollton, Time Elctrns. 214-241-7441
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, Time Elctrns. 713-530-0800
TX Richardson, Jaco Elctrns. 214-235-9575
TX Richardson, Kent Elctrns. 214-669-2600
UT Salt Lake City, Standard Supp. Co. 801-486-3371
UT W. Valley, Time Elctrns. 801-973-8181
VT Rutland, S.A.I. 802-775-7126
WA Bellevue, Bell Inds. 206-747-1515
WA Redmond, Time Elctrns. 206-882-1600
WI New Berlin, Classic Comps. 414-786-5300
WI New Berlin, Nep Elctrns. 414-785-9100
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UNITED FOAM PLASTICS, 172-Q E. Main St, Georgetown, MA 01833, Tel: 508-352-2200, TWX: 710-347-0315, FAX: 508-352-7169; FSC No.: 55900; Empl.: 200; *Sls. Mgr.:* Richard L. Corrigan

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CO Denver, Deltron Co. 303-373-0300
FL Clearwater, Brennan Assoc. 813-446-5006
GA Atlanta, Magaro & Assocs. 404-451-8862
IL Des Plaines, Lincoln, Hodges & Assocs. 312-297-3810
IN Ft. Wayne, Outman Sls. 219-483-7879
MD Baltimore, Callas Elctrns. 301-744-7711
MA Northboro, Henik Assoc. 508-393-3127
MI Kentwood, C.A. Geer Co. 616-534-9449
MN St. Paul, Countrymen Assocs. 612-645-9151
NJ Basking Ridge, Churchill Assocs. 201-204-0744
NY Larchmont, Hingston Walsh Assocs., Inc. 914-834-5781
NY Syracuse, Lenard Co. 315-479-9191
OH Akron, Augnat Assocs. 216-273-1211
PA Norristown, Rivco January 215-631-1414
TX Richardson, Barry Sls. 214-234-0255
Can Guelph, Ont., Hammond Mfg. Co., Ltd. 519-822-2960

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MA Winchester, Rush Inds. 617-729-5800
MI Grand Rapids, S-F Elctrn. Supp. Co. .. 616-459-0216
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Dayton, Televox, Inc. 513-294-4499
OH Warren, Rem Elctrns. Supp. Co., Inc. .. 216-373-1300
PA Erie, Rem Elctrns. Supp. Co., Inc. 814-453-5625
TX Wylie, Air Quip/Robleyco 214-442-3573

UNITRODE CORP., 580 Pleasant St., Watertown, MA 02172, Tel: 617-926-0404, TELEX: 92-2414, TWX: 710-326-6509; Empl.: 2,000; *Sls. Mgr.:* Leslie Wallace; *Dist. Mgr.:* Ron Myers

UNITRODE PASSIVE COMP. DIV., 11144 Penrose St, Sun Valley, CA 91352, Tel: 818-767-6770, TWX: 910-498-4998; FSC No.: 59942; Empl.: 210; *Sls. Mgr.:* Terry Cantine

Unitron

FAX: 214-341-2099

UNITRON INC., 10925 Miller Rd., Dept. EE, Dallas, TX 75238, Tel: 214-340-8600, TELEX: 882511; FSC No.: 6130; Empl.: 75; *Sls. Mgr.:* R. L. Beutel ... **D•2175-2177**

Local Sales Offices & Reps
CA Sunland, JVC Assocs. (Jim Crevier) ... 818-352-7348
NC Charlotte, Bruster Lawing & Assocs. .. 803-831-1205
VA Midlothian, Bruster Lawing & Assocs. 804-794-3879

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Local Sales Offices & Reps
MA Whitinsville, Power Factor & Assocs. .. 617-234-6415
MN Minneapolis, R.J. Sls. 612-866-3661
PA Audubon, Holmes Assocs. 215-666-0636
VA Fairfax, Schibley Assocs. 703-591-3008

Local Distributors
AZ Phoenix, Trembly Assoc. Inc. 602-967-2058
CO Wheat Ridge, Trembly Assoc. Inc. 303-421-8900
IN Ossian, Science Sls., Inc. 219-622-7383
NV Las Vegas, Trembly Assoc. Inc. 702-739-9770
NM Albuquerque, Trembly Assoc. Inc. 505-266-8616
TX El Paso, Trembly Assoc. Inc. 915-533-9380
UT North Salt Lake, Trembly Assoc. Inc. .. 801-295-4703
EXP London, England, Stansberry Assoc. Int'l, Inc. 01-467-0535
Can Toronto, Ont., Datacomp Elctrns. 416-533-4076

UNIVERSITY SOUND, INC., Mark IV Industries, 13278 Ralston, Sylmar, CA 91342, Tel: 818-362-9516, FAX: 818-367-5292; Empl.: 72; *Sls. Mgr.:* Jeffrey J. Pallin

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FAX: 213-531-6217

UPSYSTEMS, INC., Subsidiary of Chloride Power Elec., 16530 Garfield Ave., Paramount, CA 90723, Tel: 213-634-0621, TWX: 910-346-7814; FSC No.: 3698; *Sls. Mgr.:* Dick Williams, Inside Sls. Mgr. ..... **D•2238**

Local Sales Offices & Reps
CA San Diego, UPSystems, Inc. 619-546-4495
GA Atlanta, UPSystems, Inc. 404-768-1160
IL Rolling Meadows, UPSystems, Inc. 312-981-5141

URBAN ELECTRONICS, P. O. Box 456, Dover, MA 02030, Tel: 617-329-4068, FAX: 508-785-2265; Empl.: 50; *Sls. Mgr.:* G. Urban

URDC, Acme Electric Corporation, 7915 South 1530 West, Box 10, West Jordan, UT 84084, Tel: 801-561-9385, FAX: 801-562-9004; *Sls. Mgr.:* Leland Coleman

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AL Huntsville, ALPHA Mktg. 205-533-0766
AZ Tempe, EDS 602-438-1547
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CA Newport Bch., Qua/Conn 714-851-6465
CA Sunnyvale, Wedemeyer Entprs. 408-733-9344
FL Orlando, Comp. Des. Mktg. 407-352-5480
GA Norcross, Alpha Mktg. 404-448-2050
IL Rolling Meadows, Heartland 312-579-9222
IL Wood Dale, XYZ Mktg. Grp. Inc. 312-584-3001
IN Huntington, Ellet Sls. 219-356-1866
KS Overland Park, Spectrum Sls. 913-648-6811
MD Glen Burnie, Macrotech Assocs. Inc. .. 301-766-1111
MA Tewksbury, Sequel Assocs. Inc. 617-851-4010
MI Birmingham, Forand Sls. Co. 313-644-0087
MS Meridian, Alpha Mktg. 601-483-9306
NJ Cherry Hill, Rep Tech 605-424-9061
NJ West Caldwell, Grimm Siegal Assoc. .. 201-575-9300
NY Buffalo, NRM 716-634-4300
NJ Matawan, Shepard & Assocs. 201-566-0095
NC Matthews, Arthur Harris & Assoc. 704-845-1085
OH New Lebanon, J.N. Bailey & Assocs. .. 513-687-1325
SC Myrtle Bch., Candor Co. Inc. 803-448-8361
TN Oak Ridge, Alpha Mktg. 615-482-4681
TX Irving, EDS Southwest 214-929-8140
WA Bellevue, Caruso & Co. 206-455-8811
Can Montreal, Que., Shelly Newman 514-586-6984

Local Distributors
MA Ashland, March Elctrns. 617-881-6715
NJ Old Bridge, B & C Elctrn. Comp. 800-526-2828
NY Bohemia, March Elctrns. 516-563-6000
PA Philadelphia, PEI Genesis 800-523-0727
TX Ft. Worth, TTI Inc. 800-225-5884

US DIGITAL

FAX: 213-594-6091

U. S. DIGITAL CORP., 12371 Kensington Rd., Los Alamitos, CA 90720, Tel: 213-594-0094 ..... **B•1997**

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VA Roanoke, Engrg. & Mktg. Corp. of VA 703-562-0726

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USD PRODUCTS, Cooper Industries, 7300 W. Wilson Ave., Chicago, IL 60656, Tel: 312-867-4600, TELEX: 910-221-3474, FAX: 312-867-2211; Empl.: 200; *Sls. Mgr.:* Ron Pitchford

USECO DIV., Litton Inds, 13536 Saticoy St, Van Nuys, CA 91409, Tel: 818-786-9388, FAX: 818-709-4510; FSC No.: 88245; Empl.: 100; *Sls. Mgr.:* Peggy Slattery

U.S. INSTR. RENTALS, 2988 Campus Dr., San Mateo, CA 94403, Tel: 800-824-2873, TELEX: 349301 USIR SMT; Empl.: 500

U. S. LASER CORP., 825 Windham Court North, Wyckoff, NJ 07481, Tel: 201-848-9200; Empl.: 25; *Sls. Mgr.:* John Tobin

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FAX: 213-374-2387

U.S. POWER CONVERTING COMPANY/RELCO, Leonard V. Snow & Assocs., 21517 Ocean, Torrance, CA 90503, Tel: 213-316-9984; Empl.: 6; *Sls. Mgr.:* Van Snow; *Dist. Mgr.:* Tom Clark ..... **C•1087; D•2041**

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CA Torrance, U.S. Power Converting/L. Snow & Assocs. 213-316-9984
Can New Dundee, Ont., Ritz Elctrns. 519-696-2616

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CA Torrance, U.S. Power Converting/L. Snow & Assocs. 213-316-9984
Can New Dundee, Ont., Ritz Elctrns. 519-696-2616

U.S. TERMINALS, 7502 Camargo Rd., Cincinnati, OH 45243, Tel: 513-561-8145, FAX: 513-561-8755; FSC No.: 12615; Empl.: 45; *Sls. Mgr.:* George L.Stepp ... **C•1557**

Local Sales Offices & Reps

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FL Melbourne, Jerry Williams, Inc. 305-259-7700
FL Melbourne, Jerry Williams, Inc. 407-259-7700
IL Chicago, L-Tec, Inc. 312-773-2900
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AZ Phoenix, Howe & Howe Sls. 602-264-7971
CA Oceanside, Noo Rep Tech Sls. 619-941-0558
CA San Gabriel, U.S. Toyo Fan Corp. 818-287-5297
CA San Jose, U.S. Toyo Fan Corp. 408-434-1615
CO Lakewood, Christee-Meade 803-232-0287
CT Bethel, Livera-Polk Assocs. Inc. 203-748-4639
FL Winter Springs, Sunland Assocs. 305-365-9533
IL Elk Grove, Parcom Inc. 312-228-6360
KS Lenexa, Midtec Assocs. 913-541-0505
MD Columbia, Dalbrook Corp. 301-740-4346
MA Needham, Component Technlg. 617-449-8490
MI Farmington Hills, W. R. Hummon 313-474-0661
MN Minneapolis, Stan Clothier Co. 612-944-3456
MO St. Louis, Midtec Assocs. 314-275-8666
NJ Madison, Livera-Polk Assocs. 201-377-3220
NY Cooperstown, Fitzelle Assocs. 607-547-9333
NY Glen Head, Livera-Polk Assocs. 516-759-9300
NC Matthews, Arthur, Harris & Assoc. 704-845-1085
OH Richfield, Geotronix 216-659-6100
OH Trotwood, Geotronix 513-252-6700
OR Beaverton, LD Elctrns. Inc. 503-568-0511
PA Allison Pk., Geotronix Inc. 412-487-1770
PA Colmar, Dalbrook Corp. 215-331-5330
TX Houston, Zonk & Assocs. 713-579-7777
TX Richardson, Zonk Assocs. 214-238-7651
WA Snohomish, LD Elctrns. 206-568-0511
PR Santruce, SISCO 809-726-3137
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AZ Phoenix, Aero-Space Southwest 602-269-5655
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CA Buena Park, Cypress Elctrns. 714-521-5230
CA Fremont, Terminal Sls. Corp. 415-656-7722
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Tustin, Added Value Elctrns. Distr. 714-259-8258
CO Arvada, Denver Beta Wintronics 303-431-7161
FL Largo, Lo-Dan Elctrns. 813-586-2851
FL Longwood, Intertec Comps. 305-834-7777
IL Elk Grove, Martec Assocs. 312-956-8090
MD Beltsville, Petricko Sls. 301-937-4960
MA Haverhill, Cord Elctrns. 617-374-0100
MI Farmington Hills, Versatron 313-474-0667
MN Fridley, Voyager Elec. 612-571-7766
NV Las Vegas, Kiesub Corp. 702-733-3888
NJ Corbin City, Index 609-628-4040
NM Albuquerque, Betatron 505-821-1122
NY Elmsford, Multimeterics 914-347-3666
NY Endwell, Pryme-Line Distr. 607-748-5200
OH Richfield, Alpha Distr. Corp. 216-659-7100
OR Beaverton, Hansen Elctrns. 503-642-4455
PA Harrisburg, Cumberland Elctrns. 717-233-5883
TX Dallas, Cypress Elctrns. 214-869-1435
TX Richardson, Zec Sls. 214-669-0895
WA Bothell, Cypress Elctrns. 206-483-1144

UTE MICROWAVE, 3500 Sunset Ave., Asbury Park, NJ 07712, Tel: 201-922-1009, TELEX: 13-2461, FAX: 201-922-0848; FSC No.: 23261; Empl.: 35

UTI INSTRUMENTS CO., 497 S. Hillview Dr., Milpitas, CA 95035-2008, Tel: 408-945-1955, TWX: 910-339-9546, FAX: 408-942-0949; Empl.: 80; *Sls. Mgr.:* C. Bruce McAllister

UVP, INC., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778, Tel: 818-285-3123, TELEX: 371 6381, FAX: 818-285-2940; Empl.: 100

VACO PRODUCTS, 7200 McCormick Blvd., Chicago, IL 60645, Tel: 312-677-9500, TELEX: 72-4431; Empl.: 250; *Sls. Mgr.:* Bill Redmond

VACTRONIC LAB. EQUIP. INC., 160 Wilbur Place, Bohemia, NY 11716, Tel: 516-567-0520, FAX: 516-567-0684; Empl.: 30

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FAX: 619-457-0127

VALHALLA SCIENTIFIC, 9955 Mesa Rim Rd., San Diego, CA 92121, Tel: 619-457-5576, TELEX: 181750 VALHALLA SDG; Empl.: 75; *Sls. Mgr.:* Stephen Merrill ..... **D•1366-1368**

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AL Huntsville, Currie, Peak & Frazier 205-536-1506
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CA Costa Mesa, Cutlass Elctrns. 714-549-9358
CA San Diego, Mesa Engrg. 619-268-3500
CA San Jose, Applied Sys. 408-988-6006
CA Torrance, Cutlass Elctrns. 213-324-7360
CO Englewood, Barnhill Assocs. 303-799-6999
FL Orlando, Currie, Peak & Frazier 407-855-0843
FL Tampa, Currie, Peak & Frazier 813-968-2480
FL W. Melbourne, Currie, Peak & Frazier 407-724-6795
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IN Indianapolis, Comtel Midwest Co. 317-253-1681
IA Cedar Rapids, Delltron Co., Inc. 319-393-0058
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MA Hokinton, Eastern Sys. 508-435-2151
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MO Kansas City, Delltron Co., Inc. 816-436-6445
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NY Ilion, Labtronics 315-895-7135
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NY Syracuse, Labtronics 315-455-7314
NC Bakersville, Currie, Peak & Frazier 704-688-4371
NC Greensboro, Currie, Peak & Frazier ... 919-373-0380
NC Matthews, Currie, Peak & Frazier 704-846-1702
OH Berea, Carter, McCormic & Peirce (CMP) 216-826-0400
OH Englewood, Carter, McCormic & Peirce (CMP) 513-836-0951
OK Tulsa, Barnhill Assocs. 918-744-6535
OR Portland, Westcon, Inc. 503-283-0132
PA Philadelphia, Robert Meyers Assocs. .. 215-224-1663
PA Pittsburg, Carter, McCormic & Peirce (CMP) 412-826-3800
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TX Houston, Barnhill Assocs. 713-444-1733
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UT Murray, Barnhill Assocs. 801-262-3000
VA Hampton, Sel-Tronics 804-827-6308
WI New Berlin, Comtel Midwest Co. 414-544-6042

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VALLEY ELECTROMAGNETICS, P.O. Box 131, Spring Valley, IL 61362, Tel: 815-664-2348, FAX: 815-663-1112; Empl.: 100; *Sls. Mgr.:* A. Petak

VALOR ELECTRONICS, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, Tel: 619-458-1471, TELEX: 653406 VALORSD, FAX: 619-458-0875; FSC No.: 15003; Empl.: 600; *Sls. Mgr.:* Nick Freyling

VALOR POWER SYSTEMS DIV., Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, Tel: 619-458-1471, FAX: 619-458-0875; FSC No.: 58999; Empl.: 350; *Sls. Mgr.:* Brad Rogers; *Dist. Mgr.:* Nick Freyling

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VAMISTOR CORP., 115 Industrial Pk, Sevierville, TN 37862, Tel: 615-453-0001, TWX: 810-570-4931, FAX: 615-453-0003; FSC No.: 56856; Empl.: 53; *Sls. Mgr.:* John Farry, Sls. Mgr.; *Dist. Mgr.:* Ken Sult, Dist. Sls. Mgr.

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VARIAN MICROWAVE EQUIP. DIV., Varian Assocs., Inc., 3200 Patrick Henry, Santa Clara, CA 95054, Tel: 408-496-6273, TELEX: 510-601-5674 MEDSC, TWX: 348476, FAX: 408-496-6235; FSC No.: 59782; Empl.: 300

VARIAN TEMPE ELCTRNS. DIV., Varian Assocs., 615 S. River Rd., Tempe, AZ 82581, Tel: 602-968-6790, FAX: 602-894-5381; Empl.: 175; *Sls. Mgr.:* Douglas Kim

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CA	Norwalk, Ed Rivers Assocs.	213-868-1471
CA	San Mateo, Stewart Fullerton Assocs.	415-570-7666
CT	Cheshire, Sci. Comps.	203-272-2963
MD	Ellicott City, Technlg. Sls.	301-461-7802
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NY	Glen Head, Livera-Polk	516-759-9300
NC	Lillington, EMF	919-893-3650
OH	Beachwood, Thompson & Assocs.	216-831-6277
OH	Dayton, Thompson & Assocs.	513-435-7733
OR	Portland, VMI	503-252-5197
PA	West Chester, TCA Assocs.	215-353-2022
TX	Richardson, Comp. Technlg.	214-783-8831
WA	Redmond, VMI	206-882-2999
Can	Mississauga, Ont., K.C. Sls. & Mktg.	416-826-5435
Can	Mississauga, Ont., Nica Power Battery Corp.	416-828-7100

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AZ	Phoenix, Specific Energy Corp.	602-433-0288
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CA	Mtn. View, Energy Sls.	415-969-0800
CA	San Jose, Rose Elctrns.	408-263-9700
CA	Van Nuys, Nesco, Inc.	818-781-0505
CO	Englewood, Indl. Elctrns.	303-694-9444
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GA	Marietta, Synergistic Batteries	404-973-2220
HI	Honolulu, Pacific Energy Dvcs.	808-737-2021
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NJ	Butler, Access Distrs.	201-492-0808
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OR	Aloha, Elctrn. Concept	503-642-9715
TX	Spring, Battery Pak Sls. & Svc.	713-367-9393
TX	Stafford, S.W. Elctrns.	713-240-4000
WA	Redmond, Energy Sls., Inc.	206-883-2343
Can	Mississauga, Ont., NICA Power Battery Corp.	416-828-7100

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VCH INCORPORATED, Chicago Miniature, 1080 Johnson Drive, Buffalo Grove, IL 60089, Tel: 312-459-3400, TWX: 910-221-5445, FAX: 312-459-2708; FSC No.: 71744; Empl.: 52; *Sls. Mgr.:* Jim Flanagan

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FAX: 818-365-5718

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CA	Milpitas, R & D Elctrn. Parts	408-262-7144

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AL	Birmingham, Ack Radio Supp. Co.	205-322-0588
AL	Huntsville, Allied Elctrns. Inc.	1-800-433-5700
AL	Huntsville, Mock Elctrns. Inc.	205-539-2401
AL	Huntsville, Pioneer Technlgs.	205-837-9300
AL	Huntsville, W & W Elctrns. Inc.	205-534-0376
AZ	Phoenix, Dalis Elctrns.	602-275-2885
AZ	Phoenix, Elctrn. Supp.	602-276-1199
AZ	Phoenix, Tri-Tek Inc.	602-371-0860
AZ	Tempe, Circuit Specialists	602-966-0764
AR	Little Rock, Carlton Bates	501-562-9100
CA	Anaheim, R&D Elctrns.	714-773-0240
CA	Belmont, Jameco	415-592-6718
CA	Buena Pk., Cypress Elctrns.	714-521-5230
CA	Canoga Pk., Sandy's Elec. Supp.	818-346-8353
CA	Chatsworth, Priority 1 Elctrns.	818-709-5111
CA	Costa Mesa, Dow Radio	714-645-6448
CA	Costa Mesa, Marvac Elctrns.	714-650-2001
CA	Costa Mesa, Powell	714-754-1717
CA	Fremont, Allied Elctrns.	415-770-0590
CA	Fremont, Fry's Elctrns.	415-770-3797
CA	Fullerton, Orvac Elctrns.	714-871-1020
CA	Gardena, Cal Switch	213-770-2330
CA	Hollywood, Yale Elctrns.	213-465-3186
AL	Huntsville, Powell Elctrns.	205-539-2731
CA	Inglewood, Newark Elctrns.	213-670-0020
CA	Irvine, Priority 1 Elctrns.	714-660-1411
CA	Los Angeles, ITC Elctrns.	213-388-0621
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	Oakland, Brill Elctrns.	415-834-5888
CA	Pasadena, Empire Elctrn. Dist.	213-681-2711
CA	Riverside, Elctrn. Supp.	714-787-9220
CA	Sacramento, Zack Elctrns.	916-369-1786
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	San Diego, Elctrn. Supp.	619-693-8222
CA	San Diego, Shanks & Wright	619-239-0176
CA	San Diego, Western Radio Elctrns.	619-268-4400
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	San Jose, Elctrn. Supp.	408-297-3726
CA	San Jose, Powell Elctrns.	408-943-9020
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Mateo, Newark Elctrns.	415-571-5300
CA	Santa Ana, Advanced Computer Prod.	714-558-8813
CA	Santa Clara, Active	408-727-4550
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Santa Clara, Halted Specialties	408-732-1573
CA	Santee, Mouser Corp.	619-449-2300
CA	Sunnyvale, Abacus Elctrns. Co.	408-732-2000
CA	Sunnyvale, Fry's Elctrns.	408-733-0115
CA	Thousand Oaks, Pace Elctrn.	818-497-7515
CA	Tustin, Allied Elctrns. Inc.	714-669-4190
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Shelley/Ragon	303-762-0670
CT	Danbury, Pilgrim Elec. Inc.	203-792-7274
CT	Greenwich, Wise Comps. Inc.	203-531-4880
CT	Hamden, Allied Elctrns.	203-248-8900
CT	Norwalk, Pioneer Stand. Elctrns. Inc.	203-853-1515
CT	S. Windsor, Car-Lac Elctrns.	203-282-0631
CT	Wallingford, Sager Elec. Supp. Co.	203-265-4600
FL	Altamonte Springs, Pioneer Tech. Sls.	407-834-9090
FL	Ft. Lauderdale, Pioneer Technlg.	305-428-8877
FL	Ft. Lauderdale, Powell Elctrns.	305-484-8377
FL	Ft. Lauderdale, Southeastern Elect. Inc.	305-563-4131
FL	Miami, Elctrn. Equip.	305-871-3500
FL	Pompano Bch., Peerless Radio Corp.	305-973-4141
GA	Atlanta, Jack Spears Elctrns.	404-237-4531
GA	Norcross, Allied Elctrns. Inc.	404-377-3555
GA	Norcross, Newark Elctrns.	404-448-8500
GA	Norcross, Pioneer Technlgs.	404-448-1711
IL	Bensonville, GBL Goold Elctrns.	312-860-7171;800-323-6639
IL	Champaign, Klaus Radio, Inc.	217-356-1856
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Chicago/Elgin, Allied Elctrns.	312-697-8200
IL	Palatine, OHM Elctrns.	312-359-5500
IL	Peoria, Klaus Radio	309-691-4840
IL	Schaumberg, Newark Elctrns.	312-310-8980
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Meunier Elctrns.	317-635-3511
IN	Indianapolis, Newark Elctrns.	317-872-7070
IA	Cedar Rapids, Dee Elctrns., Inc.	319-365-7551
KS	Overland Park, Newark Elctrns.	913-677-0727
KY	Louisville, Peerless Elec. Equip.	502-637-7674
MD	Baltimore, ASI Elctrns.	301-265-5100
MD	Baltimore, Resco/Baltimore	301-529-0500
MD	Columbia, Newark Elctrns.	301-964-4482
MD	Columbia, Powell Elctrns. Inc.	301-995-6410
MD	Gaithersburg, Pioneer Technlgs.	301-921-0660
MD	Rockville, Capitol Radio Whlslrs.	301-881-2270
MA	Boston, Active	508-366-8899
MA	Hingham, Sager Elec. Supp. Co.	617-749-6700
MA	Lexington, Pioneer Inc.	617-861-9200
MA	Lynn, Land Elctrn. Supp.	617-592-2220
MA	Milford, Car-Lac Elctrns.	617-478-7797
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Needham, YDI Elctrns. Corp.	617-449-1005
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Westborough, Powell Elctrns.	508-366-6100
MA	Wocester, Newark Elctrns.	508-756-0702
MI	Ann Arbor, Wedemyer Elect. Supp.	313-665-8611
MI	Lansing, Wedemeyer Elec. Supp.	517-484-9047
MI	Livonia, Chelsa/RS Div.	313-525-1155
MI	Livonia, Pioneer Std.	313-525-1800
MI	Oak Pk., Newark Elctrns.	313-967-0600
MI	Southfield, Newark Elctrns.	313-557-8227
MN	Minneapolis, Acme Elctrns. Inc.	800-328-0270
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Minneapolis, Shelley/Ragon Inc.	612-642-2828
MN	St. Paul, Gopher Elctrns.	612-483-3322
MN	Thief River Fls, Digi-Key Corp.	800-344-4539
MO	Kansas City, Elctrns. Supp.	816-931-1321
MO	Maryland Hgts., Chelsea Elctrns.	314-426-4500
MO	St. Louis, Gateway Elctrns.	303-458-5444
NH	Salem, Sager Elctrl.	603-898-1348
NJ	Camden, GRS Co.	609-964-8560
NJ	E. Hanover, State Elctrn. Parts Co.	201-887-2550
NJ	Englewood, Powell Elctrns.	201-894-0800
NJ	Kenilworth, Federated Purchaser	201-272-0505
NJ	Mt. Laurel, Active	609-273-2700
NJ	Mt. Laurel, Future Elctrns.	609-778-7600
NJ	Pennsauken, Resco	609-662-4000
NJ	Pine Brook, Pioneer Stand. Elctrn.	201-575-3510
NM	Albuquerque, Elctrn. Parts Co.	505-293-6161
NY	Binghamton, Pioneer Elctrns.	607-722-9300
NY	Bohemia, Car-Lac Elctrns.	516-567-4200, 800-645-1192
NY	Buffalo, Newark Elctrns.	716-892-4321
NY	Buffalo, Summit Dists. Inc.	716-887-2800
NY	Commack, Car-Lac Elctrns.;NY Branch Sls. Off.	516-493-0556,800-433-0387
NY	Hauppauge, Broadline Elctrn. Dist.	516-231-4100
NY	Hempstead, Davis Elctrns.	516-483-9200
NY	L.I. City, H. L. Dalis	718-361-1100
NY	Lynbrook, Peerless Radio Dist. Inc.	516-593-2121
NY	Mineola, Allied Elctrns. Inc.	516-248-2360
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rochester, Summit Dists. Inc.	716-334-8110
NY	Ronkonkoma, Arrow Elctrns., Inc.	800-932-7769
NY	Woodbury, Pioneer Stand. Elec.	516-921-8700
NC	Cary, Powell Elctrns.	919-467-1212
NC	Charlotte, Pioneer Technlgs.	704-527-8188
NC	Raleigh, Allied Elctrns. Inc.	919-876-5845
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Akron, Akron Elect. Supp. Inc.	216-762-8818
OH	Cincinnati, Hughes Peters Inc.	513-351-2000
OH	Cleveland, Pioneer Stand. Elec.	216-587-3600
OH	Columbus, Hughes Peters Co.	614-294-5351
OH	Columbus, Wedemeyer Elec. Supp.	614-436-9600
OH	Dayton, Pioneer-Dayton	513-236-9900
OH	Dayton, Stotts-Friedman Co.	513-298-5555
OR	Beaverton, Almac Elctrns.	503-629-8090
OR	Beaverton, Norvac Elctrns.	503-644-1025
OR	Portland, Radar Elec. Co.	503-232-3404
PA	Drexel Hill, Kass Elctrn. Dist.	215-449-2300
PA	Harrisburg, Cumberland Elect. Inc.	717-232-9715
PA	Horsham, Pioneer Technlgs.	215-674-4000
PA	McKean, Advacom, Inc.	814-476-7774
PA	Philadelphia, Powell Elctrns.	215-365-1900
PA	Pittsburgh, Pioneer Std.	412-782-2300
PA	Reading, Barbey Elctrns.	215-376-7451
PA	Willow Grove, RESCO Elctrns.	215-659-4575
SC	Charleston, Wholesale Indl. Elec.	803-722-2634

TN Nashville, Carlton Bates 615-244-3562
TX Austin, Pioneer Std. 512-835-4000
TX Dallas, Harrison Equip. Co., Inc. 214-239-2750
TX Dallas, Off-the-Shelf Comps. 214-247-0052
TX El Paso, Ideal Indl. Elec. 915-779-6647
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Garland, Newark Elctrns. 214-494-5911
TX Houston, Newark Elctrns. 713-999-0529
TX Houston, Pioneer Std. 713-988-5555
TX Irving, Powell Elctrns. 214-550-0547
TX Mansfield, Mouser Elctrns. 817-483-4422
TX Richardson, Off-the-Shelf Comps. 214-238-0808
TX Stafford, Harrison Equip. Co. 713-879-2600
UT Salt Lake City, Kimball Elctrns. Inc. 801-328-2075
UT Salt Lake City, Stand. Supp. ..... /. 801-486-3371
VA Arlington, Arlington Elec. Whlslrs. 703-524-2412
VA Norfolk, Priest Elctrns. 804-855-0105
WA Bellevue, Active 206-881-8191
WA Bellevue, Almac Elctrns. 206-643-9992
WA Seattle, Radar Elec. Co. 206-282-2511
WA Spokane, Almac Elctrns. 509-924-9500
WA Spokane, Radar Elctrns. 509-747-3053
WI Milwaukee, Marsh Elctrns. 414-475-6000

VECTOR ELECTRONIC CO., 12460 Gladstone Ave., Sylmar, CA 91342, Tel: 818-365-9661, FAX: 818-365-5718; Empl.: 95 ..... **C•1121, 1722, 1727-1729; D•1122-1123**

VECTRONICS MICROWAVE CORP., 113 Lincoln Blvd., Middlesex, NJ 08846, Tel: 201-356-2377, TELEX: 833560; FSC No.: 32846; Empl.: 51; *Sls. Mgr.:* John G. Vogler

VECTRON LABORATORIES, INC., 166 Glover Ave., Norwalk, CT 06850, Tel: 203-853-4433, TWX: 710-468-3796, FAX: 203-849-1423; FSC No.: 27802; Empl.: 325; *Sls. Mgr.:* Larry Jawitz ..... **A•1492-1497**

Local Sales Offices & Reps

AL Huntsville, Saber Assocs. 800-327-0853
AZ Mesa, Fetty/Schoenduve 602-241-9009
CA El Segundo, Fetty/Schoenduve 213-322-4991
CA Mountain View, Fetty/Schoenduve ... 415-962-8330
CA San Diego, Fetty/Schoenduve 619-292-5136
CO Parker, Techn. Mktg. Assocs. 303-841-3435
CT Cheshire, Meco 800-225-3409
FL Melbourne, Saber Assocs. 800-432-6288
GA Norcross, Saber Assocs. 800-327-0853
IL Bannockburn, GMR Sls., Inc. 312-295-8440
IN Greenwood, Valentine & Assocs. 317-888-2260
IN South Bend, Valentine & Assocs. 219-288-7070
IA Anamosa, WG Controls 319-462-3456
MO Independence, Engrg. Svcs. Co. 816-254-3600
MA Reading, Meco 617-944-6660
MI Detroit, R. P. Urban Assocs. 313-535-2355
MI Grand Rapids, R. P. Urban Assocs. ... 616-245-0511
MN Burnsville, Allied Comp. Reps. 612-435-7876
MO St. Louis, Engrg. Svcs. Co. 314-997-1515
NY Great Neck, F & F Metro 516-482-4080
NM Albuquerque, J. Smith & Assocs. 505-345-6501
NY Syracuse, T–Squared Elctrns. 315-463-8592
NC Clayton, Saber Assocs. 800-327-0853
OH Englewood, A. Nace Co. 513-836-0931
OH Hudson, A. Nace Co. 216-656-3273
PA Newtown Sq., SWR Tech., Inc. 215-353-6639
TX Dallas, Texas Avionics 214-437-5677
UT Salt Lake City, Techn. Mktg. Assocs. .. 801-483-1009
VA Alexandria, Tech-Reps 703-370-2600
WA Seattle, Datacom 206-285-2525
Can Montreal, Ont., Soquelec, Ltd. 514-482-6427

VEECO INSTRUMENTS INC., Terminal Dr., Plainview, NY 11803, Tel: 516-349-8300; *Sls. Mgr.:* Robert Kase

VEECO INTEGRATED AUTOMATION, INC., Veeco Instruments Inc., 10480 Markison Rd., Dallas, TX 75238, Tel: 214-349-8482

VEEDER-ROOT, 70 Sargeant St., Hartford, CT 06102, Tel: 203-527-7201, FAX: 203-527-1479; Empl.: 1200; *Sls. Mgr.:* Alan Schoenhut; *Dist. Mgr.:* Alan Schoenhut

VEETRONIX

FAX: 303-324-4985

VEETRONIX, INC., Box 480, Lexington, NE 68850, Tel: 308-324-4600; Empl.: 25; *Sls. Mgr.:* Eddie Howerter ..... **B•1852-1853**

VEGA PRECISION LABS., 800 Follin La., Vienna, VA 22180, Tel: 703-938-6300, TELEX: 89-2521; FSC No.: 23115; Empl.: 350; *Sls. Mgr.:* Joe E. Bennett

VEKTREX ELECTRONIC SYSTEMS, INC., P.O. Box 490, Imperial Bch., CA 92032, Tel: 619-753-0408; FSC No.: 0BV42; Empl.: 5

VELMEX, INC., P. O. Box 38, East Bloomfield, NY 14443, Tel: 716-657-6151, 800-642-6446, FAX: 716-657-6153; Empl.: 30; *Sls. Mgr.:* R. Yurick

VELONEX, 560 Robert Ave., Santa Clara, CA 95050, Tel: 408-727-7370, FAX: 408-727-0389; Empl.: 40; *Sls. Mgr.:* Kevin M. Coffey ..... **D•1421**

VELONEX, 6551 Loisdale Ct., Ste. 322, Springfield, VA 22150, Tel: 703-922-8005, FAX: 703-922-8007

VEMALINE PRODS. DIV., 333 Strawberry Field Rd., P.O. Box 6979, Warwick, RI 02887, Tel: 401-739-7600, FAX: 401-732-6119; FSC No.: 08730; *Sls. Mgr.:* Paul Vamvaketis

VENABLE INDUSTRIES, INC., 3555 Lomita Blvd., Torrance, CA 90505, Tel: 213-539-2522, FAX: 213-539-4139; Empl.: 20; *Sls. Mgr.:* C.B. Dreyer

VENT RAK, See General Devices

VERMONT AUTOMATION CO., INC., 18 Morse Dr., Essex Junction, VT 05452, Tel: 802-879-7571; Empl.: 7; *Sls. Mgr.:* G. Cox

VERMONT PRECISION RESISTOR, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1207, Tel: 802-253-8567, FAX: 802-253-8019; Empl.: 8

VERMONT RESEARCH CORP., Precision Pk., N. Springfield, VT 05150, Tel: 802-886-2256, TWX: 710-363-6533; Empl.: 45; *Sls. Mgr.:* John Dimitruk

VERMONT SEMICONDUCTOR, INC., 7-Ave.D, PO Box 526, Williston, VT 05495, Tel: 802-865-3000, FAX: 802-865-3800; Empl.: 70

VERNITECH:VERNITRON CORP., 300 Marcus Blvd., Deer Pk, NY 11729, Tel: 516-586-5100, TWX: 510-227-6079; FSC No.: 30223; Empl.: 225 .... **A•2147; B•1037, 1316, 1998**

Local Sales Offices & Reps

AZ Fountain Hills, Halbar Assoc. 602-837-2464
AZ Fountain Hills, Halbar Assocs. 602-837-2464
CA Glendale, Halbar Assoc. 818-246-8263
CA Glendale, Halbar Assocs. 213-246-8263
CO Wheat Ridge, Waugaman Assocs. 303-423-1020
CO Wheatridge, Waugaman Assocs. 303-423-1020
CT North Haven, Kitchen & Kutchen, Inc. 203-239-0212
FL Madiera Beach, Mackay, Smith & Assoc., Inc. 813-530-1873
FL Orlando, MacKay Smith & Assocs. 305-423-4353
IL Palatine, Technlg. Sls. 312-991-6600
IL Palatine, Technology Sls. 312-991-6600
IA Davenport, Rush & West 319-388-9494
KS Olathe, Rush & West 913-764-2700
MD Monkton, Imagitron Sls. Co., Inc. 301-374-5600
MA Burlington, Kitchen & Kutchen Inc. 617-229-2660
MN Minneapolis, Boerger & Assocs. 612-560-3435
MO St. Louis, Rush & West Assocs., Inc. .. 314-965-3322
NJ Cherry Hill, Lanson Assoc. 609-424-4670
NY Melville, Comtronic Engrg. Sls. 516-249-0505
NY Melville, Comtronics Eng. & Sls. 516-249-0505
NY Syracuse, T-Squared Co. 315-463-8592
NY Syracuse, T-Squared Elctrn. Sls. 315-463-8592
NY Victor, T-Squared 716-924-9101
OH Beachwood, Electronic Salesmasters, Inc. 216-831-9565
OH Dayton, J. C. Hofstetter Co. 513-296-1010
OH Medina, J. C. Hofstetter Co. 216-241-4880
OH Medina, J.C. Hofstetter & Co. 216-241-4880
TX Ronoake, CMR 817-379-6540
UT Salt Lake City, Waugaman 801-261-0802
UT Salt Lake City, Waugaman Assocs. ... 801-261-0802
WA Bellevue, Schultz Co. 206-454-0300
WI Milwaukee, Technology Sls., Inc. 414-964-5015

VERNITRON CONTROLS, Vernitron Corporation, 1601 Precision Park La., San Diego, CA 92073, Tel: 619-428-5581, TWX: 910-322-1862, FAX: 619-428-5090; FSC No.: 10112; Empl.: 200; *Sls. Mgr.:* R. Campbell ..... **B•1313-1315**

Local Sales Offices & Reps

AZ Fountain Hills, Halbar Assocs. 602-837-2464
CA Glendale, Halbar Assocs. 818-246-8263
CA Mtn. View, Westech Sls. 415-961-1422
CO Wheat Ridge, Waugaman Assocs. 303-423-1020
CT North Haven, Kitchen & Kutchin 203-239-0212
FL Madeira Beach, Mackay, Smith & Assocs, Inc. 813-393-7144
FL Orlando, Mackay Smith & Assocs. 305-423-4353
GA Dunwood, Ken Raby 404-396-5848
IL Palentine, Technology Sls. 312-991-6600
MA Burlington, Kitchen & Kutchin 617-229-2660
MO St. Louis, Rush & West 314-965-3332
NJ Cherry Hill, Lanson Assocs. 609-424-4670
NY Jericho, Metro Tech. Sls. 516-935-3330
NY Syracuse, T-Squared Elctrns., Inc. 315-463-8592
NY Victor, T-Squared Elctrns., Inc. 716-924-9101
OH Dayton, Rixan Assocs. 513-222-0011
TX Dallas, CMR 817-379-6540
UT Salt Lake City, Waugaman Assocs. ... 801-261-0802
VA Fredericksburg, Vernitron 703-752-4499

VRN INTERNATIONAL

FAX: 813-347-7520

VERNITRON CORP., VRN Div., 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, Tel: 813-347-2181, TELEX: 6815306, TWX: 310-681-5306; FSC No.: 84048; Empl.: 400; *Sls. Mgr.:* P. Healy; *Dist. Mgr.:* P. Healy ..... **A•2148-2150; B•1038; D•1065**

Local Sales Offices & Reps

AL Huntsville, R. O. Whitesell & Assoc. ... 205-883-5110
AZ Phoenix, Shefler-Kahn 602-257-9015
CA Burlingame, Wm. J. Purdy Co. 415-347-7701
CA Campbell, Kottmeier Assocs. 408-371-8700
CO Englewood, Omega, Ltd. 303-762-1921
CT Farmington, R. Perron Co. 203-673-4825
FL Orlando, Cartwright & Bean 305-422-4531
IL Downers Grove, Circuit Sls. 312-833-2242
IN Fort Wayne, Ro Whitesell & Assocs. .. 219-432-5591
IN Indianpolis, Ro Whitesell & Assocs. ... 317-359-9283
IN Kokomo, Ro Whitesell & Assocs. 317-457-9127
KS Merriam, MTS 913-236-8557
KY Louisville, Ro Whitesell & Assocs. 502-426-7696
MI Grand Rapids, Ro Whitesell & Assocs. 616-942-5420
MI Southfield, Ro Whitesell & Assocs. 313-559-5454
MI St. Joseph, Ro Whitesell & Assocs. ... 616-983-7337
MN Minneapolis, PSI 612-944-8545
NM Albuquerque, Shefler-Kahn 505-345-3591
NY Great Neck, Mos Assocs. 516-487-3966
NY Syracuse, Pi'tronics 315-435-7346
OH Cincinnati, Ro Whitesell & Assocs. 513-521-2290
OH Cleveland, Ro Whitesell & Assocs. 216-447-9020
OH Columbus, Ro Whitesell & Assocs. 614-888-9396
OH Dayton, Ro Whitesell & Assocs. 513-298-9546
OK Tulsa, Comptech 918-622-7744
PA Lawrenceville, DVS 609-896-1112
PA Pittsburg, Ro Whitesell & Assocs. 412-963-6161
TX Arlington, Comptech 817-265-6007
UT Salt Lake City, Omega, Ltd. 801-277-8061
VA Charlottesville, LD Lowery 804-973-6672
Can Rexdale, Ont., Source Elec., Ltd. 613-592-5392

Local Distributors

AR Little Rock, Carlton-Bates 501-562-9100
CA Chatsworth, TTI 818-709-1010
CA San Diego, Shelley-Ragon 619-453-7133
CA San Jose, Future 408-945-9100
CA San Jose, Shelley-Ragon 408-942-9111
CA Thousand Oaks, Bell Inds. 818-340-1940
CO Denver, Denver-Wintronics 303-431-7161
CT Bethel, Future 203-847-6442
CT Norwalk, Cobra Comps. 203-847-6442
CT Wallingford, Sager Elctrl. Supp. 203-265-4600
FL Clearwater, Future 813-441-4771
FL Ft. Lauderdale, NRC Elctrns. 305-772-4500
FL Orlando, TTI Inc. 305-849-1000
FL Tampa, Impala Elctrns. 813-885-4747
GA Norcross, TTI 404-662-0911
IL Lisle, Components Inc. 312-852-7707
IL Lombard, Shelley Ragon 312-595-6633
IA Cedar Rapids, Dee Elctrns. 319-365-7551
MA Woburn, TTI Inc. 617-938-8800
MD Columbia, TTI 301-995-1331
MD Rockville, M S Elctrns. 301-340-6400
MA Hingham, Sager Elctrl. Supp. 617-749-6700
MA Westboro, Future 617-366-2400
MI Farmington Hills, Advent Elctrns. 313-477-1650
MN Eden Prarie, TTI 612-944-5080
MN St. Pauls, Shelley Ragon 612-642-2823

MO	St. Louis, Chelsea	314-426-4500
NJ	Berlin, GCI	609-768-6767
NJ	East Hanover, State Elctrns.	201-887-2550
NJ	Mt. Laurel, Future	609-778-7600
NJ	New Brunswick, Brothers Elctrns.	201-238-2200
NJ	Whippany, Tonar Ind.	201-884-1400
NM	Albuquerque, Sterling	505-884-1900
NY	Albany, Adirondacks	518-456-0203
NY	Buffalo, Summit	716-887-2800
NY	Farmingdale, Command Elctrns. Corp.	516-293-1212
NY	Hauppauge, Fairmont Elec. Sls.	516-231-3313
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Liverpool, Future	315-451-2371
NY	Ronkonkoma, TTI Inc.	516-737-2000
NY	Valley Stream, L & S Elctrns.	516-561-2474
NC	Charlotte, Elctrns. Mktg.	704-394-6195
NC	Raleigh, Southeastern	919-828-2311
OH	Columbus, Elctrns. Mktg.	614-299-4161
OH	Dayton, Bell Micro-Mil	513-434-8231
OK	Tulsa, Radio	918-587-9123
PA	Braddock, Leff	412-351-5000
PA	Montgomeryville, Pyttronic	215-643-2850
PA	Philadelphia, PEI Genesis	215-568-7400
TX	Ft. Worth, TTI Inc.	817-831-0441
TX	Houston, Sterling	713-627-9800
TX	Richardson, Altair	214-231-5166
UT	Salt Lake City, Future	801-972-8489
VA	Charlottesville, Virginia Radio	804-296-4184
WA	Bellevue, Future	206-881-8199
WA	Redmond, Priebe Elec. Inc.	206-881-2363
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Pointe Claire, Que., Future Elctrns.	514-694-7710

VERNITRON ELEC. COMPS., See Beau Prods. Div.

Vernitron

FAX: 216-232-8731

VERNITRON PIEZOELECTRIC DIV., 232 Forbes Rd., Bedford, OH 44146-5478, Tel: 216-232-8600, TWX: 810-427-2274; Empl.: 100; *Sls. Mgr.:* Mark Montie ... **A•1499**

Local Sales Offices & Reps

AL	Hunstville, R. O. Whitesell & Assoc.	205-883-5110
FL	Orlando, B & M Sls.	305-855-2455
GA	Norcross, R. O. Whitesell & Assoc.	404-449-9190
IL	Des Plaines, Esco Assoc.	312-298-5310
IN	Ft. Wayne, R. O. Whitesell & Assoc.	219-432-5591
IN	Indianapolis, R. O. Whitesell & Assoc.	317-359-9283
IN	Kokomo, R. O. Whitesell & Assoc.	317-457-9127
KY	Pewee Valley, R. O. Whitesell & Assoc.	502-241-1441
MD	Sykesville, DVS Company	301-781-4080
MI	Grand Blanc, R. O. Whitesell & Assoc.	313-695-0770
MI	Grand Rapids, R. O. Whitesell & Assoc.	616-942-5420
MI	Southfield, R. O. Whitesell & Assoc.	313-559-5454
MI	St. Joseph, R. O. Whitesell & Assoc.	616-983-7337
NJ	Lawrenceville, DVS Company	609-896-1112
NC	Fuguay-Varina, R. O. Whitesell & Assoc.	919-552-1122
NC	Greenboro, R. O. Whitesell & Assoc.	919-273-1945
OH	Cincinnati, R. O. Whitesell & Assoc.	513-521-2290
OH	Cleveland, R. O. Whitesell & Assoc.	216-447-9020
OH	Columbus, R. O. Whitesell & Assoc.	614-888-9396
OH	Dayton, R. O. Whitesell & Assoc.	513-298-9546
OK	Tulsa, CompTech	918-622-7744
PA	Pittsburgh, R. O. Whitesell & Assoc.	412-963-6161
TN	Knoxville, R. O. Whitesell & Assoc.	615-694-9476
TN	Nashville, R. O. whitesell & Assoc.	615-352-4760
TX	Austin, CompTech	512-343-0300
TX	Houston, Comptech	713-492-0005
TX	Irving, CompTech	214-751-1181

VERN KIEBLER ASSOC., 201 N. Gables, Wheaton, IL 60187, Tel: 312-668-5407, FAX: 312-462-7590; Empl.: 200; *Sls. Mgr.:* Wm. Archbold

VERSACAD CORPORATION, Prime Computer, Inc., 2124 Main St., Huntington Bch., CA 92648, Tel: 714-960-7720, TWX: 510-101-1759 TWINC UD; Empl.: 75; *Sls. Mgr.:* Everett Dickson; *Dist. Mgr.:* Glenn Johnson

VERSALOGIC, 3888 Stewart Rd., Eugene, OR 97402, Tel: 503-485-8575, FAX: 503-485-5712

VERTEK INTL. INC., 6775 CustomHouse Plaza Ste.D , San Diego, CA 92073, Tel: 619-661-6868, FAX: 706-686-3444 (Mexico); Empl.: 150

VERTEX INDUSTRIES, INC., P. O. Box 996, 23 Carol St., Clifton, NJ 07014, Tel: 201-472-1331, FAX: 201-472-0814; Empl.: 85; *Sls. Mgr.:* Carlo Pastore

VERTOX CO., 10022 Imperial Ave. E , Garden Grove, CA 92643, Tel: 714-530-4541, FAX: 714-530-0143; FSC No.: 53688; Empl.: 12; *Sls. Mgr.:* Steve Hacker; *Dist. Mgr.:* Steve Hacker

VESTA TECHNOLOGY, INC., 7100 W. 44th Ave. Ste 101, Wheat Ridge, CO 80033, Tel: 303-422-8088, FAX: 303-422-9800; Empl.: 9

VIABLE SYSTEMS INC., Box 369, Sherborn, MA 01770, Tel: 508-653-7665, TELEX: 922 495 VIABLEUS, FAX: 508-653-6645; Empl.: 30

VIA WEST INTERFACE, INC., 534 N. Stone Ave., Tucson, AZ 85705, Tel: 602-623-5716; Empl.: 4; *Sls. Mgr.:* Robert S. Bos

VIBRAC, 16 Columbia Dr., Amherst, NH 03031, Tel: 603-882-6777, TELEX: 312698 VIBRAC, FAX: 603-886-3857; Empl.: 50; *Sls. Mgr.:* R. Searle

Vibra•Metrics INC.

FAX: 203-288-4937

VIBRA-METRICS, INC., 1014 Sherman Ave., Hamden, CT 06514, Tel: 203-288-6158, 1-800-352-2001, TWX: 710-465-0169; Empl.: 25; *Sls. Mgr.:* Tom Golden ... **B•1999**

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AZ	Mesa, Mayco, Inc.	602-491-1372
CA	Canoga Pk., FLW	818-719-0037
CA	Carlsbad, FLW	619-434-5251
CA	Costa Mesa, FLW	714-751-7521
CO	Parker, Heritage Chem. Co.	303-690-0589
CT	North Haven, International Div.	203-288-1638
CT	Wallingford, Pat Jenks Assocs.	203-265-9939
DC	Columbia, Stein Instr. Corp.	301-596-3748
FL	Orlando, FLW Southeast	407-894-1100
HI	Kailua, FLW	808-954-1030
KS	Olathe, Tech. Sls. Assoc.	913-829-2800
MA	Beverly, Pat Jenks Assoc.	508-921-4600
MI	Southfield, Comtel	313-358-2505
MI	Southfield, Comtel Instrs.	313-358-2505
NM	Albuquerque, Mayco, Inc.	505-299-4002
NY	Baldwinsville, Oshex Assoc.	315-635-6027
NY	Baldwinsville, Oshex Assocs., Inc.	315-635-6027
NC	Raleigh, Lee Assoc.	919-848-8818
NC	Raleigh, Lee-Carolinas	919-848-8818
OH	Cleveland, Comtel	216-442-8080
OH	Cleveland, Comtel Instrs.	216-442-8080
OH	Dayton, Comtel Instrs.	513-426-5310
OH	Hilliard, Comtel Instrs.	614-876-8305
OR	Portland, Extech Ltd.	503-292-9219
PA	Philadelphia, Metrasystems	215-247-7347
PA	Philadelphia, MetraSystems	215-247-7347
PA	Pittsburgh, Comtel Instrs.	412-922-5720
TN	Chattanooga, Pump & Vibation Consits.	404-935-5851
TN	Chattanooga, Pump & Vibration Consits.	404-935-5851
TX	Argyle, Milestek, Inc.	817-455-7444
TX	Argyle, MilesTek	817-455-7444
UT	W. American Fork, Highland Tech. Mktg.	801-756-2634
UT	West Amercan Fork, Highland Tech. Mktg.	801-756-2634
WI	Elm Grove, James L. Griffin Co. Inc.	414-797-0980
WI	New Berlin, Comtel -Midwest	414-544-6042
EXP	New Haven, Masten Wright	203-288-1638
EXP	New Haven, CT, Masten Wright	203-288-1638
Can	Rexdale, SRP Control Syss. Ltd.	416-746-0117
Can	Rexdale, Ont., SRP Control Sys. Ltd.	416-746-0117

VIBRATION INSTRUMENTS CO., 1614 Orangethorpe Way, Anaheim, CA 92801, Tel: 714-879-6085, TELEX: 692433; FSC No.: 32102; Empl.: 35; *Sls. Mgr.:* Fritz Egger

VIBRO-METER CORP., P.O. Box 5058, Billerica, MA 01822-5058, Tel: 508-663-7322, TELEX: 948145, TWX: 710-320-1872, FAX: 508-667-1944; FSC No.: 617-667-1944; Empl.: 50; *Sls. Mgr.:* Joe Micali

VICOM SYSTEMS, INC., 2520 Junction Avenue, San Jose, CA 95134, Tel: 408-432-8660, TELEX: 171-603; Empl.: 65; *Sls. Mgr.:* Neil Newman

VICON INDUSTRIES, INC., 525 Broad Hollow Rd., Melville, NY 11747, Tel: 516-293-2200, TELEX: 144581, FAX: 516-293-2627; Empl.: 284; *Sls. Mgr.:* Carol Ryan; *Dist. Mgr.:* Carol Ryan

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VICTOREEN, INC., 6000 Cochran Rd., Solon, OH 44139, Tel: 216-248-9300, TWX: 810-421-8287 ... **A•2062-2067**

Local Sales Offices & Reps

AZ	Tempe, Ele-Comm Assocs.	602-844-0566
MA	Newton, Victoreen, Inc.	617-964-2226
WA	Edmond, EDCO Sls.	206-776-8922

VICTOR ELEC. WIRE & CABLE, 618 Main St., W. Warwick, RI 02893, Tel: 401-821-1700, SALES 401-821-7800, TELEX: 952122, TWX: 710-382-1534, FAX: 401-828-0441; Empl.: 900; *Sls. Mgr.:* E. M. Colasanto

VICTOR WIRE & CABLE CORP., 3601 Holdrege Ave., Los Angeles, CA 90016, Tel: 213-870-9933, FAX: 213-559-4167; Empl.: 30

VICTORY ENGINEERING CORP., Victory Rd., Springfield, NJ 07081, Tel: 201-379-5900, TWX: 710-983-4430; Empl.: 150; *Sls. Mgr.:* P. Foley

VIDAIRE ELECTRONICS MFG. CORP., 54 Nancy St., W. Babylon, NY 11704, Tel: 516-491-1826; Empl.: 20

VIDCO, INC., 8039 S.W. Cirrus Dr., Beaverton, OR 97005, Tel: 503-641-1804, FAX: 503-641-1806; Empl.: 10; *Sls. Mgr.:* Bradley Cohen

VIDEO AUTOMATION SYSTEMS, Upper Shad Rd., Pound Ridge, NY 10576, Tel: 914-764-4613; Empl.: 5

VIDEO MONITORS, INC., Dotronix, Inc., 3833 N. White Ave., Eau Claire, WI 54703, Tel: 715-834-7785, TELEX: 510-100-1880, FAX: 715-834-5672; Empl.: 190; *Sls. Mgr.:* L. Stewart

VIKING CASES, 10480 Oak St. N.E., St. Petersburg, FL 33716, Tel: 813-577-1216, FAX: 1-800-237-2082; *Sls. Mgr.:* Bill Strickland

VIKING CONNETORS CO., Criton Technologies, 21001 Nordhoff St., P.O. Box 2379, Chatsworth, CA 91311, Tel: 818-341-4330, TWX: 910-434-4912; FSC No.: 05574; Empl.: 375

VIKING ELECTRONICS, 1531 Ind. St. PO Box 448, Hudson, WI 54016, Tel: 715-386-8861; Empl.: 26; *Sls. Mgr.:* Roy Crist

VIKING INDUSTRIAL PRODUCTS, 729 Farm Rd., Marlboro, MA 01752, Tel: 617-481-4600; Empl.: 20; *Sls. Mgr.:* Aubrey Elms

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CA	Santa Clara, Penmark Sls. Co.	408-980-1303
CO	Denver, Lindberg Co.	303-758-9033
CT	Middletown, Gerber Sls.	203-347-3000
FL	Lighthouse Pt, Mr. Charles J. Kerns	305-785-6362
IL	Wheaton, Chadra-Schilke	312-653-8126
MD	Gaithersburg, Carwithen Assocs.	301-921-9545
MA	Waltham, Gerber Sls.	617-890-3334
MI	Livonia, Engrg. & Mktg. Svcs. Co.	313-522-9465
MN	Minneapolis, Northstar Comps., Inc.	612-553-1888
NJ	Cranbury, Kay Sls. Assocs.	609-655-3778
NY	Buffalo, NRM Mktg. Grp.	716-634-4300
NY	Skaneateles, NRM Mktg. Grp.	315-685-8991
NY	Spencerport, NRM Mktg. Grp.	716-352-9166
OK	Bixby, MGR Elctrns.	918-369-5186
OH	Cincinnati, Makin & Assocs.	513-871-2524
OH	Cleveland, Makin & Assocs.	216-248-7370
OH	Columbus, Makin & Assocs.	614-848-5424
OR	Portland, SPS Elctrns.	503-297-6919
PA	Harrison City, NRM Mktg. Grp.	412-327-0858
TX	Austin, MGR Elctrns.	512-250-0926
TX	Dallas, MGR Elctrns., Inc.	214-238-5246
UT	Salt LaRe City, Lindberg Co.	801-277-2643
WA	Redmond, SPS Elctrns.	206-323-4140
Can	Toronto, Ont., Tiemkay, Inc.	416-736-1221

Local Distributors

AL	Huntsville, Components Dist. Inc.	205-883-7501
CA	Granada Hills, Acort Inds.	818-368-4474
FL	Melbourne, Components Dist. Inc.	407-724-9910
GA	Norcross, Component Dist. Inc.	404-449-1712
MN	Minneapolis, K & H Elctrn. Distrbg.	800-328-8515
NH	Manchester, Yankee Elctrn. Supp. Co.	800-221-1738
NC	Raleigh, Components Dist. Inc.	919-787-7311

VIRTIS CO., Rte. 208, Gardiner, NY 12525, Tel: 914-255-5000, TELEX: 926474, FAX: 914-255-5338; Empl: 92; *Sls. Mgr.:* J. D. Schmidt

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Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
AZ	Phoenix, Howe & Howe	602-264-7971
CA	Los Alamitos, Reed Elctrns.	213-598-6676
CA	Redwood City, James S. Heaton Co.	415-367-9000
CA	San Diego, Vishay Res. Sys. Grp.	619-690-5112
CO	Englewood, Comps. Sls. Inc.	303-779-8060
CT	Wallingford, Comp Rep Assocs.	203-269-1145
FL	Altamonte Springs, Semtronic Assocs.	305-831-8233
FL	Clearwater, Semtronic Assocs.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs.	305-731-2484
GA	Atlanta, JWL Assocs.	404-320-7643
ID	Boise, N. R. Schultz Co.	208-377-8686
IL	Rolling Meadows, Eagle Tech. Sls.	312-991-0700
IN	Carmel, Shamrock Elctrn. Sls.	317-848-5265
KS	Olathe, Technical Sls. Assocs.	913-829-2800
MD	Lutherville, J. A. Dougherty Sls. Co.	301-321-7890
MA	Westwood, Comp Rep Assocs.	617-329-3454
MI	Plymouth, Jay Mktg. Assocs.	313-459-1200
MO	St. Louis, Technical Sls. Assocs.	314-521-2044
NJ	Flanders, K & R Engrg. Sls. Co.	201-584-5235
NM	Albuquerque, Nelco Electronix	505-293-1399
NY	Rochester, L-Mar Assocs.	716-381-9100
NC	Charlotte, JWL Assocs.	704-541-5750
NC	Raleigh, JWL Assocs.	919-787-4826
OH	Aurora, EMA, Inc.	216-562-6104
OH	Centerville, EMA, Inc.	513-433-2800
OR	Beaverton, N. R. Schultz Co.	503-643-1644
PA	Horsham, TMI	215-441-4300
PA	Malvern, Vishay Resistive Sys. Grp.	215-644-1300
TX	Dallas, Edward F. Aymond Co.	214-826-7620
TX	Houston, Vishay Resistive Sys. Grp.	713-550-0568
UT	Salt Lake City, Harris/CSI	801-974-5155
WA	Bellevue, N. R. Schultz Co.	206-454-0300
PR	Caguas, Comp Rep Assocs.	809-746-6550
Can	Concord, Ont., Kaytronics, Inc.	416-669-2262
Can	Kawata, Ont., Kaytronics, Inc.	613-564-0080
Can	Surrey, B.C., Kaytronics, Inc.	604-581-5005
Can	Ville St. Laurent, Que., Kaytronics, Inc.	514-745-5800

Local Distributors

AZ	Tempe, Shelley-Ragon, Inc.	602-894-2058
AZ	Tempe, TTI, Inc.	602-431-1191
CA	Chatsworth, Petell/Passive Comps. Inc.	818-700-8838
CA	Chatsworth, Shelley-Ragon, Inc.	818-998-3333
CA	Chatsworth, TTI, Inc.	818-709-1010
CA	Milipitas, TTI, Inc.	408-946-5577
CA	San Diego, Shelley-Ragon, Inc.	619-453-7133
CA	San Diego, TTI, Inc.	619-587-4888
CA	San Jose, Shelley-Ragon, Inc.	408-432-0600
CA	Santa Ana, TTI, Inc.	714-641-9393
CO	Denver, TTI, Inc.	303-429-6806
CO	Englewood, Shelley-Ragon, Inc.	303-762-0670
FL	Orlando, TTI, Inc.	407-859-1000
FL	Tampa, Impala Elctrns., Inc.	813-885-4747, 800-237-7777
FL	Tampa, Shelley-Ragon, Inc.	813-623-6560
CT	Wallingford, TTI, Inc.	203-284-7474
GA	Norcross, TTI, Inc.	404-662-0911
ID	Coer d'Alene, A-I Elctrns.	208-765-3280
IL	Lombard, Shelley-Ragon, Inc.	312-629-8833
IL	Palatine, Ohm Elctrns.	312-359-5500
IA	Cedar Rapids, Shelley-Ragon, Inc.	319-373-0525
MD	Baltimore, RESCO/Baltimore	301-529-0500, 800-638-1242
MD	Beltsville, RESCO/Washington	301-937-9100
MD	Columbia, TT I, Inc.	301-995-1331
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NY	Hauppauge, Mast Distrs., Inc.	516-273-4422
NY	Medford, Shelley-Ragon, Inc.	516-447-2000
NY	Ronkonkoma, TTI, Inc.	516-737-2000
NY	Valley Stream, L & S Elctrns.	516-561-2474
OH	Cleveland, Specialized Comps. Sls.	216-464-0405
OH	Dayton, Micro Mil Div.	513-434-8231
OH	Worthington, TTI, Inc.	614-848-5770
OR	Beaverton, Shelley-Ragon, Inc.	503-641-1691
PA	Malvern, Vishay Resistive Sys. Grp.	215-644-1300
TX	Dallas, Shelley-Ragon, Inc.	214-349-2424
TX	Fort Worth, TTI, Inc.	817-595-3100
TX	Ft. Worth, TTI, Inc.	817-831-8300
TX	Houston, Texas Comp. Corp.	713-468-3882
WA	Redmond, Shelley-Ragon	206-883-2220
WA	Redmond, TTI, Inc.	206-882-0291
Can	Concord, Ont., Kaytronics	416-669-2262
Can	Kawata, Ont., Kaytronics	613-564-0080
Can	Que., Kaytronics, Inc.	514-745-5800
Can	Surrey, B.C, Kaytronics	604-581-5005

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VISION ENGINEERING, INC., 570 Danbury Rd., New Milford, CT 06776, Tel: 203-355-3776, TELEX: 643769, FAX: 203-355-0712; Empl.: 15; *Sls. Mgr.:* John Clery

VISIONICS CORPORATION, 343 Gibraltar Dr., Sunnyvale, CA 94089, Tel: 408-745-1551, TELEX: 346352, FAX: 408-734-9012; *Sls. Mgr.:* Alex Wellins

VISTAR CORP., 13740 McCormick Dr., Tampa, FL 33626, Tel: 813-855-6611, TELEX: 522434; Empl.: 25; *Sls. Mgr.:* Ron Rooks; *Dist. Mgr.:* Ron Rooks

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IL	Elmhurst, Utronix Sls.	312-834-1100
VA	Forest, Beacon North	804-239-8486
VA	Sterling, Beacon No.	703-591-1300
EXP	CT, Litchfield, Intrade	203-567-5901

Local Distributors

AL	Huntsville, Component Dist. Inc.	205-883-7501
AZ	Phoenix, Keystone Electro	602-995-3005
CA	Costa Mesa, Orange County Comp.	714-979-3597
CA	Los Angeles, Electric Switch Inc.	213-660-1310
CA	Mission Viejo, Opto Plus	714-380-8654
CA	San Jose, Spectra Elctrns.	408-452-1590
CA	Sunnyvale, PSC Elctrns.	408-737-1333
CA	Torrance, WBC Electro Supp.	213-328-6871
CO	Denver, Component Dist. Inc.	303-799-4916
CO	Englewood, Indelco	303-694-9444
FL	Melbourne, Component Dist. Inc.	305-724-9910
GA	Norcross, Component Dist. Inc.	404-441-3320
IL	Palatine, OHM Elctrns.	312-359-5500
MA	Lynn, Land Elctrns.	617-592-2220
MI	Grand Rapids, S F Elctrn. Supp.	616-459-0216
MN	New Brighton, Chris Electr. Dist.	612-631-2647
NJ	Bellmawr, Midatlantic Electr.	609-931-5303
NY	Elmsford, Ancar Elctrn. Supp.	914-592-7100
NC	Raleigh, Component Dist. Inc.	919-834-9465
OH	Centerville, Industrial Prod. Dist.	513-435-2086
TX	Dallas, Component Dist. Inc.	214-644-0373
WA	Redmond, Priebe Elctrns.	206-881-2363

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AL	Huntsville, EPi Inc.	205-534-3747
AZ	Tempe, Techni Source Inc.	602-730-8093
CA	San Diego, Miners & Assocs.	619-566-9891
CA	Visalia, Vitec Elctrns. Corp.	209-739-1077
DC	McLean, Jin Sung Hsia	703-734-1739
FL	Longwood, SAM Reps. Inc.	305-869-0097
GA	Atlanta, Elctrns. Mktg. Assocs.	404-448-1215
IL	Addison, Baldwin Sls. Assocs., Inc.	312-279-0352
KS	Overland Pk., EPi Inc.	913-642-9118
MN	Minneapolis, HMR Inc.	612-888-2122
MS	Jackson, EPi Inc.	601-856-6251
MO	St. Louis, EPi Inc.	314-962-1411
NM	Albuquerque, Techni Source Inc.	505-268-4232
NC	Raleigh, Elctrn. Mktg. Assocs.	919-847-8800
OH	Beachwood, Elctrn. Sls. Master Inc.	216-831-9555
SC	Greenville, Elctrn. Mktg. Assocs.	803-233-4637
WA	Seattle, Evergreen Mktg. Inc.	206-633-3160

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CA	Costa Mesa, E.E.P. Corp.	714-549-2275
CA	Irvine, Schweber Elctrns.	714-863-0261
CA	Santa Clara, Wyle Labs.	408-727-2500
CT	Danbury, Hamilton Avnet	203-797-2842
FL	Oakland Pk., Zelcon, Inc.	305-565-2555
GA	Norcross, Hamilton Avnet	404-447-7500
IL	Northbrook, Classic Comps. Supp., Inc.	312-272-9650
IL	Palatine, OHM Elctrns.	312-359-5500
IL	Rosemont, Advent Elctrns.	312-297-6200
IN	Indianapolis, Bell Inds.	317-875-8200
IA	Cedar Rapids, Dee Elctrns., Inc.	319-365-7551
KY	Louisville, Peerless Elctrn. Equip.	502-637-7674
ME	N. Adams, ICO-Rally Corp.	413-664-4951
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Livonia, RS Elctrns.	313-525-1155
MN	N. Adams, Elctrn. Supp. Ctr.	413-664-1086
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NY	Westbury, Schweber Elctrns.	516-334-7474
NC	Charlotte, Dixie Elctrns.	704-377-5413
NC	Winston-Salem, Dixie Elctrns.	919-724-5961
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OH	Dayton, Hamilton Avnet	513-439-6700

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OK Tulsa, Radio, Inc. 918-587-9123
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PA McKean, Advacom, Inc. 814-476-7774
PA Philadelphia, Almo Elctrns. Corp. 215-698-4000
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WI New Berlin, Classic Comps. Supp. Inc. 414-786-5300
Can Burnaby, BC, RAE Indl. Elctrns. 604-291-8866

VIZ METEOROLOGICAL INSTRUMENTS, 335 E. Price St., Philadelphia, PA 19144-5782, Tel: 215-844-2626, TWX: 710-670-2626; FSC No.: 41226; Empl.: 450; *Sls. Mgr.:* V. Scott Zelov; *Dist. Mgr.:* V. Scott Zelov

FAX: 213-663-3711

VL ELECTRONICS, INC., Varitronix LTD., 3171 Los Feliz Blvd. Suite 303, Los Angeles, CA 90039, Tel: 213-661-8883; FSC No.: 95-3896380; Empl.: 6; *Sls. Mgr.:* C. Kreslake; *Dist. Mgr.:* C. Kreslake ..... **B•1123**

Local Sales Offices & Reps
CA Los Angeles, Luscombe Engrg. 818-249-9000
CA Los Gatos, Luscombe Engrg. Co.-San Francisco 408-370-2020
CO Denver, MRC 303-794-4684
CO Littleton, MRC 303-794-4684
IN Indianapolis, J-C Hofstetter 317-897-7914
IA Marion, A.E.M. Assocs. 319-377-1129
KS Olathe, A.E.M. Assocs. 913-888-0022
DC D.C./Baltimore, Eastern Elctrns. 609-662-2113
MA Canton, New England Elctrn. Sls. 617-828-4835
MO St. Louis, A.E.M. Assocs. 314-298-9900
OH Dayton, J. C. Hofstetter Co. 513-296-1010
OH Medina, Hoftstetter 216-241-4880
PA Hickory, J. C. Hoffsetter 412-356-2305
PA Philadelphia, J.C. Hoffsetter 215-489-3256
TX Austin, THT Sls. Co. 512-835-2794
TX Dallas, THT Sls. 214-783-1501
WA Bothell, A/D Elctrns. 206-481-8555
WI Colgate, Rep One 414-628-4016
WI Madison, Rep 1 & Assocs. 608-246-8889
Can Dorval, Que., Dosh-Dart Import Ltd. ... 514-636-1913
Can Toronto, Ont., Norgay Entprs., Ltd. 416-259-9663
Can Vancouver, Norgay 604-275-1121

Local Distributors
CA Los Angeles, VL Elctrns Inc. 213-661-8883
NC Raleigh, Eastern Elctrns. 919-876-7591

VLSI TECHNOLOGY, INC., 1109 McKay Dr., San Jose, CA 95131, Tel: 408-434-3100, TELEX: 278807; Empl.: 1600; *Dist. Mgr.:* Frank Reynolds

VME MICROSYSTEMS INTL. CORP., 12090 South Memorial Pkwy., Huntsville, AL 35803-3308, Tel: 205-880-0444, FAX: 205-882-0859; *Sls. Mgr.:* Ray Garren

VMETRO, INC., VMETRO as, 2500 Wilcrest Ave., Ste. 550, Houston, TX 77042, Tel: 713-266-6430, FAX: 713-266-6919; Empl.: 15; *Sls. Mgr.:* Gunnar Ostgaard; *Dist. Mgr.:* Jim Williams

THE VOICE CONNECTION, 17835 Skypark Circle, Ste. C, Irvine, CA 92714, Tel: 714-261-2366, FAX: 714-261-8563; *Sls. Mgr.:* Shirlee Runge

VOICE IDENTIFICATION, Box 714, Somerville, NJ 08876, Tel: 201-526-3408, FAX: 201-526-5714; Empl.: 7

VOLGEN AMERICA, INC., 39650 Liberty St., Suite 325, Fremont, CA 94538, Tel: 415-498-5950, FAX: 415-498-5954; Empl.: 2; *Sls. Mgr.:* Brian Hagino

VOLPI-MFG-USA, 26 Aurelius Ave., Auburn, NY 13021, Tel: 315-255-1737, FAX: 315-255-1202; Empl.: 25; *Dist. Mgr.:* Stephanie Chesanek

FAX: 209-651-0740

VOLTAGE MULTIPLIERS, INC., 8711 W. Roosevelt Ave., Visalia, CA 93291, Tel: 209-651-1402, TELEX: 530484; FSC No.: 60211; Empl.: 85; *Sls. Mgr.:* Karen Spano ..... **A•2208-2209; B•1039**

FAX: 516-887-9869

VOLTAMPERE CORP., 146 Horton Ave., Lynbrook, NY 11563, Tel: 516-887-9443; FSC No.: 64196; Empl.: 30; *Sls. Mgr.:* Robert Pampin ..... **D•2127**

VOLTARC TUBES, 176 Linwood Ave. P.O. Box 688, Fairfield, CT 06430, Tel: 203-255-2633, TELEX: 96-4337, FAX: 203-259-1194; Empl.: 180; *Sls. Mgr.:* Albert H. Katz

VOLTECH, INC., 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-881-7329, ESYLNK: 510-100-3630, FAX: 508-879-8669; Empl.: 10; *Sls. Mgr.:* Louise Hall .... **D•1371**

Local Sales Offices & Reps
CA Laguna Hills, Electro Venture-South .. 714-581-9244
CA Santa Clara, Electro Venture-North ... 408-727-1553
IL Arlington Hgts., Berndt Assoc., Inc. 312-632-0900
MA Burlington, Intersell 508-273-3844
OH Cleveland, Bradcor Elctrns. Co. 216-671-1200

VOLTEX, 3460 Great Neck Rd., Amityville, NY 11701, Tel: 516-842-2772; Empl.: 55; *Sls. Mgr.:* S. Vogel ..... **D•2129-2131**

Local Sales Offices & Reps
CA Santa Clara, R-C Elctrns. 408-988-0701
CT Washington, Tri-Com Assocs. 203-868-7027
MD Burtonsville, Bekr Inds., Inc. 301-421-1200
MA Burlington, Tri-Com Assocs. 617-272-8163

VOLTRONICS CORPORATION, West St., P.O. Box 476, E. Hanover, NJ 07936, Tel: 201-887-1517, FAX: 201-887-3349; FSC No.: 18736;Multiple; Empl.: 70; *Sls. Mgr.:* Richard J. Newman ..... **A•1185**

Local Sales Offices & Reps
AZ Mesa, Fetty/Schoenduve, Inc. 602-241-9009
CA El Segundo, Fetty/Schoenduve, Inc. .. 213-322-4991
CA Moorpark, Fetty/Schoenduve 805-529-4395
CA Mtn. View, Fetty/Schoenduve, Inc. 415-962-8330
CA San Diego, Fetty/Schoenduve, Inc. ... 619-292-5136
CO Boulder, Herb Bass Assocs. 303-530-7509
FL Lighthouse Pt., R. C. Simon & Co. 305-941-2757
IL Chicago, Technical Sls., Inc. 312-237-7210
MA Peabody, J.K. Assocs. 508-535-8068
MN St. Paul, Countryman Assocs. 612-645-9151
NY Melville, RF Elctrn. Sls. Grp. 516-420-8890
PA Campbell, Quick Response Tech. Sls. 215-362-9225
TX Dallas, Allied Comps., Inc. 214-238-0408
UT Bountiful, Herb Bass Assocs. 801-292-8991
VA Sterling, Beacon North Inc. 703-478-2480
WA Seattle, Datacom 206-285-2525
Can St. Laurent, Que., RF Microwave 514-335-2335

VONCO, INC., 22829 Heslip Drive, Novi, MI 48050, Tel: 313-344-0050, FAX: 313-344-0052; FSC No.: 7J499; *Sls. Mgr.:* Larry Ragsdale

VTM MICROWAVES, INC., 4975 W. 80 Ave., Westminster, CO 80030, Tel: 303-426-6866; FSC No.: 52474; Empl.: 15

V-TRON ELECTRONICS CORP., 10 Venus Way, P.O. Box 3297, S. Attleboro, MA 02703, Tel: 617-761-9100, FAX: 617-761-4727; Empl.: 250; *Sls. Mgr.:* Richard E. French

VU-DATA, 9180 Brown Deer Rd., San Diego, CA 92121, Tel: 619-452-7670, TWX: 910-335-1586, FAX: 619-452-2543; FSC No.: 34160; Empl.: 20; *Sls. Mgr.:* M. Knapp

WABASH MAGNETICS, Kearney-National Inc., 1375 Swan Street, Huntington, IN 46750, Tel: 219-356-8300, TWX: 510-100-2867, FAX: 219-356-3846; Empl.: 1000; *Sls. Mgr.:* Stanley P. Bickhart

WABASH MAGNETICS, First & Webster Streets, P.O. Box 708, Wabash, IN 46992, Tel: 219-563-2191, TWX: 810-290-2722, FAX: 219-563-1652; Empl.: 250; *Sls. Mgr.:* Bob Lunn ..... **B•1652-1653**

Local Sales Offices & Reps
AZ Fountain Hills, Halbar Assocs., INc. ... 602-837-2464
CA Glendale, Halbar 818-246-8263
CA San Mateo, Halbar 415-349-4700
CO Englewood, Computech 303-773-3981
FL Tampa, APM Assocs. 813-886-2457
GA Duluth, Dixie Tech. Mktg. 404-381-5592
IL Arlington Hgts., M. J. Petersen Assocs. 312-577-8200
IN Fort Wayne, M/S Sls. 219-436-3023
KS Lenexa, Midtec Assocs. 913-541-0505
MD Glen Burnie, Macrotech Assocs., Ltd. 301-766-1111
MA Andover, Crawford Assocs. 508-470-2122
MN Minneapolis, Des. Technlg. 612-424-7605
MO St. Louis, Midtec Assocs. 314-275-8666
NJ Watchung, Dolan Assocs. 201-753-2671
NC Raleigh, Dixie Tech. Mktg. 919-781-5745
TX Ft. Worth, El-Tec Sls., Inc. 817-268-2896
WA Redmond, Halbar Assocs., Inc. 206-882-0990

Local Distributors
CA Fullerton, Pyramid Elctrn. Supp. 714-773-0781
CA Santa Clara, Pyramid Elctrn. Supp. 408-727-9810
IL Elk Grove Village, Nu-Way Elctrn. Distrs. 312-437-7120
PA Philadelphia, Shap Elctrns. Co. 215-969-3300
WA Redmond, Pyramid Elctrn. Supp., Inc. 206-883-7200

WAGO CORP., 9085 N. Deerbrook Trail, Brown Deer, WI 53223, Tel: 414-354-5511, FAX: 414-354-1268; FSC No.: 65996; *Sls. Mgr.:* Michael A. Lane

WALDES TRUARC, INC., Member of the Seeger Fastening Sys. Grp., 29-01 Borden Ave., Long Island City, NY 11101-4478, Tel: 718-392-3100, TELEX: 126-829; Empl.: 450

WALKER POWER, INC., 10 B Mill St., Warner, NH 03278, Tel: 603-456-3111, FAX: 603-456-2498; Empl.: 115; *Sls. Mgr.:* Paul D. Iverson

WALKER SCIENTIFIC, Rockdale St., Worcester, MA 01606, Tel: 508-852-3674, 508-853-3232, TELEX: 9102508517, FAX: 508-856-9931; Empl.: 83; *Sls. Mgr.:* B. Langley ..... **D•1372**

Local Sales Offices & Reps
AL Birmingham, Levand Sci. Co. 800-222-2595
AZ Phoenix, Jensen Tools Inc. 602-968-6231
CA Irvine, Ion Spec 714-261-7743
CA Santa Barbara, Abbeon Cal, Inc. 805-966-0810
IL Chicago, McMaster Carr Supp. Co. 312-834-9600
IL McHenry, McHenry Elec. Co.
MD Baltimore, Applied Magnetics Lab 301-655-5800
NM Albuquerque, Mayco, Inc.
NY Rochester, Transcat 716-458-4801
OH Cincinnati, Bill Teplitz Assoc. 513-481-1648

Local Distributors
AL Birmingham, Levand Sci. Co. 800-222-2595
AZ Phoenix, Jensen Tools Inc. 602-968-6231
CA Irvine, Ion Spec 714-261-7743
CA Santa Barbara, Abbeon Cal, Inc. 805-966-0810
IL Chicago, McMaster Carr Supp. Co. 312-834-9600
IL McHenry, McHenry Elec. Co.
MD Baltimore, Applied Magnetics Lab 301-655-5800
NM Albuquerque, Mayco, Inc.
NY Rochester, Transcat 716-458-4801

WALL, A. T., CO., 55 Service Ave., Warwick, RI 02886, Tel: 401-739-0740, TWX: 710-382-1535, FAX: 401-732-5784; Empl.: 75; *Dist. Mgr.:* R. Huntsman

WALL-ABLE MFG. CORP., 2201 Landmeier Rd., Elk Grove Vl, IL 60007, Tel: 312-956-8000, TELEX: 312288 WLLABLE, FAX: 312-956-8082; Empl.: 150; *Sls. Mgr.:* Dennis O'Brien

WALL INDUSTRIES, 5 Watson Brook Rd., Exeter, NH 03833, Tel: 603-778-2300, 800-321-WALL, FAX: 603-778-9797; Empl.: 50; *Sls. Mgr.:* Dorothy Amato ..... **D•2128**

Local Sales Offices & Reps
AZ Scottsdale, Memco Sls. 602-952-2254
CA Hayward, Pacific Mktg. 415-887-1620
CA Pasadena, A-F Sls. Engrg. 213-681-5631
CO Aurora, Butler Tech. Sls. 303-651-7703
FL Maitland, Beacon Elctrns. 305-647-3496
GA Atlanta, Beacon Elctrns. 404-256-9640
IL Chicago, ESA Tech. Mktg. 312-544-0120
IN Indianapolis, Elctrn. Mktg. Consits. 317-253-1668
MA Chelmsford, Encotronics 508-256-4207
MI East Detroit, Elect. Mktg. Consits. 317-253-1668
MN Eden Prairie, High Technlg. Sls. 612-944-7274
MO St. Louis, Reptronics 314-576-9816
NJ E. Brunswick, Winch Sls. 201-613-1515
NY N. Syracuse, Labtronics 315-455-7314
OH Cleveland, E.M.C.I. 216-458-8486
PA Huntingdon Valley, Inacker Sls. 215-947-5660
TX Austin, Milco Mktg. Inc. 512-453-3023

TX Dallas, Milco Mktg. 214-783-2716
TX Houston, Milco Mktg. Inc. 713-723-5003
WA Kirkland, N.W. Comp. Sls. 206-828-2104
WI Madison, ESA Tech. Mktg. 312-544-0120
Can Oakville, Ont., Haltronics 416-844-2121

WALL LENK CORPORATION, Box 3349, Kinston, NC 28502-3349, Tel: 919-527-4186, FAX: 919-527-4189; Empl.: 60; *Sls. Mgr.:* Richard W. Cooper

WAMCO, INC., 11555-A Coley River Cir., Fountain Valley, CA 92708, Tel: 714-545-5560, TELEX: 678-459, FAX: 714-545-6093; FSC No.: 58774; Empl.: 18; *Sls. Mgr.:* Gordon R. Calvert; *Dist. Mgr.:* Sheila A. Sherman .... **B•1176-1177**

Local Sales Offices & Reps

AZ Scottsdale, Advent Comp. Corp. 602-481-0044
CA Cupertino, F&F Assocs. 408-446-2349
FL Melbourne, Jerry Williams Inc. 407-259-7700
IL Elmhurst, Utronix Sls., Inc. 312-834-1100
IL Elmhurst, VTRONIX Sls. Inc. 312-834-1100
IN Kokomo, (SAI)Schillinger Assoc. Inc. .. 317-455-2708
IN Kokomo, Schillinger Assocs., Inc. 219-282-4570
KS Parker, S. W. Wollard Co. 913-898-6552
KS Parker, S.W. Wollard Co. 913-898-6552
MI Grosse Pointe Park, Greiner Assoc. Inc. 313-499-0188
NY Bayshore, Richard McGrath Inc. 516-968-8448
NY Jericho, Metro Tech. Sls., Inc. 516-935-3330
NY Massapequa, Richard McGrath, Inc. ... 516-789-0400
TN Nashville, INSUL-REPS Inc. 615-383-0524
WA Seattle, Repwest 206-283-8351

WARREN COMMUNICATIONS, See Fiskars Electronics Corporation

WARREN G-V, UNIT OF SIGNAL CO., 1 Apollo Dr., Whippany, NJ 07981, Tel: 201-386-1200, FAX: 201-386-9331; FSC No.: 93929; Empl.: 200; *Sls. Mgr.:* William Vandertulip

WARREN-KNIGHT INSTRUMENT CO., Warren Industries, Inc., 2045 Bennett Rd., Philadelphia, PA 19116, Tel: 215-464-9300; Empl.: 50; *Sls. Mgr.:* Richard M. Marron

WASATCH HIGH VOLTAGE, P.O. Box 15457, Salt Lake City, UT 84115, Tel: 801-265-9561; Empl.: 75; *Sls. Mgr.:* Gary I. Tobian

WATERS MANUFACTURING, INC. | Talley Industries

FAX: 508-358-5649

WATERS MANUFACTURING, INC., Talley Industries, Longfellow Ctr., Wayland, MA 01778, Tel: 508-358-2777, TELEX: 948441; FSC No.: ;Multiple; Empl.: 125; *Sls. Mgr.:* James Dyne ..... **A•2152-2153**

Local Sales Offices & Reps

AZ Sun City, Hannah Hill 602-933-4623
CA Hayward, Liaisen, Inc. 415-783-1131
CA Lomita, Techrep 213-539-9070
CO Broomfield, Hannah Hill 303-460-0602
CT Bloomfield, Sir Assocs. 203-243-9343
FL Melbourne, R-Rep 305-725-6993
FL Pompano Beach, R-Rep Co. 305-725-6993
IL La Grange Park, Bierhaus Sls 312-354-5100
MA Westford, Sir Assocs. 617-692-2500
MO Hazelwood, Acorn Elctrns. 314-731-2002
NJ Union, S. Simberkoff Assocs. 201-687-6363
NY Le Roy, SSAI 716-768-7213
OH Dayton, INH Comp. Sls. 513-434-8808
TX Dallas, Allied Comps. 214-238-0408
WI Milwaukee, Bierhaus Sls. 414-963-0318
Can Rexdale, Ont., Myelco, Inc. 416-674-1636

Local Distributors

CA Lomita, TecRep Comps. 213-539-9070
TX Dallas, Allied Comps. 214-238-0408

WATKINS-JOHNSON CO., 3333 Hillview Ave., Palo Alto, CA 94304, Tel: 415-493-4141, TELEX: 34-8415, TWX: 910-373-1253; FSC No.: 14482; Empl.: 3000

WAVELINE, Box 718, W. Caldwell, NJ 07006, Tel: 201-226-9100, TWX: 710-734-4324; FSC No.: 00443; Empl.: 95; *Sls. Mgr.:* D. Morsillo

WAVETEK, (Western Area Sales Office), 9045 Balboa Avenue, San Diego, CA 92123, Tel: 619-565-9234

WAVETEK, (Central Area Sales Office), 5808 Churchman Bypass, Indianapolis, IN 46203, Tel: 317-782-4619

WAVETEK, Northeast Area Sales Office, One Executive Blvd., Ste. 206, Suffern, NY 10901, Tel: 914-357-5544

WAVETEK, Southeast Area Sales Office, 2085 U.S. 19 North, Ste. 102, Clearwater, FL 34623, Tel: 813-797-1792

WAVETEK DATRON, See Datron Instruments (or call area sales offices)

WAVETEK MICROWAVE, INC., (Formerly Pacific Measurement, Inc.), 488 Tasman Dr., Sunnyvale, CA 94089, Tel: 408-734-5780, FAX: 408-747-1265

For sales offices and representatives, see Wavetek San Diego, Inc.

WAVETEK RF PRODUCTS, INC., (Formerly Wavetek Indiana, Inc.), 5808 Churchman By-Pass, Indianapolis, IN 46203, Tel: 317-787-3332, FAX: 317-788-5999

For sales offices and representatives, see Wavetek San Diego, Inc.

WAVETEK

FAX: 619-565-9558

WAVETEK SAN DIEGO, INC., 9045 Balboa Avenue, San Diego, CA 92123, Tel: 619-279-2200 ..... **D•1373**

Local Sales Offices & Reps

AL Huntsville, Southern Mktg. Assocs. 205-534-6020
AZ Phoenix, Tech. Mktg. Specialists 602-582-4800
CA Costa Mesa, Ward/Davis Assocs. 714-556-0956
CA Redondo Bch., Ward/Davis Assocs. .. 213-643-6977
CA San Diego, Ward/Davis Assocs. 619-292-1000
CA Santa Clara, Ward/Davis Assocs. 408-245-3700
CO Denver, Tech. Mktg. Specialists 303-691-5620
CT Wallingford, Pat Jenks Assocs. 203-265-9939
FL Longwood, Southern Mktg. Assocs. ... 407-682-7317
GA Marietta, Southern Mktg. Assocs. 404-565-0603
IL Arlington Heights, Dytec/Midwest, Inc.. 312-255-3200
IN Indianapolis, Dytec/Midwest, Inc. 317-297-5988
KS Lenexa, Dytec/South, Inc. 913-888-0215
MD Rockville, Creative Mktg. Assocs. 301-251-4100
MA Beverly, Pat Jenks Assocs. 508-921-4600
MI Madison Hgts., WKM Assocs. Inc. 313-588-2300
MN Edina, Dytec Instrs., Inc. 612-831-7169
MO Maryland Hgts., Dytec/South, Inc. 314-739-0665
NM Albuquerque, Tech. Mktg. Specialists .. 505-889-4595
NY Great Neck, RTI 516-829-3770
NY Liverpool, NTS Assocs., Inc. 315-451-1091
NC Greensboro, Southern Mktg. Assocs. .. 919-854-5588
OH Independence, WKM Assocs., Inc. 216-524-5930
OK Tulsa, Data Mktg. 918-494-2711
OR Beaverton, Northwest Test & Meas. 503-645-9000
PA Southampton, Eastern Instrmn. of PA.. 215-355-7700
TX Dallas, Data Mktg. Assocs. 214-661-0300
TX Houston, Data Mktg. Assocs. 713-954-5020
WA Redmond, Northwest Test & Meas. ... 206-881-8857
WI Brookfield, Dytec/Midwest, Inc. 414-792-0320
Can Montreal, Que., Interfax Sys., Inc. 514-336-0392

WAYNE TRANSFORMERS CO., INC., A Marine Electric Systems Co., 50 Carol St., P.O. Box 1135, Clifton, NJ 07014-1135, Tel: 201-614-1100, TELEX: 139039; *Sls. Mgr.:* J. DeMauro ..... **A•2512**

WEBER, Inmark Corporation-Importer, 4 Byington Place, Norwalk, CT 06850, Tel: 203-866-8474, FAX: 1-203-866-0918

WECO®

FAX: 518-298-5938

WECO ELECTRICAL CONNECTORS, INC., Trimex Bldg., Rte. 11, Mooers, NY 12958, Tel: 518-298-4810; FSC No.: 5935, 5963, 5940; Empl.: 52; *Sls. Mgr.:* David Asseraf; *Dist. Mgr.:* David Asseraf ..... **C•1563-1574**

Local Sales Offices & Reps

AL Huntsville, Twentieth Century Mktg. Inc. 205-533-9281
AZ Scottsdale, Haas & Assoc. Inc. 602-998-7195
AR Mabelville, Erickson Sls. Inc. 501-455-0618
CA Newport Bch., SPA Inc. 714-863-1193
CA San Jose, Landia Sls. Grp. 408-280-5695
CA Vista, SPA Inc. 619-530-0209
CO Littleton, Chinook Tech Sls. 303-933-9007
DE Belair, LHR Assocs., Inc. 609-829-6861
FL Deerfield Beach, Florida Comp. Sls., Inc. 305-429-1758
FL Tampa, Florida Comp. Sls. Inc. 813-960-7044
GA Norcross, Twentieth Century Mktg. Inc. 404-446-1999
IL Palatine, Key Entprs. Inc. 312-991-2144
IN Indianapolis, MEI (Mktg. Engrs.) 317-872-5665
IA Coralville, Engrg. Prods. Assocs. 319-354-5344
KS Shawnee Mission, Thomas L. Dowell & Assoc. 913-599-1100
KY Louisville, M E I 502-267-7093
LA Chalmette, Erickson Sls. Inc. 314-849-4234
ME Kittery, Olsen Tech Sls. Inc. 207-439-0280
MD Belair, LHR Assocs. Inc. 301-877-3405
MA Scituate, Olsen Tech Sls. Inc. 617-878-9386
MA Scituate, Olsen Tech. Sls. Inc. 617-545-5101
MN Edina, Engrg. Prods. Assocs. 612-835-9022
MO St. Louis, Thomas L. Dowell & Assocs. 314-849-4234
NJ Woodbridge, John Chirico Assocs. Inc. 201-855-9600
NY Buffalo, Upstate Engrg. Sls. 716-632-0011
NY Rochester, Upstate Engrg. Sls. 716-225-2383
NY Utica, Upstate Engrg. Sls. 315-797-6721
NC Cary, Twentieth Century Mktg. 919-481-3370
OH Cleveland, Marlow Assocs. 216-991-6500
OH Dayton, Marlow Assocs., Inc. 513-274-9666
OR Portland, SPS Elctrns. 503-297-6919
PA Harrisburg, Beil & Whitaker 717-564-6900
PA Pittsburg, Marlow Assocs., Inc. 412-343-5050
TN Knoxville, Twentieth Century Mktg. 615-966-2099
TX Dallas, Erickson Sls. Inc. 214-739-5833
TX Houston, Erickson Sls. Inc. 713-266-1604
TX Round Rock, Erickson Sls. Inc. 512-244-3068
UT Riverton, Chinook Tech Sls. 801-254-7166
VA Belair, LHR Assocs. Inc. 301-877-3405
WA Redmond, SPS Elctrns. 206-323-4140
WI Milwaukee, Key Entprs. Inc. 414-453-9462

Local Distributors

AL Mobile, Spectronics Inc. 205-344-0450
AZ Tempe, Control Design Supp. Inc. 602-829-7981
CA Anaheim, Control Design Supp. Inc. 213-802-1371, 714-821-1516
CA Anaheim, DECO Elctrns. Inc. 714-630-8252
CA Fountain Valley, Comp. Ctr. 714-979-0433
CA Fremont, Terminal Sls. Corp. 415-656-7722
CA Fullerton, I.S.I. Mktg. Co. 714-773-0411
CA Orange, Wed-Garde Comps. Grp. 714-953-1254
CA San Carlos, Control Design Supp. Inc.. 415-592-4806
CA San Diego, Sigma Elctrns. 619-565-2000
CA San Diego, Wes-Garde Comps. Grp. .. 619-264-6117
CA Van Nuys, Wes-Garde Comps. Grp. 213-873-4802
CT Middlefield, Control Design Supp. Inc... 203-349-0200
CT Yalesville, Glynn Elctrns. 203-265-2498
FL Altamonte Springs, Control Design Supp. 305-788-3220,1-800-432-58
FL Bradenton, Specialty Dist. Co. Inc. 813-756-9571, 1-800-282-58
FL Davie, ARCO Dists. Inc. 305-473-2550, 305-940-3295
FL Ft. Lauderdale, Specialty Dist. Co. inc.. 305-561-2544
FL Jacksonville, Specialty Dist. Co. Inc. ... 904-356-8426
FL Lakeland, Specialty Dist. Co. Inc. 813-686-8193, 1-800-282-90
FL Largo, Electronic Precepts of FL Inc. .. 813-544-3636
FL Melbourne, Specialty Dist. Co. Inc. 305-254-5274
FL Pompano Bch., Control Design Supp. Inc. 305-782-1311
FL Tampa, Specialty Dist. Co. Inc. 813-870-3315, 1-800-282-78
GA Albany, Specialty Dist. Co. Inc. 912-435-1711, 1-800-633-40
GA Athens, Specialty Dist. Co. Inc. 404-548-1334, 1-800-443-55
GA Atlanta, Specialty Dist. Co. Inc. 404-458-6341, 1-800-392-98
GA Augusta, Specialty Dist. Co. Inc. 404-722-1526, 1-800-874-87
GA Fayetteville, Frankland Inc. 404-461-4026
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PA	Mars, T.M.S.	412-776-1666
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TX	Richardson, J. Wisdom & Assocs.	214-470-9093
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NY	Great Neck, Instr. Mart	516-487-7430
NC	Raleigh, Lee Assocs.	919-848-8818
OH	Cleveland, Comtel	216-442-8080
OH	Dayton, Comtel	513-426-5310
OH	Hilliard, Comtel	614-876-8305
PA	Philadelphia, Instrmn. Specialists	215-742-0898
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CA	Palo Alto, Metermaster/Palo Alto	415-960-8500
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CA	Yorba Linda, Crompton Metermaster	714-921-2101
CO	Aurora, R & R Instrmn.	303-340-8728
CO	Denver, EIL Instrs., Inc.	303-534-4160
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FL	Palm Bay, EIL Instrs., Inc.	407-725-8300
GA	Atlanta, Brownell Instrs. & Controls Co.	404-762-5181
GA	Norcross, Metermaster	404-446-0166
IL	Bridgeview, EIL Instrs.	312-430-2292
IL	Countryside, Pacific Indicator	312-352-3500
IL	Glendale Heights, Crompton Metermaster	312-351-4644
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NY New York, Brownell Instrs. & Controls Co. 212-691-1171
NY New York, Herman H. Sticht Co., Inc. 212-732-8163
NY New York, Nilsson Labs. 212-675-7944
NY Pittsford, EIL Instrs., Inc. 716-586-8251
NC Charlotte, Brownell Instrs. & Controls Co. 704-597-1270
NC Charlotte, EIL Instrs., Inc. 704-376-2237
NC Charlotte, Mill Power Supp. Co. 704-373-3336
NC Raleigh, Brownell Instrs. & Controls Co. ..... 919—876-6524
OH Cleveland, Crompton Metermaster 216-651-4100
OH Dayton, EIL Instrs., Inc. 513-435-2134
OK Tulsa, Tri-State Instr. Lab 918-836-0286
PA Malvern, Rumsey Elec. Co. 215-296-3900
PA Pittsburgh, EIL Instrs., Inc. 412-823-2255
PA Pittsburgh, Process Engrg. Co. 412-561-5050
PA Trevose, Brownell Electro, Inc. 215-364-1400
SC Columbia, Brownell Electro, Inc. 803-772-6111
TN Knoxville, Brownell Instrs. & Controls Co. 615-966-3441
TN Memphis, Brownell Instrs. & Controls Co. 901-795-8483
TN Nashville, Brownell Instrs. & Controls Co. 615-885-1302
TX Dallas, Butler & Land, Inc. 214-343-8800
TX Dallas, EIL Instrs., Inc. 214-357-0297
TX Garland, Crompton Metermaster 214-271-5671
TX Harlingen, Bush Supply Co. 512-428-1613
TX Houston, Brownell Instrs. & Controls Co. 713-694-2771
TX Houston, Butler & Land, Inc. 713-896-0808
TX Houston, CMI Meters & Instr. 713-644-1631
TX Houston, EIL Instrs., Inc. 713-271-3100
VA Norfolk, EIL Instrs., Inc. 804-885-9553
VA Richmond, Metermetrics 804-275-1431
VA Springfield, EIL Instrs., Inc. 703-569-2611
WA Redmond, EIL Instrs., Inc. 206-882-3222
WA Seattle, Eicher-Richards Co. 206-523-7888
WI Milwaukee, E-M Instrs. 414-272-7799
Can Mississauga, Ont., EIL Instrs., Inc. 416-624-6660

Westrex Products

FAX: 617-254-6848

WESTREX PRODUCTS, 25 Denby Rd., Boston, MA 02134, Tel: 617-254-1200, TELEX: 951589; Empl.: 200; *Sls. Mgr.:* Blaine Wotring ..... **D•1108, 1116**

Local Sales Offices & Reps

Can Markham, Ont., Tech. Logistics Support 416-479-1911

WESTRONICS INC. OF TEXAS, 2441 Northeast Pkwy, Box 961003, Ft. Worth, TX 76161, Tel: 817-625-2311, FAX: 817-625-1068; Empl.: 180; *Sls. Mgr.:* Paul Shultz

WHEELOCK, INC., 273 Branchport Ave., Long Branch, NJ 07740, Tel: 201-222-6880, TWX: 710-722-6510, FAX: 201-222-8707; Empl.: 200; *Sls. Mgr.:* William L. Goldstein, Sls./Mktg. VP

WHITMOR WIRE & CABLE, 27737 Ave. Hopkins, Valencia, CA 91355, Tel: 805-257-2400, FAX: 805-257-2495; FSC No.: 15851; Empl.: 29; *Sls. Mgr.:* Mark Lee; *Dist. Mgr.:* Mark Lee

WHITSO, 9326 Byron St., Schiller Pk., IL 60176, Tel: 312-678-5200; Empl.: 170

WHITTAKER CORP., Electronic Resources Div., 1955 N. Surveyor Ave., Simi Valley, CA 93063, Tel: 805-584-4100, TWX: 910-498-2751, FAX: 805-584-9157; FSC No.: 72152; Empl.: 200

WHITTAKER CORP., Providence Chemicals Div., King Philip Rd., P.O. Box 16069, E. Providence, RI 02916, Tel: 401-434-1770, TELEX: 92-7652, FAX: 401-434-8090; Empl.: 25

WHITTAKER-YARDNEY POWER SYSTEMS, Whittaker-Tech. Prods., Inc., 82 Mechanic St., Pawcatuck, CT 02891, Tel: 203-599-1100, TELEX: 6813114, TWX: 710-470-0260; FSC No.: 87362; Empl.: 250; *Sls. Mgr.:* Rene DuBois

WIDE BAND ENGINEERING CO., INC., Box 21652, Phoenix, AZ 85036, Tel: 602-254-1570; Empl.: 10

WIDE RANGE ELCTRNS. CORP., 140 Sun Valley Cir., St. Louis, MO 63026, Tel: 314-343-9191, TELEX: 44-2560; Empl.: 11; *Sls. Mgr.:* Donald Toone

WILBRECHT ELECTRONICS, 346 Chester St., St. Paul, MN 55107, Tel: 612-222-2791, FAX: 612-222-7639; Empl.: 200; *Sls. Mgr.:* Laurie Wilbrecht

Wilco

FAX: 317-293-9462

WILCO CORP., 6451 Saguaro Court, Indianapolis, IN 46268, Tel: 317-293-9300 ..... **A•1324-1327**

Local Sales Offices & Reps

AL Huntsville, ACM 205-883-9720
AZ Scottsdale, Mactronix 602-998-1848
CA San Jose, Texel North 408-272-6836
FL Hollywood, Askland Elctrn. Comps. ... 305-987-1074
IL Arlington Hgts., M B Sls. 312-392-9499
IN Carmel, Current Elctrn. Mktg. 317-575-9943
NH Londonderry, Bennetron 603-432-9092
MI Grand Rapids, DEM Elctrn. Sls. 616-361-5414
MI Warren, DEM Elctrn. Sls. 313-575-9444
NY Hicksville, L. Tronix 516-935-0220
OH Cincinnati, JMK Elctrns. 513-271-3860
OH Cleveland, JMK Elctrns. 216-886-7100

Local Distributors

CA Stanton, Inductive Comps. 714-828-3420
FL Ft. Lauderdale, Bros. Elctrns. FL 305-561-6700
NJ E. Brunswick, Brothers Elctrns., Inc. ... 201-238-2200

WILCO WIRE & CABLE CO., INC., 1921 Las Plumas Ave., San Jose, CA 95133, Tel: 408-926-8880, FAX: 408-251-0508; Empl.: 52; *Sls. Mgr.:* Joe Shepherd; *Dist. Mgr.:* Sylvia Neal

WILCOXON RESEARCH, 2096 Gaither Rd., Rockville, MD 20850, Tel: 301-330-8811, TELEX: 898-342; Empl.: 50; *Sls. Mgr.:* Fred Wilcoxon ..... **B•2000**

WILKINSON, P.O. Box 4558, Westlake Village, CA 91359, Tel: 818-889-0050, 800-822-4653, TELEX: 698213, FAX: 818-889-3810; Empl.: 44; *Sls. Mgr.:* R. Cook; *Dist. Mgr.:* R. Cook

WILMANCO, 19529 Business Center Drive, Northridge, CA 91324, Tel: 818-993-1662/1663, TWX: 9103807912 WILMANCOUWAV, FAX: 818-993-5438; FSC No.: 1Y521; Empl.: 12; *Sls. Mgr.:* Christian Noiroux

WILMAR ELECTRONICS, INC., 2430 Amsler St., Torrance, CA 90505, Tel: 213-326-6668, TELEX: 182417, FAX: 213-326-9147; FSC No.: 25248; Empl.: 25; *Sls. Mgr.:* Zev Heifetz

WILMORE ELECTRONICS CO., Box 1329, Hillsborough, NC 27278, Tel: 919-732-9351, TELEX: 292617; Empl.: 48; *Sls. Mgr.:* J. L. Harris ..... **D•2140-2143, 2236-2237**

WILSON, H. F., ENGINEERING CO., 475 Taft Ave., Glen Ellyn, IL 60137, Tel: 312-469-8473, TELEX: 72-1438; Empl.: 21; *Sls. Mgr.:* H. Wilson; *Dist. Mgr.:* William Henry

WILSON, H. M., CO., 11501 Chimney Rock Rd., Houston, TX 77035, Tel: 713-729-1183; Empl.: 3; *Sls. Mgr.:* H. M. Wilson

WILSON ELECTRONICS, See Regency Land Mobile, Inc.

WILTRON, 490 Jarvis Dr., Morgan Hill, CA 95037-2809, Tel: 408-778-2000, TELEX: 285227 WILTRON MH, FAX: 408-778-0239; FSC No.: 20944; Empl.: 800; *Sls. Mgr.:* W. Baxter

WINSYSTEMS, INC., P.O. Box 121361, Arlington, TX 76012, Tel: 817-274-7553, FAX: 817-548-1358; FSC No.: 1AU87

WINTEK CORP., 1801 South St., Lafayette, IN 47904-2993, Tel: 317-742-8428, 800-742-6809, TELEX: 70-9079, FAX: 317-448-4823; Empl.: 16 ..... **D•1124-1125**

WIREBENDERS, INC., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021, Tel: 602-861-1856, FAX: 602-870-9242; FSC No.: 5950;FSCS/CAGE 1DA26; Empl.: 18; *Sls. Mgr.:* Leo Middleton

THE WIREMOLD COMPANY, 60 Woodlawn Street, W. Hartford, CT 06110, Tel: 203-233-6251, FAX: 203-323-2062; Empl.: 900; *Sls. Mgr.:* F. D. Casteel

WIRE-PRO, INC., 23 Front Street, Salem, NJ 08079, Tel: 609-935-7601, 609-935-7651, TWX: 510-680-4750, FAX: 609-935-0102; Empl.: 225; *Sls. Mgr.:* Philip Negrin, Mktg. Mgr.; *Dist. Mgr.:* Philip Negrin

WIRING ANALYZERS, INC., 9850 Owensmouth Ave., P.O. Box 4535, Chatsworth, CA 91313, Tel: 818-709-4500, 800-221-5979 (excl. CA & AK); Empl.: 15; *Sls. Mgr.:* Norman Wartell

WON TRONICS, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057, Tel: 213-381-2500, TWX: 910-321-4348; *Sls. Mgr.:* Michael Ronzon

WORLDNET MARKETING INC., 3187 F Airway Ave., Costa Mesa, CA 92626, Tel: 714-545-7118, TELEX: 3781824, FAX: 714-540-9138; Empl.: 7; *Sls. Mgr.:* Frank Buday; *Dist. Mgr.:* Frank Buday

WORLD PRODUCTS INC., 19654 8th St. East, Sonoma, CA 95476, Tel: 707-996-5201, TELEX: Worldpro snom 171715, FAX: 707-996-3380; FSC No.: 410966309; Empl.: 445; *Sls. Mgr.:* Mark Beynon; *Dist. Mgr.:* Mark Beynon ..... **A•1194-1195, 2212-2213; B•1926-1927**

Local Sales Offices & Reps

AL Huntsville, Technlg. Mktg. Assoc. 205-883-7893
AZ Scottsdale, American Mktg. Inc. 602-948-2778
CA Agoura Hills, Westpower 818-706-2550
CA Mountain View, Straube Assocs., Inc. 415-969-6060
CO West Minster, Straube Assocs. Mountain States 303-426-0890
FL Orlando, Technlg. Mktg. Assocs. 407-857-3760
GA Norcross, Technlg. Mktg. Assoc. 404-446-3565
IL Arlington, KMA Sls. Co. 312-398-5300
IN Indianapolis, Frank J. Campisano Co. 317-253-7651
IA Marion, Associated Elctrn. Mktg. Inc. .. 319-377-1129
KS Lenexa, Associated Elctrn. Mktg. Inc. .. 913-888-0022
MA Lexington, Jodan Technlg. 617-863-8898
MI Grosse Pointe Park, Greiner Assocs. Inc. 313-499-0188
MN Minneapolis, Tecteam Sls. Inc. 612-854-6616
MO St. Louis, Assocd. Elctrn. Mktg. Inc. 314-731-2240
NJ Fords, Marlin Data Corp. 201-738-7200
NM Albuquerque, Syntech 505-266-7951
NY Rochester, Apex Assocs. 716-272-7040
NC Raleigh, Technlg. Mktg. Assoc. 919-850-0878
OH Cincinnati, Frank Campisano Co. 513-574-7111
OR Portland, Caruso & Co. 503-620-0375
PA Coraopolis, Frank J. Campisano Co. .. 412-264-5151
PA Montgomeryville, Quick Response Tech. Sls. 215-362-9225
TX Houston, R-Squared Elctrns., Inc. 713-820-3210
UT Salt Lake City, Straube Assocs.,Mtn. States Inc. 801-263-2640
WA Bellevue, Caruso & Co. 206-455-8811
WI Milwaukee, KMA Sls. Co. 414-259-1771

Local Distributors

FL Melbourne, Pridmore 305-727-2491
IL Lisle, Comps., Inc. 312-852-7707
MA Norwood, Emtel 617-769-9500
NH Salem, Tech-Mark Corp. 603-893-8380
PA McKean, Advacom 814-476-7774
TX Dallas, Omni Pro 214-233-0500
WI Milwaukee, Comps., Inc. 414-529-4106

WORLD PRODUCTS INC., Systems Devices Grp., 19654 8th St. E., Sonoma 95476, Tel: 707-996-5201, FAX: 707-996-3380; Empl.: 50 ..... **B•1124-1125**

'WORLD' TEST SYSTEMS, INC., P. O. Drawer 1428, Waynesboro, VA 22980, Tel: 703-949-6753, FAX: 703-943-3826; *Sls. Mgr.:* Buford H. Baber

WOVEN ELECTRONICS, Woven Electronics Corporation, Old Stage Road, Simpsonville, SC 29681, Tel: 803-963-5131, TWX: 810-963-5131, FAX: 803-963-1761; Empl.: 400; *Sls. Mgr.:* Peggy Burnett

WYLE LABS, See Electronic Enclosures

XCEL CORPORATION, See Digitran and Computron Display Sys. Divs.

XCP, INC., 8 W. Main St., Dryden, NY 13053, Tel: 607-844-9143; *Sls. Mgr.:* Diane Rademacher

XEDAR CORP., 2500 Central Ave., Boulder, CO 80301, Tel: 303-443-6441, FAX: 303-443-6444; *Sls. Mgr.:* Andy Zeidler

XELTEK, 473 Sapena Ct., Unit 24, Santa Clara, CA 95054, Tel: 408-727-6995, TELEX: 408-727-6996; *Sls. Mgr.:* Jung Mi Lee; *Dist. Mgr.:* Youngho Chung

XENON CORP., 20 Commerce Way, Woburn, MA 01801, Tel: 617-938-3594, TELEX: 928204; Empl.: 45; *Sls. Mgr.:* Louis R. Panico

XENOTRONIX INC., 26074 Ave., Hall No. 10, Valencia, CA 91355, Tel: 805-257-4793, FAX: 805-257-1093; *Sls. Mgr.:* Coleen Miller

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XENTEK, INC., 760 Shadowridge Drive, Vista, CA 92083, Tel: 619-727-0940, TWX: 910-322-1155; FSC No.: 52360; Empl.: 300 ..... **D•2144-2149**

Local Sales Offices & Reps

AL	Huntsville, The Novus Grp.	205-534-0044
AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	Glendale, Halbar Assocs.	818-246-8263
CA	San Jose, Richards Assocs.	408-452-8171
FL	Orlando, Currie Peak & Frazier	305-855-0843
GA	Lilburn, The Novus Grp.	404-381-1015
IL	Itasca, LTD Technlgs., Inc.	312-773-2900
IN	Carmel, Berndt Assocs.	317-844-0114
MD	Hunt Valley, Phoenix Sls.	301-628-2066
MA	Southboro, Sullivan Tech.Sls.	508-485-2215
MI	Jenison, Young Technlgs.	616-457-2616
MI	Southfield, Fred Gehrke	313-559-5363
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	Ellisville, Gateway Tech. Sls.	314-391-6543
NH	Nashua, Bell Controls	603-882-6984
NY	Hartsdale, Spectrum Sls.	914-472-8600
NY	Liverpool, M.M.Hare Co.	315-457-6859
NY	Syracuse, M. M. Hare	315-457-6859
NC	Raleigh, The Novus Grp.	919-883-7771
OH	Cincinnati, Tri-State Mktg.	513-761-7993
PA	Jenkintown, Monument Tech. Assocs.	215-884-3737
TX	Dallas, Allied Comps.	214-238-0408
WA	Redmond, Halbar Assocs.	206-882-0990
WI	Milwaukee, LTD Technlgs.	414-774-1000

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XERCON, INC., P.O. Box 554, Portland, OR 97207, Tel: 503-292-8682, FAX: 503-292-8697; Empl.: 6; *Sls. Mgr.:* G. Osgood

XEROX CORPORATION, Xerox Square, 0-5, Rochester, NY 14644, Tel: 800-832-6979; Empl.: 100,367

XEROX IMAGING SYSTEMS, INC., Xerox Corp., 1215 Terra Bella Ave., Mountain View, CA 94043, Tel: 415-965-7900, 800-821-2898, TELEX: 701994 DATACOPY UO, FAX: 415-965-3474; Empl.: 235; *Sls. Mgr.:* Wayne Crandall, Dir. of Domestic Sls.; *Dist. Mgr.:* Nancy Ellickson

XERTEX CORP., See Rosemont Corp., Sensall National Sonics

XETEL CORPORATION, 8100 Cameron Rd., Austin, TX 78753, Tel: 512-834-2266, FAX: 512-834-9250; Empl.: 300; *Sls. Mgr.:* Mark Trutna

EXICO

FAX: 818-709-5235

XICO, INC., 9737 Eton Ave., Chatsworth, CA 91311, Tel: 818-709-4403, TELEX: 709577, ESYLNK: 62253150; Empl.: 21; *Sls. Mgr.:* Ralph Reccia ..... **D•1117**

WORLD WIDE POWER SOLUTIONS INC., 1009 S.E. 12th Pl., No. 5, Cape Coral, FL 33990, Tel: 813-574-5505, FAX: 813-574-9512; Empl.: 10; *Sls. Mgr.:* David J. Paul, Dir. of Mktg.; *Dist. Mgr.:* David J. Paul

XICON CAPACITORS, P.O. Box 170537, Arlington, TX 76003, Tel: 817-561-2900; *Sls. Mgr.:* Drey Hayford

XICOR, INC., 851 Buckeye Court, Milpitas, CA 95035, Tel: 408-432-8888, TWX: 910-379-0033, FAX: 408-432-0640; FSC No.: 60395; Empl.: 910; *Sls. Mgr.:* Bruce Mattern; *Dist. Mgr.:* Bruce Mattern

XKD CORPORATION, 101 Cooper Court, Los Gatos, CA 95030, Tel: 408-395-3700, TELEX: 171946, FAX: 408-354-2606; *Sls. Mgr.:* Skip McLaughlin

XSIS ELECTRONICS, INC., 12620 W. 63rd St., Shawnee, KS 66216, Tel: 913-631-0448, TELEX: 437227, FAX: 913-631-1170; FSC No.: 57051; *Sls. Mgr.:* Jerry Dehnert ..... **A•1500-1501**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Phoenix, Western High Tech. Mktg.	602-266-2070
CA	Mission Viejo, Chaparrah Elctrn. Sls.	714-582-2950
CA	Saratoga, F & F Assoc.	408-446-2349
CT	Cheshire, Ashworth Assocs.	203-968-0656
IL	Schaumberg, Sieger Assocs.	312-310-8844
KY	Ft. Mitchell, G. W. Thelen Co.	606-341-8181
MD	Ellicott City, VPI, Inc.	301-461-2525
MA	Shrewsbury, Ashworth Assocs.	617-845-9688
MN	Eden Prairie, Aldridge Assocs., Inc.	612-944-8433
NJ	Fairfield, Addem Sls.	201-882-0993
NM	Albuquerque, Western High Tech Mktg.	505-884-2256
NY	E. Syracuse, R. D. Sherman	315-433-1165
NC	Winston-Salem, Murcota Corp.	919-722-9445
PA	Montgomeryville, Rufo Sys. Comps.	215-368-8495
TX	Sherman, Repmaster	214-247-6236
EXP	NY, Great Neck, Ad Auriema	516-487-0700

XYLOG CORP., 83 Hobart St., Hackensack, NJ 07601, Tel: 201-489-4040, FAX: 201-489-6745; Empl.: 30; *Sls. Mgr.:* Milton Frank ..... **D•2150**

YELLOW SPRINGS INSTRUMENT CO., Box 279, Yellow Springs, OH 45387, Tel: 513-767-7241, TELEX: 205437, FAX: 513-767-9353; Empl.: 380; *Sls. Mgr.:* M. Mason

YEW CORP., See Yokogawa Corp. of America

YOKOGAWA CORP. OF AMERICA, 2 Dart Rd., Newnan, GA 30265, Tel: 404-253-7000, FAX: 404-251-4088; Empl.: 450; *Sls. Mgr.:* Chuck Micallef; *Dist. Mgr.:* Jack Martz

YORK METAL PRODUCTS, INC., 34-20 12th St., Long Island City, NY 11106, Tel: 718-932-3660, FAX: 718-932-0007; Empl.: 45; *Sls. Mgr.:* Harold Miller

YORK TECHNOLOGY, INC., 210 N. Glenoaks Blvd., Ste. C, Burbank, CA 91502, Tel: 818-955-8927, TELEX: 990-968 York CA, FAX: 818-955-9728; *Sls. Mgr.:* Bradley E. Sousa

YUASA

FAX: 213-949-5527

YUASA BATTERY (AMERICA), INC., 9728 Alburtis Ave., Santa Fe Springs, CA 90670, Tel: 213-949-4266, TELEX: 696272; Empl.: 5,000; *Sls. Mgr.:* Les Biggins ..... **D•1535**

Local Sales Offices & Reps

AZ	Phoenix, Westrep	602-997-8899
CA	Huntington Bch., West Elctrn Sls.	213-493-5569
CA	San Jose, Novatronix	408-727-9530
CO	Denver, Lindberg Co.	303-758-9033
CT	Horth Haven, Kitchen & Kutchin	203-239-0212
FL	Tampa, Over and Over	813-626-9100
GA	Atlanta, Over and Over	404-449-6205
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
IA	Cedar Rapids, R.W. Kunz & Assocs.	319-396-5386
KS	Prairie Vlg., R.W. Kunz & Assocs.	913-648-3535
MA	Burlington, Kitchen & Kutchin	617-229-2660
MN	Minneapolis, Electronic Innovators, Inc.	612-941-0830
MO	St. Louis, R.W. Kunz & Assocs.	314-966-4977
NJ	Berkeley Hgts., Cambridge Allen & Assocs.	201-464-0203
NJ	Carlstadt, Yuasa Battery (Amer.) E. Reg. Off.	201-896-8800
NY	Rochester, Ossman Comps. Sls.	716-359-1200
NY	Syracuse, Ossman Comps. Sls.	315-455-6611
NC	Charlotte, Over and Over	704-542-9111
OH	Columbus, McFadden Sls.	614-459-1280
OK	Tulsa, Barry Sls.	918-749-7775
OR	Portland, Earl & Brown	503-245-2283
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
UT	Salt Lake City, Lindberg Co.	801-277-2643
WA	Lynwood, Earl & Brown	206-885-5064
WI	Waukesha, Brainard-Wilson Mktg.	414-797-7940
Can	Pointe-Claire, Que., Tech Trek, Ltd.	514-697-3385
Can	Rexdale, Ont., Tech Trek, Ltd.	416-674-1717

Local Distributors

AL	Huntsville, Newark Elctrns.	205-837-9011
AL	Juneau, Juneau Elctrl. Equip.	907-586-2260
AZ	Glendale, Lynntronics	602-931-5981
CA	Buena Pk., Cypress Elctrns.	714-521-5230
CA	Costa Mesa, House of Batteries	714-642-8222
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CO	Wheatridge, Cypress Elctrns.	303-431-2622
FL	Miami, Elctrn. Equip.	305-871-3500
GA	Norcross, Applied Power	404-263-0421
HI	Honolulu, Elctrl. Equip.	808-533-3881
IL	Downers Grove, Jarbo Battery	312-964-9358
IN	Indianapolis, Newark Elctrns.	317-872-7070
MD	Beltsville, Mark Elctrns.	301-595-5040
MA	Middleboro, Glynn Elctrns.	617-947-4262
MI	Brighton, Applied Power	313-229-6550
MI	Grand Rapids, Newark Elctrns.	616-214-6681
MN	Minneapolis, Bergquist Co.	612-835-2322
MS	Jackson, Newark Elctrns.	314-291-6200
NH	Salem, Cronin Elctrns.	603-898-4440
NJ	Clifton, Engrd. Assemblies	201-340-0600
NJ	Edison, Newark Elctrns.	201-572-2103
NY	Farmingdale, Battery Expeditors	516-752-0111
NY	FLushing, W & W Assocs.	718-961-2103
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rochester, Newark Elctrns.	716-473-6600
NC	Raleigh, Engrd. Assemblies	919-790-9700
OH	Columbus, Whitehead Elctrns.	614-224-1186
OH	Solon, Repco Elctrns.	216-248-8900
OR	Portland, Standard Batteries of Portland	503-234-7251
SC	Greenville, Newark Elctrns.	803-228-9610
TX	Allen, Prime Distrbg.	214-231-0170
TX	Dallas, Cypress Elctrns.	214-869-1435

UT Salt Lake City, Newark Elctrns. 801-484-8611
WA Redmond, Priebe Elctrns. 206-881-2363
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ZAMBRE CO., INC., 2134 Old Middlefield Way, Mountain View, CA 94043, Tel: 415-968-9176

Z COMMUNICATIONS, INC., 5450 N.W. 33rd Ave., Ste. 100, Ft. Lauderdale, FL 33309, Tel: 305-735-1000, FAX: 305-735-1094; FSC No.: 1564A; Empl.: 20; *Sls. Mgr.:* Devang Patel

ZEBRA TECHNOLOGIES CORPORATION, 3455 Commercial Ave., Northbrook, IL 60062, Tel: 312-564-1800, TELEX: 206230; FSC No.: ;;;312-564-4714; Empl.: 110; *Sls. Mgr.:* Kevin O'Donnell

ZEHNTEL, INC., 2625 Shadelands Dr., Walnut Creek, CA 94598, Tel: 415-932-6900, TELEX: 371-6185, TWX: 910-385-6300; Empl.: 500; *Sls. Mgr.:* Dick Noren; *Dist. Mgr.:* Jim Mohr

CARL ZEISS, INC., One Zeiss Drive, Thornwood, NY 10594, Tel: 914-747-1800, TELEX: RCA 221834, TWX: WV64-6928

ZENDEX CORP., 6700 Sierra La., Dublin, CA 94568, Tel: 415-828-3000, TWX: 910-389-4009, FAX: 415-828-1574; Empl.: 42; *Sls. Mgr.:* Gary Jewell

ZENITH CRT & COMPONENTS OPERATIONS, 1000 Milwaukee Ave., Glenview, IL 60025, Tel: 312-391-7733; *Sls. Mgr.:* Norm Berkowitz

ZENITH

FAX: 312-391-7078

ZENITH COMPONENTS GROUP, Zenith Electronics Corp., 1000 Milwaukee Ave., Glenview, IL 60025, Tel: 312-391-7733, TELEX: 254396; *Sls. Mgr.:* George Zimmerer ..... **D•2151-2155**

Local Sales Offices & Reps

AL Huntsville, R.O. Whitesell & Assocs. ... 205-883-5110
AZ Phoenix, Pinnacle Comp. Sls. 602-994-0441
AZ Tucson, Pinnacle Comp. Sls. 602-886-1726
CA Calabasas, Centaur Corp. 818-704-1655
CA Irvine, Centaur Corp. 714-261-2123
CA Mtn. View, Taarcom, Inc. 415-960-1550
CA San Diego, Centaur Corp. 619-278-4950
CO Denver, Lindberg Co. 303-758-9033
CT Clinton, Selmark Assocs., Inc. 203-573-9088
GA Norcross, R.O. Whitesell & Assocs. ... 404-449-9190
IL Elk Grove Village, Oasis Sls. Corp. 312-640-1850
IN Ft. Wayne, R.O. Whitesell & Assocs. .. 219-432-5591
IN Indianapolis, R.O. Whitesell & Assocs. 317-359-9283
IN Kokomo, R.O. Whitesell & Assocs. 317-457-9127
KY Pewee Valley, R.O. Whitesell & Assocs. 502-241-1441
MA Millis, Selmark Assocs., Inc. 617-376-2914
MI Grand Blanc, R.O. Whitesell & Assocs. 313-695-0770
MI Grand Rapids, R.O. Whitesell & Assocs. 616-942-5420
MI Southfield, R.O. Whitesell & Assocs. .. 313-559-5454
MI St. Joseph, R.O. Whitesell & Assocs. .. 616-983-7337
MN Eden Prairie, Aldridge Assocs., Inc. 612-944-8433
NH Hopkinton, Selmark Assocs., Inc. 603-746-3299
NJ Fairfield, Metro Logic Corp. 201-575-5585
NJ Saddle Brook, Metro Logic Corp. 201-797-8844
NM Albuquerque, Lindberg Co. 505-881-1006
NC Fuquay-Varina, R.O. Whitesell & Assocs. 919-552-1122
NC Greensboro, R.O. Whitesell & Assocs. 919-273-1945
OH Cincinnati, R.O. Whitesell & Assocs. 513-521-2290
OH Cleveland, R.O. Whitesell & Assocs. .. 216-447-9020
OH Columbus, R.O. Whitesell & Assocs. .. 614-888-9396
OH Dayton, R.O. Whitesell & Assocs. 513-298-9546
OK Tulsa, CompTech 918-622-7744
OR Portland, Westerberg & Assocs. 503-620-1931
PA Allentown, Patterson Elctrns. Grp. 215-398-9668
PA Pittsburgh, R.O. Whitesell & Assocs. .. 412-963-6161
TN Knoxville, R.O. Whitesell & Assocs. ... 615-694-9476
TN Nashville, R.O. Whitesell & Assocs. 615-352-4760
TX Austin, CompTech 512-331-8922
TX Dallas, CompTech 214-751-1181
TX Houston, Comptech 713-776-8330
TX Irving, Comptech 214-751-1181
UT Salt Lake City, Lindberg Co. 801-277-2643
WA Bellevue, Westerberg & Assocs., Inc. .. 206-453-8881
WI Broodfield, Oasis Sls. Corp. 414-782-6660

Local Distributors

AL Huntsville, Allied Elctrns., Inc. 205-721-3500
CA Fremont, Allied Elctrns., Inc. 415-770-0590
CA Tustin, Allied Elctrns., Inc. 714-669-7140
CO Englewood, Allied Elctrns., Inc. 303-790-1664
FL Clearwater, Allied Elctrns., Inc. 813-539-0369
FL Pompano Bch., Allied Elctrns., Inc. 305-978-3008
GA Norcross, Allied Elctrns., Inc. 404-446-8595
IL Elgin, Allied Elctrns., Inc. 312-697-8200
IN Indianapolis, Allied Elctrns., Inc. 317-875-0448
MD Columbia, Allied Elctrns., Inc. 301-381-1560
MD Marlow Hgts., Allied Elctrns., Inc. 301-423-0161
MA Billerica, Allied Elctrns., Inc. 617-942-0150
MN Eden Prairie, Allied Elctrns., Inc. 612-829-7554
NH Nashua, Brevan Elctrns. 603-889-7230
NJ Mt. Laurel, Allied Elctrns., Inc. 609-234-7769
NY Mineola, Allied Elctrns., Inc. 516-248-2360
NY Rochester, Allied Elctrns., Inc. 716-244-9440
NC Raleigh, Allied Elctrns., Inc. 919-876-5845
OH Solon, Allied Elctrns., Inc. 216-248-4200
OK Tulsa, Norvell Elctrns., Inc. 918-254-8606
PA Pittsburgh, Allied Elctrns., Inc. 412-367-4124
TX Austin, Allied Elctrns., Inc. 512-389-3771
TX Austin, Norvell Elctrns., Inc. 512-837-5555
TX Dallas, Allied Elctrns., Inc. 214-553-4370
TX Dallas, Norvell Elctrns., Inc. 214-233-0020
TX Ft. Worth, Allied Elctrns., Inc. 817-336-5401
TX Houston, Norvell Elctrns., Inc. 713-777-1666
TX Humble, Allied Elctrns., Inc. 713-446-8005
WA Seattle, Allied Elctrns., Inc. 206-547-2827
WI New Berlin, Allied Elctrns., Inc. 414-796-1280

ZERCOM CORPORATION, P.O. Box 84, Zercom Drive, Merrifield, MN 56465-0084, Tel: 218-765-3151, FAX: 218-765-3900; Empl.: 65; *Sls. Mgr.:* Jeff Zernov

ZERO CORPORATION

FAX: 818-841-5618

ZERO CORP., 777 Front St., Burbank, CA 90503, Tel: 818-846-4191; Empl.: 1400; *Sls. Mgr.:* Doug Griffith ..... **C•1098-1099, 1122**

Local Sales Offices & Reps

AZ Phoenix, Howe & Howe Sls., Inc. 602-264-7971
CA Burbank, Zero-West Div. 818-846-4191
CA San Diego, San Diego Sls. Off. 619-271-7221
CO Boulder, Component Prod. Sls. Co. Inc. 303-530-2800
FL Clearwater, Zero-East Div. 813-531-8991
IL Elk Grove Village, Carlson Elctrns. Sls. 312-956-8240
IN Indianapolis, L.M. DeVoe Co. 317-842-3245
IA Cedar Rapids, Carlson Elctrns. Sls. ... 319-378-1450
MS Jackson, S. L. Welch 601-932-5534
MD Baltimore, Marktron 301-628-1111
MA Monson, Zero-East Div. 413-267-5561
MI Grosse Pointe Park, Greiner Assoc. Inc. 313-499-0188
MN Bloomington, Elctrn. Sls. Agcy. 612-884-8291
MO St. Louis, Cadon Techn. Sls. 314-645-8670
NY Commack, MTR, Inc. 516-462-9580
NM Albuquerque, Fry-Gates 505-262-1525
NY East Syracuse, Fountain Young & Co. 315-437-7733
NC Apex, Engineering Reps Assoc. 703-632-2365
OH Columbus, Tom Mulligan & Assocs. .. 614-457-2242
OR Lake Oswego, RTS, Inc. 503-244-4123
PA Boswell, B.E. Gibson 814-629-6772
PA Huntingdon Valley, Inacker Sls. 215-947-5660
SC Greenville, Engineering Reps Assoc. .. 703-632-2365
TX Garland, Tesco Inc. 214-681-1376
TX Houston, Milco Mktg. 214-783-2716
TX Richardson, Milco Mktg. 214-783-2716
UT Salt Lake City, Effective Sls. 801-266-9617
MD Rockville, Marktron 301-251-8990
WA Vashon, RTS, Inc. 206-285-1363

ZERO CORP., Zero East Div., 288 Main St., Monson, MA 01057, Tel: 413-267-5561, TWX: 710-354-1450; *Sls. Mgr.:* Roger St. Martin ..... **C•1122**

Local Sales Offices & Reps

AL Huntsville, BJR Mfg. Reps. 205-881-3569
CT Monson, Zero-East Div. 413-267-5561
IN Indianapolis, C.C. Electro Sls. 317-355-1508
IN Indianapolis, Leslie M. Devoe Co. 317-842-3245
MD Rockville, Marktron, Inc. 301-251-8990
MA Monson, Zero-East Div. 413-267-5561
MA Palmer, Benoit-Senecal Co. 413-283-8384
MI Grosse Pointe Pk., Greiner Assocs., Inc. 313-499-0188
MS Jackson, S. L. Welch & Assocs. 601-932-5534
NY Commack, MTR, Inc. 516-462-9580
NY Syracuse, Fountain Young Co. 315-437-7733
NC Martinsville, Engrg. Reps Assocs. 703-632-2365
OH Columbus, Tom Mulligan & Assoc. 614-457-2242
PA Boswell, B. E. Gibson 814-629-6772
PA Huntingdon Valley, Inacker Sls. 215-947-5660
SC Martinsville W. VA, Engrg. Reps Assocs. 703-632-2365
Can Islington, Ont., Pipe-Thompson Ltd. ... 416-236-2355

ZETA LABS., 2811 Orchard Parkway, San Jose, CA 95134, Tel: 408-434-3600, FAX: 408-433-0205; FSC No.: 31260; Empl.: 280; *Sls. Mgr.:* Mike Mallinger

Local Sales Offices & Reps

AZ Chandler, Blackhart Assoc. 602-831-2566
AZ Phoenix, Blackhart Assocs. 602-893-3488
CA Palo Alto, RF Assocs. 415-494-3331
TX Dallas, McDonalds Assocs. 214-239-3293

ZEUS INDL. PRODS. INC., P.O. Box 298, Raritan, NJ 08869, Tel: 201-526-0800, 800-526-3842, TWX: 710-480-9346, FAX: 201-526-5699; FSC No.: 32039; Empl.: 150; *Sls. Mgr.:* Jeffrey J. Tourville; *Dist. Mgr.:* Michael C. Tourville

ZEVATECH, INC., 2700 Gateway Centre Blvd. Ste., Morrisville, NC 27560, Tel: 919-460-0111, FAX: 919-469-0480; Empl.: 70; *Sls. Mgr.:* Bob Black; *Dist. Mgr.:* Bob Black

ZEXCO, 5526 Murietta Ave., Van Nuys, CA 91401, Tel: 818-997-7895

ZIATECH, 3433 Roberto Ct., San Luis Obispo, CA 93401, Tel: 805-541-0488, TELEX: 4992316, FAX: 805-541-5088; Empl.: 65; *Sls. Mgr.:* Jim Eckford

ZIERICK

FAX: 914-666-0216

ZIERICK MANUFACTURING CORP., 56 Radio Circle, Mt. Kisco, NY 10549, Tel: 914-666-2911, 800-882-8020, TWX: 710-571-2143; Empl.: 120; *Sls. Mgr.:* L. T. Noyes; *Dist. Mgr.:* Jack Becker ..... **C•1580**

Local Sales Offices & Reps

IL Palatine, Claeson Assocs. 312-359-7230

Local Distributors

CA Fremont, Alatec Prods. 408-279-8895
CA Hayward, Arow Fasteners 415-487-2100
CA Laguna Hills, Yarbrough Timco 714-859-7021
CA Mission Hills, Coast Air 818-898-2288
CA N. Hollywood, Alatec Prods. 818-764-5600
CA San Jose, Bisco Inds. 408-435-8980
CO Denver, Hardware Specialty 303-371-8553
FL Winter Pk., Hardware Specialty 305-677-8500
MA Marlborough, Hardware Specialty 617-481-8622
MA Winchester, Rush Inds. 617-729-5800
MO Bridgeton, Alatec Prods. 314-298-0100
NJ Pine Brook, Alatec Prods. 201-227-8140
NY Long Island City, Hardware Specialty 718-361-9393
NY Peekskill, Lawrence Tufts 914-739-2107
OR Beaverton, Comps. Resources 503-641-8488
WA Redmond, Comps. Resources 206-454-8666
Can Concord, Ont., Zierick Canada Ltd. 416-669-1429

ZIPPERTUBING CO., Box 61129, Los Angeles, CA 90061, Tel: 213-321-3901, TWX: 910-346-6713, FAX: 213-321-3086; Empl.: 120; *Sls. Mgr.:* Terry Plummer

ZIRMEX, See Degussa Electronics, Hybrid Div.

ZI-TECH INSTRUMENT CORP., P.O. Box 391567, Mountain View, CA 94039-1567, Tel: 415-966-8484, TELEX: 334-447, FAX: 415-966-8201; Empl.: 15; *Sls. Mgr.:* J. Ziman

Z-LINE POWER CONTROLLERS, See Pulizzi Engineering, Inc.

ZYLAB CORPORATION, 3105-T N. Wilke Rd., Arlington Heights, IL 60004, Tel: 312-632-1100, TELEX: 38 3422 ZYLAB CGO, TWX: 910-380-4603 ZYLAB CGO, ESYLNK: 62753465, FAX: 312-632-1129; Empl.: 21; *Sls. Mgr.:* Tom Priestley

ZYMOS CORP., 477 N. Mathilda Ave., Sunnyvale, CA 94086, Tel: 408-730-8800, 408-730-5400, TWX: 910-339-9530; *Sls. Mgr.:* Jeff Jacobsen

eem

MINIGLOSSARY
BASIC ASCII CODE

				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
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Control Character Representations

NUL	Null
SOH	Start of Heading (CC)
STX	Start of Text (CC)
ETX	End of Text (CC)
EOT	End of Transmission (CC)
ENQ	Enquiry (CC)
ACK	Acknowledge (CC)
BEL	Bell
BS	Backspace (FE)
HT	Horizontal Tabulation (FE)
LF	Line Feed (FE)
VT	Vertical Tabulation (FE)
FF	Form Feed (FE)
CR	Carriage Return (FE)
SO	Shift Out
SI	Shift In
DLE	Data Link Escape (CC)
DC1	Device Control 1
DC2	Device Control 2
DC3	Device Control 3
DC4	Device Control 4
NAK	Negative Acknowledge (CC)
SYN	Synchronous Idle (CC)
ETB	End of Transmission Block (CC)
CAN	Cancel
EM	End of Medium
SUB	Substitute
ESC	Escape
FS	File Separator (IS)
GS	Group Separator (IS)
RS	Record Separator (IS)
US	Unit Separator (IS)
DEL	Delete

(CC) Communication Control
(FE) Format Effector
(IS) Information Separator

Special Graphic Characters

SP	Space
!	Exclamation Point
|	Logical OR
"	Quotation Marks
#	Number Sign
$	Dollar Sign
%	Percent
&	Ampersand
'	Apostrophe
(	Opening Parenthesis
)	Closing Parenthesis
*	Asterisk
+	Plus
,	Comma
-	Hyphen (Minus)
.	Period (Decimal Point)
/	Slant
:	Colon
;	Semicolon
<	Less Than
=	Equals
>	Greater Than
?	Question Mark
@	Commercial At
[	Opening Bracket
\	Reverse Slant
]	Closing Bracket
^	Circumflex
¬	Logical NOT
_	Underline
`	Grave Accent
{	Opening Brace
¦	Vertical Line (This graphic is stylized to distinguish it from Logical OR)
}	Closing Brace
~	Tilde

CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a]	
						Wh/kg	Wh/dm³
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-temperature	NA	S	2.1	685	1.8	200	[h]
	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

a Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.
b Based on fuel consumption only.
c Weight of air not considered in computation of watt hours.
d Water-activated
e Automatically activated; high rate discharge; 2- to 10-min rate.
f Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.
g Four-minute discharge rate.
h β-alumina electrolyte, 300°C operation.
i Fused salt; 350°C operation.
j Solid $RbAg_4I_5$ electrolyte.
k Several different cathode materials used.
l Fuel consumption is based on source of H_2.
m Based on methanol battery-fuel supply in situ.

eem MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

			Tolerance					
			Class 1					
Color	Digit	Multiplier	10pF or less	Over 10pF	Class 2	Temperature Coefficient ppm°C	Significant Figure	Multiplier
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

MINIGLOSSARY
BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\ K\ A}{t_D}$

Metric: $C = \frac{.0884\ K\ A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\ CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\pi fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\pi fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta\ (\text{loss angle}) = \frac{ESR}{X_c} = (2\pi fC)\ (ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos φ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan}\ \delta\ (\text{loss angle}) = \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\ (Xc) = (DF)\ (\frac{1}{2}\pi fC)$

XII. Power Loss (watts)

Power loss $= (2\pi fCV^2)\ (DF)$

XIII. KVA (Kilowatts)

$KVA = 2\pi fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\ (T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_O}{L_t} = \left(\frac{V_t}{V_o}\right)^x \left(\frac{T_t}{T_o}\right)^\tau$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \text{---} + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\ C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \text{---} + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

Metric prefixes:

Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^3
Mega	X 10^6
Giga	X 10^9
Tera	X 10^{12}

Symbols:

K	=	Dielectric Constant
A	=	Area of electrode overlap
t_D	=	Dielectric thickness
V	=	Voltage (volts)
t	=	time (hours)
R_S	=	Series Resistance (ohms)
f	=	frequency (Hertz)
L	=	Inductance (henries)
δ	=	Loss angle
ø	=	Phase angle
x+y	=	Exponent effect of voltage and temperature
L_O	=	Operating life (hours)
L_t	=	Test life (hours)
V_t	=	Test voltage (volts)
V_o	=	Operating voltage (volts)
T_t	=	Test temperature (°C)
T_o	=	Operating temperature (°C)

MINIGLOSSARY CONNECTORS

Connector terminology is often quite confusing. This confusion starts with the very names of connectors. The name of a connector may derive from its shape, application, type of conductor or even method of termination.

Shape—Circular, cylindrical, and rectangular.

Electrical application—High voltage, RF, microwave, input/output, etc.

Mechanical application—Printed circuit, rack & panel, cable, etc.

Conductor type—Coaxial, flat cable, ribbon cable, flex circuit, etc.

Termination method—Wirewrap, soldercup, solderless, etc.

Hardware such as clamps, hoods, and adapters are frequently used to convert cable connectors to rack and panel types. This adds to the name confusion. A very common telephone connector, for example (the "C" type) got its name from the model number of the original maker.

Contact: The part(s) of the connector that actually provides circuit continuity between its two sections—the parts which are normally mated. The back end of the connector should properly be called the *termination*. This is the point where the wires or PC board is attached to the connector.

Contact alignments: Often called *contact float*. Describes the amount of allowable contact movement within the connector body. Permits self-alignment.

Male vs. female: In the U.S. this describes the contact construction. In Europe this term is more often used to describe the outer shell mating action which may be the reverse of the contacts.

Closed entry: A female contact which prevents entry of a male contact larger than a specific size.

Open entry: A female contact designed for a specific size of male contact but which will allow entry of larger male contacts by spring action.

Hermaphrodite: Contacts or connector bodies which are the same configuration. Male/female designations do not apply. Bodies usually have some mechanical means for maintaining polarity.

Hermetic seal: Glass-to-metal seals at terminations. Often used improperly to describe vacuum-tight seals.

Waterproof seal: May or may not be truly *waterproof*. May prevent easy entrance of casual water by means of a rubber or other boot.

Printed circuit connector: Connectors which are used in conjunction with printed circuit boards. There are two distinctly different styles.

Edgeboard. May be called *edge* or *card*. The printed circuit (PC) board edge enters the connector.

Two-piece: One part of the connecting pair is physically attached to the PC board itself. The other part is attached to something else such as a cable or a motherboard.

Readout: Describes the arrangement at the terminating edge of a PC board. May be single or double. A double readout PC board has termination strips on each side not usually interconnected.

Ribbon connectors: A type of connector which allows flat "ribbon" cable to be attached to a round or rectangular connector but also used interchangeably for flat connectors to flat cable.

Ribbon contact connector: Describes the contacts in a rectangular connector which have a self-wiping mating action. Not the same as ribbon connector.

Solderless terminal: Any style of termination which does not require solder for a permanent connection. See *crimp* and *insulation displacement*.

Crimp termination: A stripped wire is inserted into a barrel or trough which is then crimped to the conductor with a suitable tool.

Insulation displacement: Unstripped insulated wire is fitted into a channel containing metal teeth which are forced through the insulation to make contact with the conductor.

Service rating: The maximum rated voltage and/or current which may be applied continuously. May be called *working voltage*. Can be confused with the term used to describe how many times a connector may be mated and separated.

Withstanding voltage: Also called *test voltage*. The voltage a connector must withstand for one minute without breakdown. Applied between connectors and between connectors and shell and any grounding devices of the connector.

MAXIMUM CURRENT CAPACITY—CONDUCTORS

Size, AWG	MIL-W-5088				National Electrical Code	Underwriters Laboratory		American Insurance Association	500 c mils/A
	Copper		Aluminum			60°C	80°C		
	Single-wire	Wire-bundled	Single-wire	Wire-bundled					
30	...	...	...	...	...	0.2	0.4	...	0.20
28	...	...	...	...	...	0.4	0.6	...	0.32
26	...	...	...	...	...	0.6	1.0	...	0.51
24	...	...	...	...	...	1.0	1.6	...	0.81
22	9	5	...	...	...	1.6	2.5	...	1.28
20	11	7.5	...	...	...	2.5	4.0	3	2.04
18	16	10	...	...	6	4.0	6.0	5	3.24
16	22	13	...	...	10	6.0	10.0	7	5.16
14	32	17	...	...	20	10.0	16.0	15	8.22
12	41	23	...	...	30	16.0	26.0	20	13.05
10	55	33	...	...	35	...	...	25	20.8
8	73	46	58	36	50	...	...	35	33.0
6	101	60	86	51	70	...	...	50	52.6
4	135	80	108	64	90	...	...	70	83.4
2	181	100	149	82	125	...	...	90	132.8
1	211	125	177	105	150	...	...	100	167.5
0	245	150	204	125	200	...	...	125	212.0
00	283	175	237	146	225	...	...	150	266.0
000	328	200	...	...	275	...	...	175	336.0
0000	380	225	...	...	325	...	...	225	424.0

MINIGLOSSARY BASIC EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11				
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hexadecimal Digit
			12				12	12		12	12	12		12	12				Zone Punches
				11				11	11	11		11	11	11		11			
					0		0		0	0	0		0	0			0		
			9	9	9	9	9	9	9	9									Digit Punches
			①	②	③	④	⑤	⑥	⑦	⑧					⑨	⑩	⑪	⑫	
0000	0	8-1	NUL	DLE	DS		SP	&	-									0	8-1
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7
1000	8	8		CAN							h	q	y		H	Q	Y	8	8
1001	9	8-1		EM							;	r	z		I	R	Z	9	9
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6
1111	F	8-7	SI	IUS	BEL	SUB		¬	?	"									8-7
			12				12				12	12		12	12	12		12	Zone Punches
				11				11				11	11	11		11	11	11	
					0				0		0		0	0	0		0	0	
			9	9	9	9									9	9	9	9	

Card Hole Patterns

①	12-0-9-8-1	⑤	No-Punches	⑨	12-0	⑬	0-1
②	12-11-9-8-1	⑥	12	⑩	11-0	⑭	11-0-9-1
③	11-0-9-8-1	⑦	11	⑪	0-8-2	⑮	12-11
④	12-11-0-9-8-1	⑧	12-11-0	⑫	0		

Control Character Representations

ACK	Acknowledge	EOT	End of Transmission	PF	Punch Off
BEL	Bell	ESC	Escape	PN	Punch On
BS	Backspace	ETB	End of Transmission Block	RES	Restore
BYP	Bypass	ETX	End of Text	RS	Reader Stop
CAN	Cancel	FF	Form Feed	SI	Shift In
CC	Cursar Control	FS	Field Separator	SM	Set Mode
CR	Carriage Return	HT	Horizontal Tab	SMM	Start of Manual Message
CU1	Customer Use 1	IFS	Interchange File Separator	SO	Shift Out
CU2	Customer Use 2	IGS	Interchange Group Separator	SOH	Start of Heading
CU3	Customer Use 3	IL	Idle	SOS	Start of Significance
DC1	Device Control 1	IRS	Interchange Record Separator	SP	Space
DC2	Device Control 2	IUS	Interchange Unit Separator	STX	Start of Text
DC4	Device Control 4	LC	Lower Case	SUB	Substitute
DEL	Delete	LF	Line Feed	SYN	Synchronous Idle
DLE	Data Link Escape	NAK	Negative Acknowledge	TM	Tape Mark
DS	Digit Select	NL	New Line	UC	Upper Case
EM	End of Medium	NUL	Null	VT	Vertical Tab
ENQ	Enquiry				

Special Graphic Characters

¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
|	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

ecm MINIGLOSSARY ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise*. The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

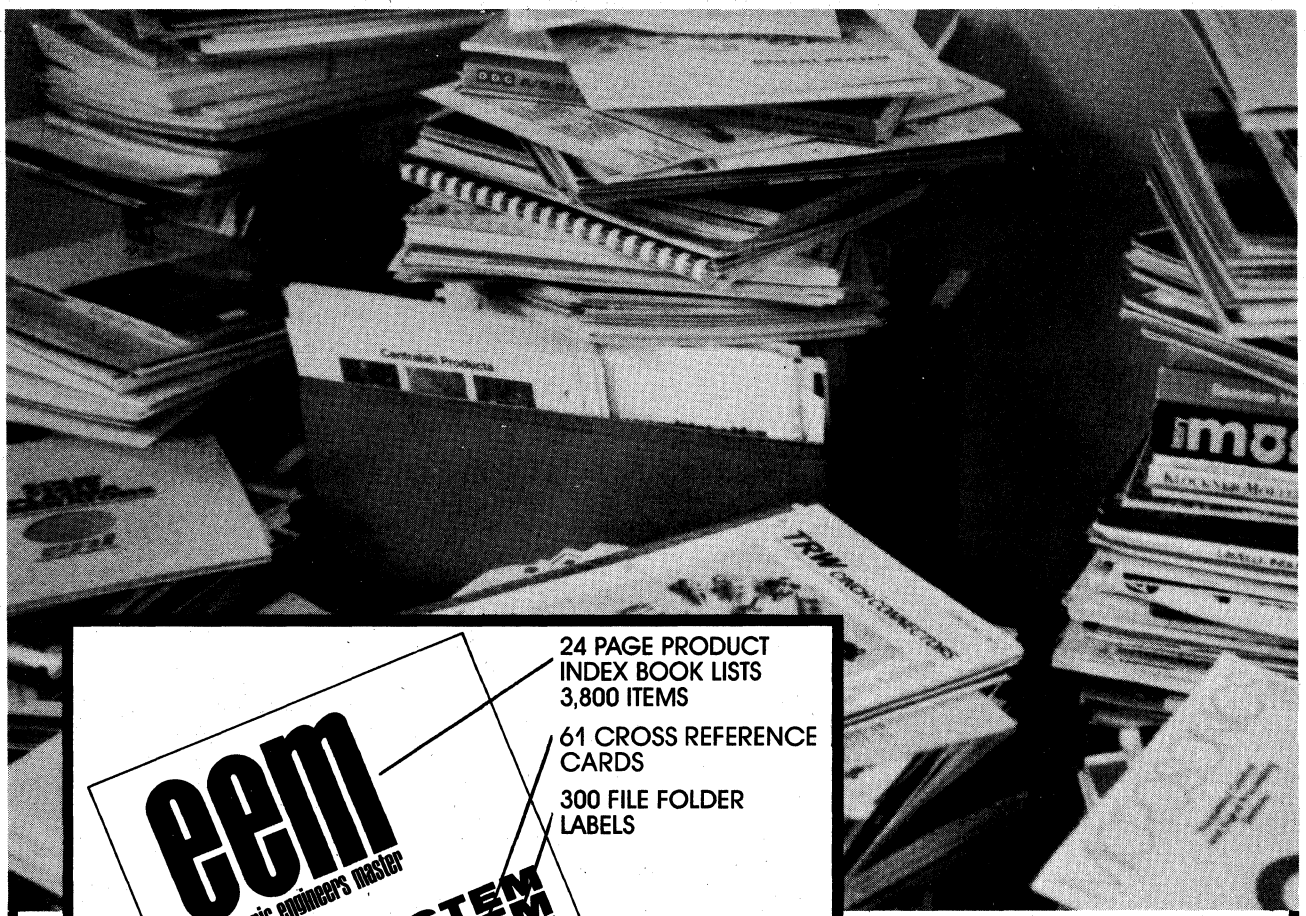
Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

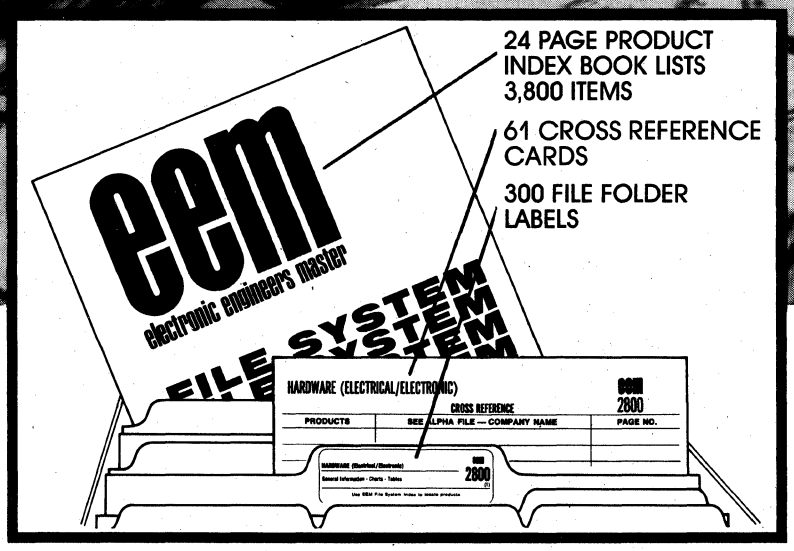
Insulation resistance: (IR) An insulating material's total DC leakage.

Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.





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ASCII Code ..... **D**•1080
Batteries, Product Selection Guide.... **D**•1447
Batteries & Fuel Cells, Characteristics..... **D**•1450
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide..... **C**•1003
Capacitors, Basic Formulas..... **A**•1093
Capacitors, Miniglossary..... **A**•1066
Capacitors, Product Selection Guide **A**•1002
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Trademark & Logofinder Directories... **C**•901
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Wire & Cable, Product Selection Guide..... **C**•1755
Wire Gauges—Diameter, Area, Copper Weight..... **C**•1343, **C**•1759

qualified products lists-2440

"Qualified Products Lists" are issued periodically by the U.S. Government as a guide for the procurement of electronic components by government contractors. Each list contains every separately designated part that has qualified under the latest Military Specification for its class and the name(s) of the manufacturer(s) of each.

EEM is publishing the names of those North American companies that are qualified producers of one or more products in each of the lists that apply to a selected group of electronic products normally cataloged in these pages. Addresses for these companies will be found in the EEM Yellow Pages.

For the complete QPLs and update information write or call:

Naval Publications and Forms Center
5801 Tabor Ave.
Philadelphia, PA 19120
(215) 697-3321

MIL-A-6752 FSC 6625
Ammeters, Voltmeters, and Loadmeters; DC

Bach-Simpson Ltd.
Coaxial Dynamics
General Electric Co., Cincinnati, OH
Hickok Electrical Inst. Co.
Ideal Precision Meter Co.
International Microelectronics
International Instruments Div., Sigma Instruments
Sutton Designs, Inc.

MIL-B-81757 FSC 6140
Batteries and Cells, Storage Nickel-Cadmium

Avex Electronics Corp.
Eagle Pitcher Industries
General Electric Co., Gainesville, FL
Marathon Battery Co.
Rebling Plastics Co.
SAFT America, Inc.
Tauber Electronics Corp.

MIL-B-23071 FSC 4140
Blowers, Miniature, for cooling electronic equipment (10 to 500 CFM)

Eastern Air Devices, Inc.
EG&G Rotron, Inc.
Globe Industries
IMC Magnetics Corp., Westbury, NY
TRW Motor Div.

MIL-B-5423 FSC 5930
Boots, Dust and Water Seal (for toggle and pushbutton switches and rotary-actuated parts)

APM Hexseal Division
Machine Components Corp.
Multi-Flex Seals, Inc.

MIL-C-915 FSC 6145
Cable and Cord, Electrical

Anaconda-Ericsson, Inc., Continental Wire & Cable
Daburn Electronics
BIW Cable Systems, Inc.
Brand-Rex Company
Brim Electronics Inc.
Carol Cable Co. West
Cerro Wire & Cable Co.
Chester Cable Corp.
Collyer Insulated Wire Co.
Consolidated Products Corp.
General Cable Corp.
ITT Surprenant Div.
Marine Industrial Cable Corp.
Mohawk Wire & Cable Corp.
Monroe Wire & Cable Corp.
The Okonite Co.
Phalo Corp.
Pirelli Cable Corp.
Plastoid Corporation
Rome Cable Corporation
Teledyne Thermatics
Times Wire & Cable Co.
Vector Cable Co.

MIL-C-49055 FSC 6145
Cable, Power, Electrical(Flexible, Flat, Unshielded), (Round Conductor)

Cooper, Belden Electronic Wire & Cable
Electronic Products Div./3M
W.L. Gore & Assocs.
Tempflex Cable

MIL-C-83503 FSC 6145
Connector, Electrical, Flat Cable, and/or Printed Wiring Board, Non-environmental

CW Industries
AMP, Incorporated
Electronic Products Div./3M
T & B Ansley

MIL-C-7974 FSC 5935
Cable Assemblies and Attachable Plugs, external electrical power, aircraft

Anderson Power Products
Burton Electrical Engineering
FKC Engineering Co.
General Cable Co., Cornish Products Div.

MIL-C-17 FSC 6145
Cables, Radio Frequency: Flexible & Semirigid

Adams Russell Electronics Co. Inc.
Belden Electronic Wire & Cable
Brim Electronics Inc.
Cablewave Systems, Inc.
Champlain Cable Corp.
Daburn Electronics
ITT Surprenant
Penstock Inc.
Phalo Corp.
Plastoid Corp.
Precision Tube Co., Inc.
Saxton Wire and Cable
Storm Products Co.
Teledyne Thermatics
Tensolite Co.
Thermax Wire Corp.
Times Fiber Communications, Inc.
Uniform Tubes, Inc.

MIL-C-22442 FSC 5965
Cable Assembly, Aircraft Audio

Astrocom Electronics, Inc.
Hiltronics Corp.
Telephonics

MIL-C-13777 FSC 6145
Cable, Special Purpose

BIW Cable Systems, Inc.
Brand-Rex Company
Brim Electronics Inc.
ITT Surprenant
Rome Cable Corp.

MIL-C-27500 FSC 6145
Cable, Electrical, Shielded and Unshielded, Aerospace

Brim Electronics Inc.
Judd Wire
Philadelphia Ins. Wire
Teledyne Thermatics

MIL-C-55681 FSC 5910
Capacitors, Chip, Multiple Layer, Unencapsulated, Ceramic Dielectric

American Technical Ceramics
AVX Ceramics Corp.
Microcap Inc.
Monolithic Components Corp.
Republic Electronics Corp.
San Fernando Electric Mfg. Co.
Sprague Electric Co.
Union Carbide Corp., Greenville, SC
Unitrode Corp.
U.S. Microtek Components
Vitramon Inc.

MIL-C-83439 FSC 5910
Capacitors, Fixed, Feedthrough, EMI Suppression, (AC, DC, and AC-DC, Hermetically Sealed in Metal Cases)

Murata Erie, Canada
Sprague Electric Co.

MIL-C-27287 FSC 5910
Capacitors, Fixed, Plastic Dielectric, DC (Nonmetallic Cases)

ASC (formerly TRW)
Mepco/Electra Inc., Columbia, SC
Midwec Corp.
San Fernando Electric Mfg. Co. (see also WES-CAP)
TRW Capacitor Div.

MIL-C-55514 FSC 5910
Capacitors, Fixed, Plastic (or Metallized Plastic) Dielectric, in Nonmetal Cases

Electronic Concepts, Inc.
Sprague Electric Co.
Union Carbide Corp., Greenville, SC

MIL-C-39022 FSC 5910
Capacitors, Fixed, Metallized, Paper-Plastic Film, or Plastic Film Dielectric, DC and AC (Hermetically Sealed in Metal Cases)

Acushnet Capacitor Co., Inc.
Alissa Manufacturing Co.
Components Research Co., Inc.
Sprague Electric Co.
TRW Capacitors
Union Carbide Corp., Greenville, SC
West-Cap Arizona

MIL-C-39018 FSC 5910
Capacitors, Fixed, Electrolytic (Aluminum Oxide)

Cornell-Dubilier, Sangamo Components, Sanford, NC
Mepco/Electra, Inc., Columbia, SC
Sangamo Capacitor Div.
Sprague Electric Co.

MIL-C-39006 FSC 5910
Capacitors, Fixed, Electrolytic, Tantalum, Solid-Electrolyted

Acushnet Electronics Co.
Mallory Capacitor Co.
Mepco/Centralab
Mepco/Electra, Inc., West Palm Beach, FL.
Sprague Electric Co.
Transitor Electronics Inc.
Union Carbide Corp., Greenville, SC

MIL-C-3965 FSC 5910
Capacitors, Fixed, Electrolytic, (Nonsolid Electrolyte), Tantalum

Cornell-Dubilier Electronics, Sanford, NC
Hunter-Stanley Electronics, Inc.
Mallory Capacitor Co.
Mepco/Centralab
Mepco/Electra, Inc., West Palm Beach, Fl.
Mepco/Electra, Inc., Columbia, SC
Sprague Electric Co.
Tansitor Electronics, Inc.

MIL-C-19978 FSC 5910
Capacitors, Fixed, Plastic (or Paper-Plastic), Dielectric (Hermetically sealed in Metal, Ceramic, or Glass Cases)

ASC (formerly TRW)
Chicago Condenser Corp.
High Energy Corp.
Sprague Electric Co.
Stone City Products Co.
TRW Capacitor Div.
West-Cap Arizona

MIL-C-11272 FSC 5910
Capacitors, Fixed, Glass-Dielectric

American Technical Ceramics Div.
AVX Electronics Corp.
Corning Glass Works, Raleigh, NC
Republic Electronics Corp.
Vitramon Inc.

MIL-C-11015 FSC 5910
Capacitors, Fixed, Ceramic-Dielectric (General Purpose)

Automation Components, Inc.
AVX Ceramics Corp.
Centralab, Los Angeles, CA
Cera-Mite Corp.
Corning Glass Works, Raleigh, NC
Republic Electronics Corp.
San Fernando Electric Mfg. Co.
Sprague Electric Co.
Tusonix, Inc.
Union Carbide Corp., Greenville, SC
Vitramon, Inc.

MIL-C-123 FSC 5910
Capacitors, Fixed, Ceramic Dielectric, (Temperature Stable & General Purpose)

AVX Electronics Corp.
San Fernando Electric Mfg. Co.

MIL-C-62 FSC 5910
Capacitors, Fixed, Electrolytic (DC, Aluminum, Dry Electrolyte, Polarized)

Sprague Electric Co.

MIL-C-5 FSC 5910
Capacitors, Fixed, Mica-Dielectric

Acushnet Capacitor Co., Inc.
ADI Electronics, Inc.
Cornell-Dubilier, Sangamo Components
Kahgan Electronics Corp.
Sangamo Capacitor Co.
Silvered Electronic Mica Co., Inc. (SEMCO)
Soshin Electric Ltd. (Distr. by Multi Products Intl.)

MIL-C-23269 FSC 5910
Capacitors, Fixed, Glass Dielectric

Corning Glass Works, Raleigh, NC
Vitramon, Inc.

MIL-C-14409 FSC 5910
Capacitors, Variable, (Piston-Type, Tubular Trimmer)

Johanson Mfg. Corp.
Murata Erie, Erie, PA
Sprague-Goodman Electronics, Inc.
Voltronics Corp.

MIL-C-81 FSC 5910
Capacitors, Variable, Ceramic Dielectric

Johanson Mfg. Corp.
Tusonix, Inc.

MIL-C-7079 FSC 5925
Circuit Breakers, Non Trip Free

Potter & Brumfield Div., AMF Inc., Gainesville, GA

MIL-C-55629 FSC 5925
Circuit Breakers, Magnetic, Unsealed or Panel Seal, Trip Free

Airpax Corp., Cambridge, MD
Heinemann Electric Co., Lawrenceville, NJ

MIL-C-15305 FSC 5950
Coils, Fixed and Variable, Radio Frequency

Cambridge Thermionic Corp.
Dale Electronics, Inc., Columbus Div.
Delevan, Div. of American Precision Industries, Inc.
Jeffers Electronics, Inc.
Nytronics Components Group, Inc.
Piconics, Inc.
Torotel Products, Inc.
TRW Inductive Products Div.
Vanguard Electronic Co., Inglewood, CA
West-Cap Arizona

MIL-C-22992 FSC 5935
Connectors, Electrical Waterproof, Quick Disconnect, Heavy Duty Type, & Accessories

Amphenol, Wallingford, Conn.
Bendix Corp., Electrical Components Div.
Burndy/Berco
Coaxial Dynamics, Inc.
ITT Cannon Electric

MIL-C-21097 FSC 5935
Connectors, Electrical, Printed Wiring Board

AMP Incorporated
Amphenol, Broadview, IL
Cinch Connectors
EDAC, Incorporated
Elco Corp., Connector Div.
Paladin Corp.
TRW Connector Div., Elm Grove Village, IL
Winchester Electronic Div., Litton Industries

MIL-C-24308 FSC 5935
Connectors, Electric Rectangular, Miniature Polarized Shell, Rack Panel

ADI Electronics, Inc.
AMP, Inc.
Amphenol, Wallingford, Conn.
Cinch Connectors
CW Industries
General Connector Corp.
ITT Cannon Electric, Fountain Valley, CA
Matrix Science Corp.
Positronic Industries, Inc.
Souriau, Inc., Valencia, CA
TRW Connectors Div., Elk Grove Village, IL

MIL-C-81703 FSC 5935
Connectors, Electric, Circular, Miniature, Rack & Panel or Push-Pull Coupling

Connector Industries of America
Deutsch Elec., Component Div.
Sealtron, Inc.

MIL-C-25516 FSC 5935
Connector, Electrical, Miniature

Paladin Corp.
TRW Electronic Components, Minneapolis, MN

MIL-C-26500 FSC 5935
Connectors, General Purpose, Electrical, Miniature, Circular

Amphenol, Wallingford, Conn.
Glenair, Inc.
Hermetic Seal Corp.
Pyle-National Co.
TRW Connectors, Minneapolis, MN

MIL-C-28748 FSC 5935
Connectors, Electrical, Rectangular, Rack & Panel, Solder Type, & Crimp Type Contacts

Continental Connector Corp.
Dale Electronics Inc., Columbus, NE
Hughes Aircraft Co., Connecting Devices Div., Irvine, CA
Positronic Industries, Inc.
U.S. Components, Inc.
Winchester Electronics, Div. Litton Industries, Inc.

MIL-C-28804 FSC 5935
Connectors, Electric, Rectangular, High Density, Polarized Center Jackscrew

Hughes Aircraft Co., Connecting Device Div., Irvine, CA

MIL-C-39012 FSC 5935
Connectors, Coaxial, Radio Frequency

Adams Russell Electronics Co. Inc.
AMP, Inc.
Amphenol, Wallingford, Conn.
Automatic Connector, Inc.
Bendix Corp., Electrical Components Div.
Cablewave Miniature Products
Delta Electronics Mfg. Corp.
ITT Cannon Electric, Phoenix, AZ
Kings Electronics Co., Inc.
M/A COM OMNI Spectra, Inc., Microwave Connector Div.
Penstock Inc.
Sealectro Corp.
Solitron/Microwave
Speciality Connector Co.

MIL-C-3098 FSC 5955
Crystal Units, Quartz

American Time Products
Bliley Electric
Cinox Corp.
Croven Ltd.
CTS Knights
Electronic Crystals
Electronic Research
McCoy Electronics
M-Tron Electronics
Murata Erie North America
Philips Electronics
Quartztek
Reeves-Hoffman
C.R. Snelgrove
Tadiran
U.S. Crystal

MIL-D-83532 FSC 5999
Delay Lines, Active

Technitrol

MIL-D-83531 FSC 5999
Delay Lines, Passive

Technitrol

MIL-D-3954 FSC 5985
Dummy Load, Electrical, Waveguide

Antenna Specialists: The Allen Group
Coaxial Dynamics
Struthers Electronics Corp.

MIL-E-1 FSC 5960
Electron Tubes

Amperex Electronic Corp., Hicksville Div.
Beam Tube Corp.
Cetron Electronics
EG & G, Inc., Electro-Optic Div.
GEC Technology Corp.
General Atronics Corp.
General Electric Co., Microwave Tube Operation
General Electric Co., MIDPS
Imaging and Sensing Technology Corp.
ITT Electron Tube Div.
Litton Industries, Electron Tube Div., Williamsport, PA
LND, Inc.
Machlett Labs., Inc.
Microwave Assoc., Inc., Burlington, MA
M.U. Incorporated
National Electronics, Inc.
OMNI-Wave Electronics Corp.
Philips ECG, Inc., Altoona, PA
Raytheon Co., Quincy, MA
Raytheon, Waltham, MA
RCA Corp., Lancaster, PA
TGM Detectors, Inc.
Thomas Electronics, Inc.
Thomson-CSF Comps. Corp., Dover, NJ
Varian Assoc., Palo Alto, CA
Varian Canada, Inc., Georgetown, Ont.
Varo Electron Devices, Inc.
Watkins-Johnson Co., Stewart Div.
Western Electric Co., Inc.
Westinghouse Electric Corp., Electronic Tube Div.

MIL-F-15733 FSC 5915
Filters, Radio Interference

Captor Corp.
Centre Engineering, Inc.
Coaxial Dynamics
Fil-Coil Co., Inc.
Murata Erie, Canada
Oxley Inc.
RFI Corporation
San Fernando Electric Mfg. Co.
Spectrum Control, Inc.
Sprague Electric Co. Filter Div., North Adams, MA
Tusonix Inc.

MIL-F-18327 FSC 5915
Filters: High Pass, Low Pass, Band Suppression & Dual Functioning

ADC Products
Alpha Components Inc.
BG Electronics
Coaxial Dynamics
Conolog Corp.
Damon Corp.
OPT Industries, Inc.
Piezo Technology
TRW Inductive Products Div.

MIL-F-23419 FSC 5920
Fuses, Instrument Type

Bussmann Mfg. Div., McGraw-Edison Co.
Littelfuse, Inc.

MIL-I-1361 FSC 6625
Instrument Auxiliaries, Electrical Measuring: Shunts, Resistors, & Transformers

Brown Boveri Electric, Inc., West Columbia, SC.
Crompton Metermaster Inc.
Electromagnetic Industries, Inc.
Rod-L Electronics Inc.
Starlust-Martin
Sutton Design

MIL-I-27273 FSC 6130
Inverter, Power, Static

Hamilton Standard Div., United Technologies Corp.
Magnetika, Inc.

MIL-J-641 FSC 5935
Jacks, Telephone

ADC Products
Kings Electronics Co., Inc.
Paladin Corp.
Switchcraft, Inc.

MIL-L-3661 FSC 6210, 6250
Lampholders, Indicator Lights, Indicator Light Housings, & Indicator Light Lenses

Cutler Hammer Grp., Eaton Corp., Aerospace Controls/Systems Div.
Dialight
General Instrument Corp., Lamp Div.
Littelfuse, Inc.
Oak Switch Systems

MIL-M-10304 FSC 6625
Meters, Electrical Indicating, Panel Type, Ruggedized

A&M Instrument, Inc.
Arga Controls
Bach-Simpson, Ltd.
Coaxial Dynamics
Crompton Metermaster Inc.
Ideal Precision Meter Co., Inc.
International Instruments
JBT Instruments
Phaoston Instruments & Electronic Co.
Simpson Electric Co.
Triplett Corp.

MIL-O-55310 FSC 5955
Oscillators, Crystal

Damon Corp.
Greenray Industries
McCoy Electronics Co.
Oscillatek Corp.
Piezo Technology
Q-TECH Corp.
Spectrum Tehnology, Inc.
Vectron Labs., Inc.
Xsis Electronics, Inc.

MIL-P-26517 FSC 6130
Power Supply, Transformer-Rectifier, Aircraft

Powercube Corp.
Varian Microwave Equipment Div.
Wagner Electric Corp., Tung-Sol Div.
Westinghouse Electric Corp., Aerospace Electrical Division

MIL-R-28803 FSC 6240
Readouts, Segmented

Master Specialties
Starlust-Martin

MIL-R-19648 FSC 5945
Relays, Time Delay, Thermal

Warren Communications

MIL-R-83726 FSC 5945
Relays, Time Delay, Electric & Electronic

Anders Inc.
Deutsch Relays, Inc.
Hi-G Co. , Inc., Windsor Locks, CT
Leach Corp., Control Products Div.
Struthers-Dunn, Inc.
Tempo Instrument, Plainview, NY

MIL-R-83407 FSC 5945
Relays, Reed (Mercury Wetted)

Mepco/Centralab
Struthers-Dunn, Inc.

MIL-R-39016 FSC 5945
Relays, Electromagnetic

Branson Corp.
Communications Instruments, Inc.
Deutsch Relays, Inc.
Electronics Specialty Div.
GENICOM Corp. (General Electric Co.), Waynesboro, VA
Gould Inc., Allied Control Division, Plantsville, CT
Hi-G Co., Inc., Windsor Locks, CT
Teledyne Relays

MIL-R-28750 FSC 5945
Relays, Solid State

Hi-G Co., Inc., Windsor Locks, CT
Teledyne Solid State, Div. of Teledyne Relays

MIL-R-94 FSC 5905
Resistors, Variable, Composition

Allen-Bradley Co.
Angstrom Precision Inc.
Clarostat Mfg. Co., Inc.
Elliott/Jordan
Ohmite
Precision Electronic Components
Vishay Resistive Systems Group

MIL-R-26 FSC 5905
Resistors, Fixed, Wire-Wound (Power Type)

Angstrom Precision Inc.
CAL-R, Inc.
Dale Electronics, Inc., Columbus, NE
Elliott/Jordan
E-Systems, Inc., Memcor, Div.
Memcor-Truohm Group Inc.
Nytronics Components Group Inc.
Ohmite Mfg. Co.
Pacific Resistor Co.
RCL Electronics, Inc.
Shallcross, Inc.
TEL-Labs, Inc.
Tepro of Florida, Inc.
Ultronix, Inc.
Vishay Resistive Systems Group
Ward Leonard Electric Co.

MIL-R-22 FSC 5905
Resistors, Variable (Wirewound, Power Type)

Angstrom Precision Inc.
Elliott/Jordan
E-Systems, Inc., Memcor Div.
Memcor-Truohm Group Inc., Litton Potentiometer Div.
Ohmite Mfg. Co.
Vishay Resistive Systems Group

MIL-R-55342 FSC 5905
Resistors, Fixed, Film, Chip

Angstrom Precision Inc.
Dale Electronics, Inc., Columbus, NE
Elliott/Jordan
Mepco/Electra, Inc., Morristown, NJ
Mini-Systems, Inc.
Solitron Devices Inc.
State of the Art, Inc.
Vishay Resistive Systems Group

MIL-R-83401 FSC 5905
Resistor Networks, Fixed Film

Allen-Bradley Co.
Angstrom Precision Inc.
Dale Electronics, Inc., Columbus, NE
California Micro Devices, Inc.
Elliott/Jordan
Hycomp Inc.
KDI Pyrofilm Corp.
Mepco/Electra, Inc., Morristown, NJ
Solitron Devices Inc.
Sprague Electric Co.
Techno-Comps. Corp.
TRW Resistors
Ultronix Inc.
Vishay Resistive Systems

MIL-R-39008 FSC 5909
Resistors, Fixed, Composition (Insulated)

Allen-Bradley Co.

MIL-S-22432/9 FSC 6105
Servomotor, Type 18SM4c

Starlust-Martin, Inc.
Tachtronic Instruments, Inc.

MIL-S-12883 FSC 5935
Sockets & Accessories for Plug-in Electronic Components

Augat, Inc.
Deutsch Relays, Inc.
Eby Company

MIL-S-3786 FSC 5930
Switches, Rotary, Selector

Cole Instruments Corp.
Janco Corp., Burbank, Ca
Grayhill, Inc.
ITW Switches
Oak Switch Systems Inc.

MIL-S-3928 FSC 5985
Switches (Coaxial), RF Transmission Line

Amphenol, RF Operations
M/A COM OMNI Spectra Inc.
RLC Electronics Inc.
Transco Products, Inc.

MIL-S-6807 FSC 5930
Switches, Rotary, Selector

Electro Switch Corp.

MIL-S-8805 FSC 5930
Switches & Switch Assemblies, Sensitive & Push (Snap Action)

Eaton Corp. Aerospace Controls/ Systems Div.
Haydon Switch & Instrument, Inc.
ITW Switches
Korry Electronics
Licon Div.
Machine Components Corp.
Master Specialties Co.
Micro Switch
Nexus

Otto Engineering
Saint Switch, Inc.
Stacoswitch
Texas Instruments, Inc., Materials & Controls Grp.
Unimax Switch Corp.
VIZ Mfg. Co., Inc.

MIL-S-9395 FSC 5930
Switches, Pressure (Absolute, Gauge & Differential)

Consolidated Controls Corp.
Electro-National Corp.
Hydra-Electric Co.
Scott Aviation
Sigma-Netics, Inc.

MIL-S-22885 FSC 5930
Switches, Pushbutton, Illuminated

Aerospace Optics, Inc.
APM Hexseal Div.
Eaton Corp., Aerospace/Commercial Controls Division
Jay-El Products, Inc.
Korry Mfg. Co.
Licon Div.
Master Dynamics Corp.
Master Specialties Co.
Micro Switch
Precision Molded Products
Stacoswitch
Unimax Switch Corp.

MIL-S-22710 FSC 5930
Switches, Rotary (Printed Circuit), (Thumbwheel, Inline & Pushbutton)

Digitran Div., Xcel Corp.
EECO, Inc.
Janco Corp.

MIL-T-23648 FSC 5905
Thermistor, (Thermally Sensitive, Resistor) Insulated

Ametick, Inc., Rodan Div.
Fenwal Electronics/APD,
Ketema-Rodan Div.
Quality Thermister, Inc.
Unitrode Corp.
Victory Engineering Corp.

MIL-T-27 FSC 5950
Transformers & Inductors (Audio, Power, & High-Power Pulse)

Abbott Technologies Inc.
ADC Products
Adec, Inc.
AEL-EMTECH Corp., Lansdale, PA
American Aerospace Controls Inc.
AMI/Coast Magnetics
Berkshire Transformer Corp.(Preferre Electronics)
Beta Transformer Technology Corp.
B.G. Laboratories, Inc.
Coast Magnetics
Dytek Laboratories, Inc.
Electronic Transformer Corp.
Epsey Mfg. & Electronics Corp.
EWC, Inc.
Fernwood Transformer Co.
Freed Transformer Co., Inc.
Hadley, Robert M., Co., Inc.
Magnetico
Microtran Co., Inc.
Midland-Ross Corp., Grimes Division
OPT Industries, Inc.
Pico Electronics, Inc.
Sigmapower, Inc.
Stagenes Industries Inc.
Titan Transformer Co.
Torwico Electronics, Inc.
Transformer Design, Inc.
TRW Inductive Products
Vanguard Electronics Co., Inc.
Wayne Transformer Co.
Zambre Co. Inc.
Zenith Transformer Co., Inc.

MIL-T-27535 FSC 5950
Transformer, Power, Isolation, Series Circuit

Amerace Corp., Elastimold Div.
Crouse Hinds/Sepco Corp.
Zambre Co. Inc.

MIL-T-21038 FSC 5950
Transformers, Pulse, Low Power

Epsey Mfg. & Electronics Corp.
JB Electronic Transformers Inc.
Magnetico
Technitrol Inc.
TRW Inductive Products
Zambre Co. Inc.

MIL-V-9999 FSC 6625
Voltmeters, Electronic

Hewlett-Packard Co., Loveland, CO.
Ballantine Laboratories

MIL-W-16878 FSC 6145
Wire, Electric, Polyvinyl Chloride Insulated

Brim Electronics
Daburn Electronics & Cable
Judd Wire
National Wire & Cable
Teledyne Thermatics

MIL-W-22759 FSC 6145
Wire, Electric, Crosslinked, Fluoro-polymer Insulated, Modified ETFE, Normal Weight, Nickle Coated, High Strength Copper Alloy, 200 Deg. C, 600 Volt

Brim Electronics Inc.
Judd Wire
Philadelphia Ins. Wire Co. Inc.
Teledyne Thermatics

MIL-W-5086 FSC 6145
Wire, Electric, Polyvinyl Chloride Insulated, Copper of Copper Alloy

Barcel Wire & Cable Corp.
Brim Electronics Inc.
Independent Cable, Inc.
ITT Suprenant Div.
Philadelphia Insulated Wire Co.
Plastoid Corp.
Prestolite Wire Division
Teledyne Thermatics

MIL-W-81381 FSC 6145
Wire, Electric, Polymide-Insulated, Copper or Copper Alloy

Barcel Wire & Cable Corp.
Brim Electronics Inc.
Champlain Cable Corp.
Independent Cable Corp,.
Teledyne Thermatics
Tensolite Co.
Thermax Wire Corp.

Mil-C-123

MILITARY PART NUMBER CROSS REFERENCE FOR MIL-C-123

MIL-C-123		MIL-C-39014		MIL-C-20		MIL-C-55681		AVX CATALOG
CKS #	M123/•	CKR #	M39014/•	CCR #	M20/•	CDR #	M55681	
CKS05	/1	CKR05	/01	CCR05	/35	N/A	N/A	MR05
CKS06	/2	CKR06	/02	CCR06	/36	N/A	N/A	MR06
CKS07	/3	N/A	N/A	CCR07	/37	N/A	N/A	MR07
CKS11	/4	CKR11	/05	CCR75	/27	N/A	N/A	MA10
CKS12	/5	CKR12	/05	CCR76	/28	N/A	N/A	MA20
CKS14	/6	CKR14	/05	CCR77	/29	N/A	N/A	MA40
CKS15	/7	CKR15	/05	CCR78	/30	N/A	N/A	MA50
CKS16	/8	CKR16	/05	CCR79	/31	N/A	N/A	MA60
CKS26	/9	CKR06	/02	N/A	N/A	N/A	N/A	CR06
CKS51	/10	N/A	N/A	N/A	N/A	CDR01	/1	0805
CKS52	/11	N/A	N/A	N/A	N/A	N/A	N/A	1210
CKS53	/12	N/A	N/A	N/A	N/A	CDR03	/1	1808
CKS54	/13	N/A	N/A	N/A	N/A	CDR06	/3	2225

Mil-C-39014 (Molded Radial Leads — Available with inside Stand-off on CK R06's)

	Per Mil-Spec			Case Size					Capacitance Range	
AVX Style	MIL-C-11015	MIL-C-39014	MIL-C-20	Length (L)	Width (W)	Thickness (T)	Lead Spacing (LS)	Lead Diameter (LD)	MIL-C-39014	MIL-C-20
MR05	CK05	CKR05	CCR05/CC05	.190 ± .010	.190 ± .010	.090 ± .010	.200 ± .015	.025 ± .002	10-.10	1-3300
MR04	—	CKR04	CCR09/CC09	.190 ± .010	.190 ± .010	.090 ± .010	.100 ± .015	.025 ± .002	10-.10	1-3300
MR06	CK06	CKR06	CCR06/CC06	.290 ± .010	.290 ± .010	.090 ± .010	.200 ± .015	.025 ± .002	1200-1.0	360-.018
CR08	—	CKR08	—	.290 ± .010	.290 ± .010	.145 ± .015	.200 ± .015	.025 ± .002	1.2-2.0	—
MR07	—	—	CCR07/CC07	.480 ± .020	.480 ± .020	.140 ± .010	.400 ± .020	.025 ± .002	—	2200-.10
MR08	—	—	CCR08/CC08	.480 ± .020	.480 ± .020	.240 ± .010	.400 ± .020	.025 ± .002	—	3900-.068

Mil-C-39014 (Molded Axial Leads)

	Per Mil-Spec			Case Size			Capacitance Range	
AVX Style	MIL-C-11015	MIL-C-39014	MIL-C-20	Length (L)	Diameter (D)	Lead Diameter (LD)	MIL-C-39014	MIL-C-20
MA10	CK12	CKR11	CCR75/CC75	.160 ± .010	.090 ± .010	.019 ± .002	10-.10	1-680
MA20	CK13	CKR12	CCR76/CC76	.250 ± .010	.090 ± .010	.019 ± .002	5600-.047	82-1000
MA40	CK14	CKR14	CCR77/CC77	.390 ± .010	.140 ± .010	.025 ± .002	.012-.27	150-5600
MA50	CK15	CKR15	CCR78/CC78	.500 ± .020	.250 ± .015	.025 ± .002	.056-1.0	820-.027
MA60	CK16	CKR16	CCR79/CC79	.690 ± .020	.350 ± .015	.025 ± .002	.47-3.3	3900-.082

Mil-C-39014 (2-Pin DIP)

AVX Style	MIL-C-39014	Length (L)	Height (H_1)	Height (H_2)	Thickness	Capacitance Range
MD01	CKR22	.260 ± .020	.128 ± .007	.165 max.	.092 ± .006	1.0-.1
MD02	CKR23	.260 ± .020	.155 ± .007	.185 max.	.092 ± .006	560-.22
MD03	CKR24	.260 ± .020	.283 ± .007	.320 max.	.092 ± .006	.12-1.0

Mil-C-55681 (Chips)

AVX Style	Per MIL-C-55681	Length (L)	Width (W)	Thickness (T) Max.	Thickness (T) Min.	Capacitance Range
0805	CDR01	.080 ± .015	.050 ± .015	.055	.020	10-4700
1805	CDR02	.180 ± .015	.050 ± .015	.055	.020	220-.022
1808	CDR03	.180 ± .015	.080 ± .015	.080	.020	330-.068
1812	CDR04	.180 ± .015	.125 ± .015	.080	.020	1200-.18
1825	CDR05	$.180^{+.020}_{-.015}$	$.250^{+.020}_{-.015}$	.080	.020	3900-.33
2225	CDR06	.225 ± .020	.250 ± .020	.080	.020	6800-.47

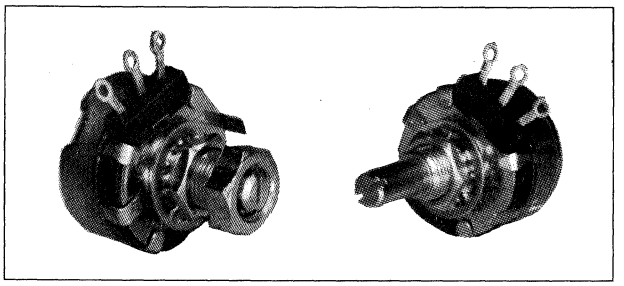
Contact AVX for Military Part Numbers.

Where to Order: AVX Corporation, Myrtle Beach, SC 29577 Tel: (803) 448-9411 TWX: 810-661-2252
AVX Corporation, Conway, SC 29526 Tel: (803) 293-4404
AVX Corporation, Olean, NY 14760 Tel: (716) 372-6611 TWX: 510-245-2815
AVX Limited, Aldershot, England Tel: (0252) 312131 Telex: 858473
AVX Asia Limited, Hong Kong Tel: 3-689-171-5 Telex: 49576 AVX AS HX

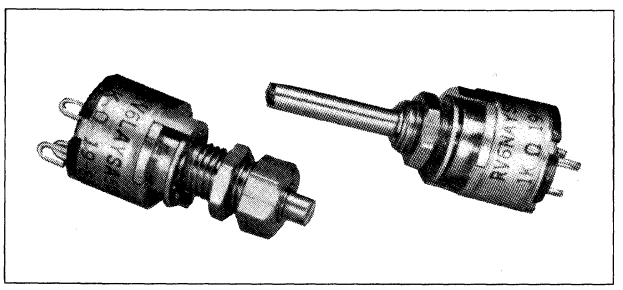
For specific capacitance ranges and other AVX Products . . . see pages **A**•1019-1023

CLAROSTAT

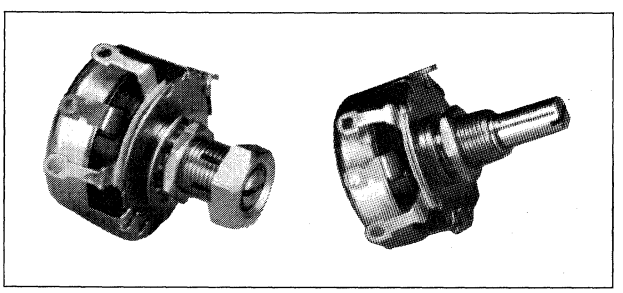
MILITARY POTENTIOMETERS



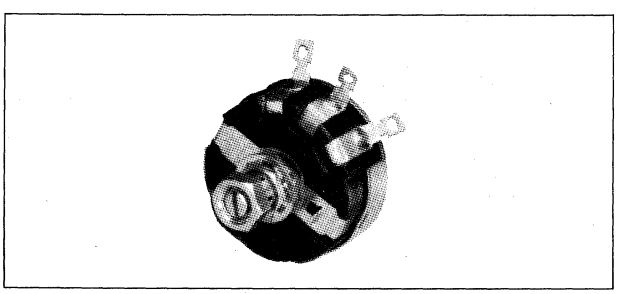
RV4
1 3/32" dia. x 9/16"
2 watts @ 70°C, conductive plastic
50 ohms to 5 meg ohms, ±10%, ±20%, linear or audio
Rotary switches available
Special features: Locking bushing, shaft and panel seals



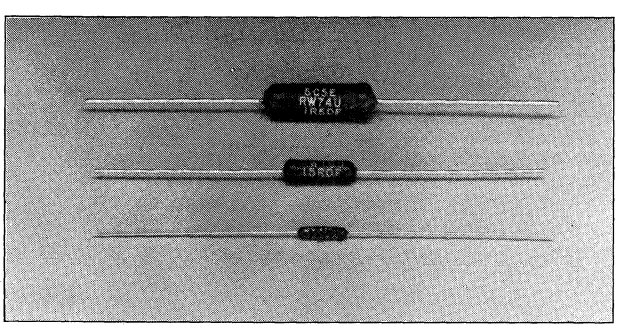
RV6
1/2" dia. x 29/64"
1/2 watt @ 70°C, conductive plastic
100 ohms to 1 meg ohms, ±10%, ±20%, linear or audio
Special features: Locking bushing, shaft and panel seal



RA20
1 3/32" dia. x 5/8"
2 watts @ 40°C, wirewound
3 ohms to 15K ohms, ±10%, linear or audio
Rotary switches available
Special features: Locking bushing, shaft and panel seals



RA30
1 23/32" dia. x 13/16"
4 watts @ 40°C
3 ohms to 25K ohms, ±10%, linear or audio
Rotary switches available
Special features: Locking bushing, shaft and panel seals



RW: Silicone Coated Axial Lead–
Military ±1% Tolerance

Wattage	Core Dia.	Core Length	Tolerance	Resist. Range (Ohms)
RW70U				
1	.094	.406	±1%	.1–3K
RW79U				
3	.187	.560	±1%	.1-10K
RW74U				
5	.312	.875	±1%	.1–25K

INFODEX

DISPLAY SYSTEMS TECHNOLOGIES

For MIL-SPEC custom or off-the shelf CRT & EL FLAT PANEL DISPLAY MONITORS

FIRST With Sunlight Readable Electroluminescent (EL) Monitors... Tough Enough to be Mounted on a Gun

MODEL EL66M44
4″ × 4″ Integrated Radar System Weapon Display

FIRST X-Y Display with Dual Deflection...Electrostatic and Magnetic ...Error Free Summing System

MODEL 27M135
21″ X-Y Monochrome CRT for Aircraft Carrier Landing Systems

For over 20 years, Infodex has met the demands of major military electronics suppliers with tough, reliable and compact video monitors.

From 1″ helmet-mounted displays to 5″ communications jamming screens, to a 21″ landing system monitor for carrier-based jets, Infodex products have shown a consistent ability to perform under the most extreme conditions of shock, vibration, EMI, temperature, humidity and altitude.

Infodex engineers shaped the future of military video monitoring with an advanced sunlight-readable, Flat Panel electroluminescent display panel for battlefield use.

When the Armed Forces of the United States need video monitors as rugged and reliable as the men whose lives depend on them, they count on Infodex.

- Infodex products and systems satisfy a full range of military specifications including MIL-STDs 810C and 454 (Design and Workmanship) and MIL-I-45208 level of MIL-STD 9858 (Quality Assurance).
- Infodex products may be found in military applications as diverse as Ground-based and Airborne Electronic Warfare Systems, C³I, Flight Simulators, Data Communications devices, Radar Bomb Directors, Jet Engine Performance Test Centers, Marine Sonar, and Periscope Optics.
- Infodex customers number some of the largest and most demanding military suppliers in the U.S.: Bell Aerospace, Raytheon, Lockheed, Martin Marietta, General Dynamics, United Technologies, LTV, and Sanders Associates.

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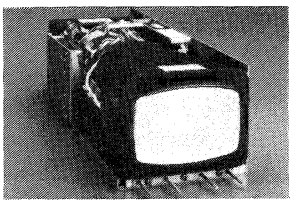
DISPLAY SYSTEMS TECHNOLOGIES

Display Monitors FOR LAND • SEA • AIR BASED SYSTEMS

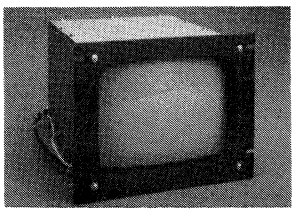
■ Responsive to your needs
■ Cost effective and price competitive
■ Limited quantity and large volume production

U.S. Army Communications Jamming System



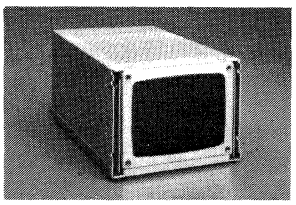
XY05-M-21
5″ diagonal electrostatic; MIL qualified; 2MHz vertical response; 28vdc

U.S. Army Radar Bomb Training System



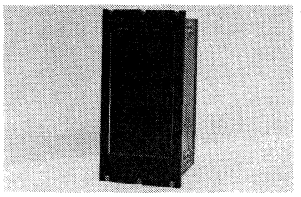
RD12-M5-145
12″ diagonal raster scan mono CRT; 15.75kHz (nominal) horizontal scan frequency; ruggedized unit; EMI/anti-reflective bonded face panel; 110vac

U.S. Navy Shipboard Test Set



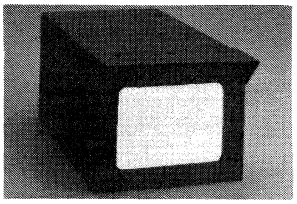
RD06-M5-138
6″ diagonal raster CRT; MIL compliant; 15.75kHz; 15vdc; bonded anti-reflective filter face panel

U.S. Navy Electronic Surveillance System



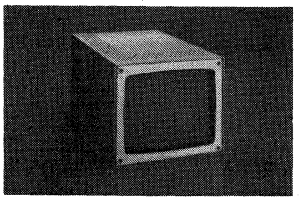
EL66M48
4″ × 8″ High Bright EL; 4 level gray scale, 1553 bus compatible

Air Force Cockpit Trainer



RD05-I5-149
5″ diagonal raster CRT; MIL-spec for aircraft use; sunlight readable; 15.75kHz; 28vdc; bonded anti-reflective filter face panel; compact unit; nonreflecting, flat black enclosure

U.S. Air Force F-16 Training Simulator



RD07-I5/8-140
7″ diagonal raster CRT; 15.75kHz and 26.25kHz horizontal scan; the dual line rate unit automatically senses 525 or 875 line input and switches to accommodate; ruggedized/ bonded face panel; 28vdc

Let us show you why Infodex should be your source for High-Performance, High-Resolution Monochrome and Color CRTs and Flat Panel EL displays...

CALL OR FAX YOUR REQUIREMENTS TO 203/879-4944

***See our ad for Industrial and Medical Displays on Page B•1088**

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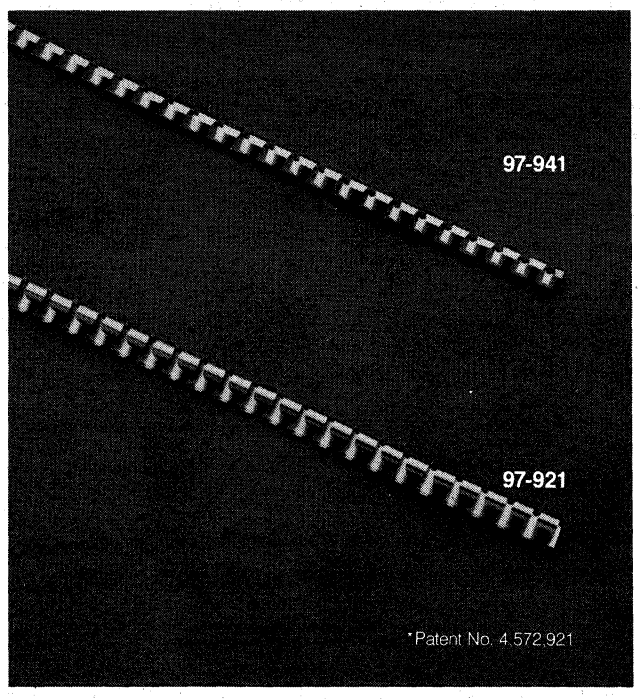
Shielding Flexible Low Compression Series



Series 97-941/921 are low-compression, flexible beryllium copper contact strips for applications where a continuous shield must conform to irregular shapes and turn tight-radius corners in either direction.

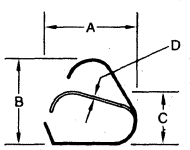
Simple snap-in installation is possible for Series 97-921 with .250″ (6,4 mm) slots and 97-941 with .187″ (4,7 mm) slots. However, soft-solder or conductive adhesive can be used for mounting to flat surfaces.

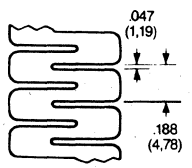
Shielding effectiveness is greater than 80 dB @ 100 MHz, plane wave.

Available in standard 24″ (610 mm) lengths in all standard finishes

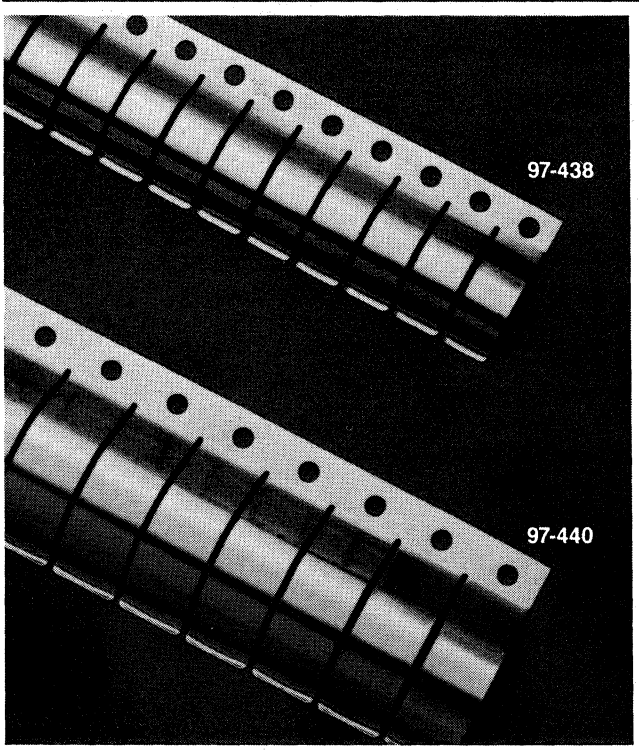
Flexible Low-Compression Series

Series	A	B	C	D	Length
97-941	.20 (5,1)	.17 (4,3)	.11 (2,8)	.003 (0,08)	24.0 (610)
97-921	.26 (6,6)	.23 (5,8)	.14 (3,6)	.003 (0,08)	24.0 (610)





Shielding Large Enclosure Series



Shielding Gaskets for Large Enclosures

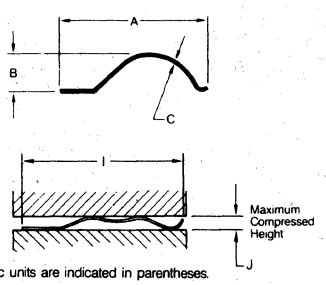
These standard beryllium copper contact gaskets offer ideal RFI/EMI shielding of doors and movable components in electronic screen rooms, trailers, computers and communication equipment.

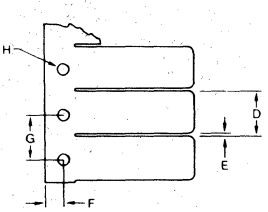
They have been scientifically designed for wiping closures, but are also usable in compression. Moreover, these contact strips feature extremely good endurance life, as well as a high deflection range. In tests, attenuation up to 112 dB has been measured at 100 MHz plane wave. Fastening of strip is usually accomplished using screws or rivets. Soldering is optional.

For pricing, please advise catalog number, total footage and surface finish required. Available in continuous lengths to a maximum of 25 ft (7,6 M) and in all standard finishes

Large Enclosure Series

Series	A Ref	B Min	C	D	E	F	G	H Dia.	I	J	Length ft (M)
97-438	1.09 (27,7)	.25 (6,4)	.005 (0,13)	.375 (9,53)	.040 (1,02)	.16 (4,1)	.38 (9,7)	.14 (3,6)	1.27 (32,3)	.06 (1,5)	25 (7,6)
97-440	1.63 (41,4)	.41 (10,4)	.007 (0,18)	.500 (12,7)	.040 (1,02)	.19 (4,8)	.50 (12,7)	.14 (3,6)	1.90 (48,3)	.06 (1,5)	25 (7,6)

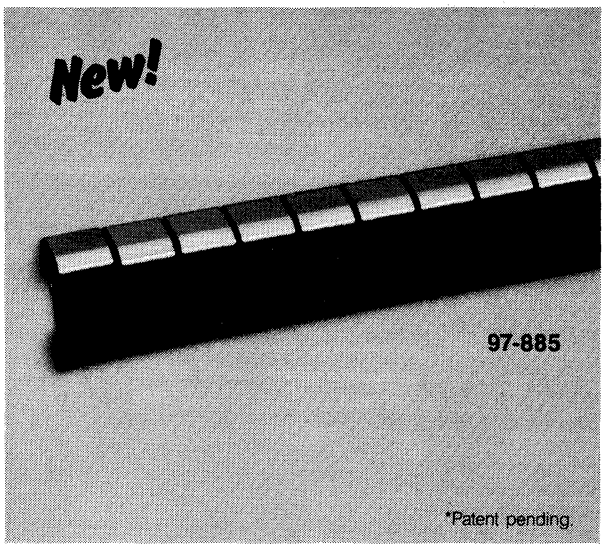




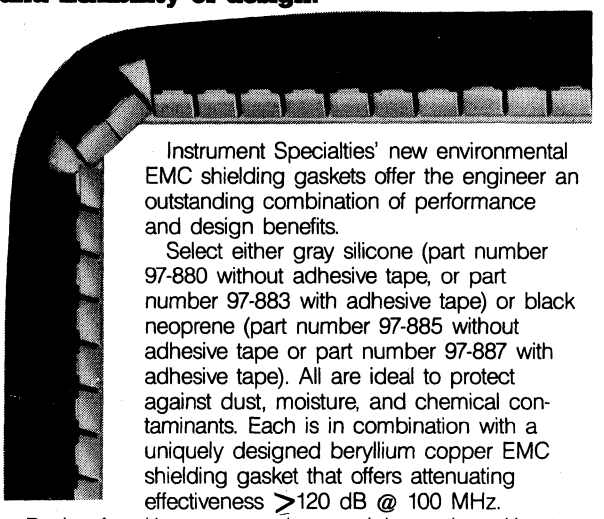
Metric units are indicated in parentheses.

Instrument Specialties Co., Inc.
Delaware Water Gap, PA 18327-0136
TEL: 717-424-8510; FAX: 717-424-6213

Shielding Environmental Low-Compression Gaskets



Environmental EMC shielding gaskets* offer low compression force, high attenuation, and flexibility of design.

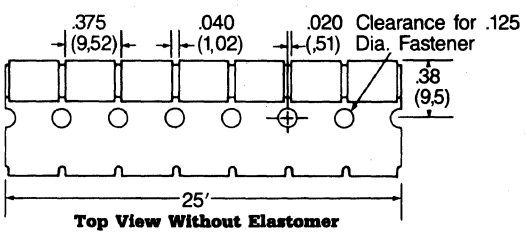


Instrument Specialties' new environmental EMC shielding gaskets offer the engineer an outstanding combination of performance and design benefits.

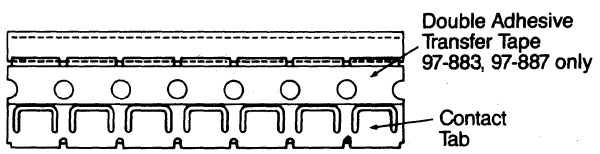
Select either gray silicone (part number 97-880 without adhesive tape, or part number 97-883 with adhesive tape) or black neoprene (part number 97-885 without adhesive tape or part number 97-887 with adhesive tape). All are ideal to protect against dust, moisture, and chemical contaminants. Each is in combination with a uniquely designed beryllium copper EMC shielding gasket that offers attenuating effectiveness ≥120 dB @ 100 MHz.

Design for either compression or wiping action without compromising shielding effectiveness, each requiring minimal compression force. Easily mounted with fasteners or optional Sticky Fingers® adhesive tape.

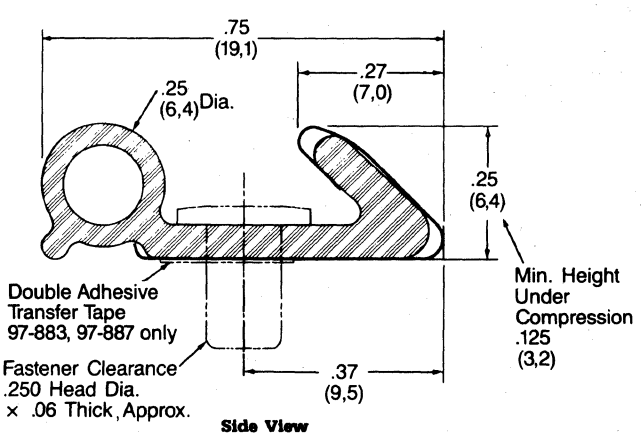
Both Series have been successfully tested on NEMA 12 enclosures and are UL 94 and UL 508 rated. Gaskets to meet NEMA 4 and other special requirements are available upon request.



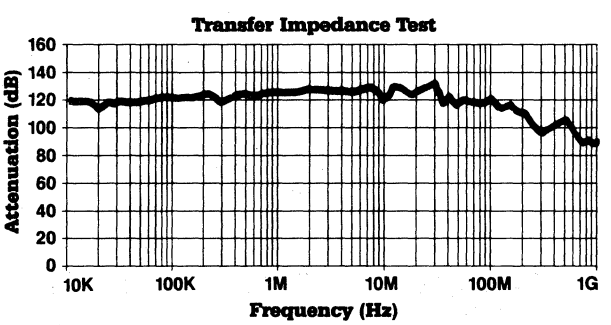
Top View Without Elastomer

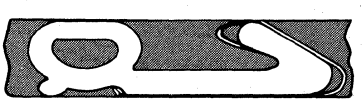


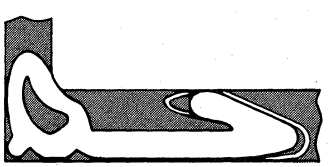
Bottom View With Elastomer



Side View




Compression


Wiping

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Delaware Water Gap, PA 18327-0136
TEL: 717-424-8510; FAX: 717-424-6213

Metric units are indicated in parentheses.

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF piccfarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

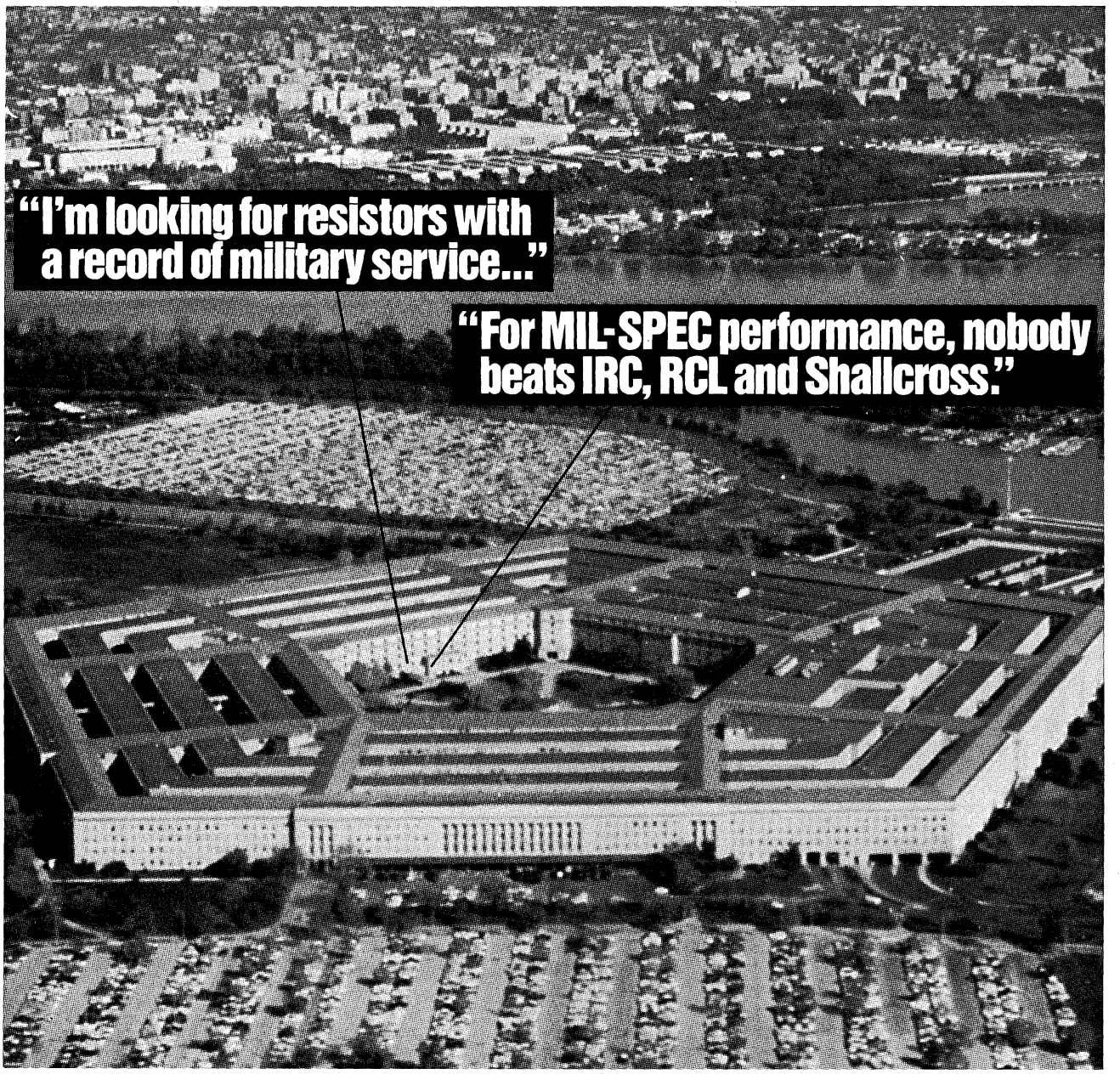
U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force



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We wrote the first MIL-SPECs for wirewound resistors; today we're still leading the way. With power wirewounds built to MIL-R-26 and MIL-R-39007. With precision resistors meeting MIL-R-93 and MIL-R-39005 levels. And with our QTA℠ Quick TurnAround program to assure timely delivery.

Specify our MIL-grade networks, matched sets and special products such as our ultra-high TCR metal element resistors. Ask for special screenings, and we deliver. Select from a variety of lead materials, or chassis mount versions built to MIL-R-18546 and MIL-R-39009.

When you're building high-performance military systems, bank on resistors that have been there — the reliable ones from RCL • Shallcross.

IRC When the brass asked for high-voltage resistors with unprecedented reliability, we stepped forward with our CGH Series. And we've received approval to test these high-performance resistors to MIL-R-49462 specifications.

In fact, we're out-front in a whole range of MIL-Qualified devices. Our SIP and DIP networks, in high- or low-profile packages, comply with MIL-R-83401.

For precision performance, our metal film RG Series fills the order in 1/8-watt to 3-watt resistors. They're built to MIL-R-55182 and MIL-R-39017 reliability levels.

IRC's GRID℠ program assures fast delivery on all our devices.

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MIL-R-83401							
MIL P/N	**MIL Style**	**IRC Type**	**Config.**	**Resistance Range**	**Tolerance**		**TCR**
M8340101 MXXXXXA	RZ010	M83401	14 Pin-3	22Ω - 100K	±2%	±5%	±300 ppm
M8340101 MXXXXXB	RZ010	M83401	14 Pin-1	22Ω - 100K	±2%	±5%	±300 ppm
M8340102 MXXXXXA	RZ020	M83401	16 Pin-3	22Ω - 100K	±2%	±5%	±300 ppm
M8340102 MXXXXXB	RZ020	M83401	16 Pin-1	22Ω - 100K	±2%	±5%	±300 ppm
M8340104 MXXXXXC	RZ040	M8340104	6 Pin 5 Res	33Ω - 100K	±2%	±5%	±300 ppm
M8340104 MXXXXXG	RZ040	M8340104	6 Pin 3 Res	33Ω - 100K	±2%	±5%	±300 ppm
M8340105 MXXXXXC	RZ050	M8340105	8 Pin 7 Res	33Ω - 100K	±2%	±5%	±300 ppm
M8340105 MXXXXXG	RZ050	M8340105	8 Pin 4 Res	33Ω - 100K	±2%	±5%	±300 ppm
M8340106 MXXXXXC	RZ060	M8340106	10 Pin 9 Res	33Ω - 100K	±2%	±5%	±300 ppm
M8340106 MXXXXXG	RZ060	M8340106	10 Pin 5 Res	33Ω - 100K	±2%	±5%	±300 ppm
M8340108 MXXXXXC	RZ080	M8340108	8 Pin 7 Res Low	22Ω - 100K	±2%	±5%	±300 ppm
M8340108 MXXXXXG	RZ080	M8340108	8 Pin 4 Res Low	22Ω - 100K	±2%	±5%	±300 ppm
M8340110 MXXXXXC	RZ090	M8340110	10 Pin 9 Res Low	22Ω - 100K	±2%	±5%	±300 ppm
M8340110 MXXXXXG	RZ090	M8340110	10 Pin 5 Res Low	22Ω - 100K	±2%	±5%	±300 ppm
M8340107 XXXXXXC	RZ070	4961	6 Pin 5 Res	100Ω - 100K	±.1%	±2%	±50 ±300 ppm
M8340107 XXXXXXG	RZ070	4969	6 Pin 3 Res	100Ω - 100K	±.1%	±2%	±50 ±300 ppm
M8340108 XXXXXXC	RZ080	4981	8 Pin 7 Res	100Ω - 100K	±.1%	±2%	±50 ±300 ppm
M8340108 XXXXXXG	RZ080	4989	8 Pin 4 Res	100Ω - 100K	±.1%	±2%	±50 ±300 ppm
M8340109 XXXXXXC	RZ090	4901	10 Pin 9 Res	100Ω - 100K	±.1%	±2%	±50 ±300 ppm
M8340109 XXXXXXG	RZ090	4909	10 Pin 5 Res	100Ω - 100K	±.1%	±2%	±50 ±300 ppm
M8340101 XXXXXXA	RZ010	M989	14 Pin 7 Res	50Ω - 100K	±.1%	±1%	±25 ±150 ppm
M8340101 XXXXXXB	RZ010	M987	14 Pin 13 Res	50Ω - 50K	±.1%	±1%	±25 ±150 ppm
M8340102 XXXXXXA	RZ020	M999	16 Pin 8 Res	50Ω - 100K	±.1%	±1%	±25 ±150 ppm
M8340102 XXXXXXB	RZ020	M998	16 Pin 15 Res	50Ω - 50K	±.1%	±1%	±25 ±150 ppm
M8340101 XXXXXXA	RZ010	1989	14 Pin 7 Res	100Ω - 100K	±.1%	±2%	±25 ±300 ppm
M8340101 XXXXXXB	RZ010	1987	14 Pin 13 Res	100Ω - 70K	±.1%	±2%	±25 ±300 ppm
M8340102 XXXXXXA	RZ020	1999	16 Pin 8 Res	100Ω - 100K	±.1%	±2%	±25 ±300 ppm
M8340102 XXXXXXB	RZ020	1998	16 Pin 15 Res	100Ω - 70K	±.1%	±2%	±25 ±300 ppm
M8340103 XXXXXXA	RZ030	8989	14 Pin 7 Res	49.9Ω - 121K	±.1%	±2%	±25 ±300 ppm
M8340103 XXXXXXB	RZ030	8987	14 Pin 13 Res	49.9Ω - 121K	±.1%	±2%	±25 ±300 ppm
MIL-R-39017 - Precision MIL Qualified Metal Glaze							
RLR05/S		RGR05	1/8 @ 70°C	10Ω–300KΩ	±1%	±2%	100
RLR07/S		RGR07	1/4 @ 70°C	10Ω–3.01MΩ	±1%	±2%	100
RLR20/S		RGR20	1/2 @ 70°C	4.3Ω–3.01MΩ	±1%	±2%	100
RLR32/S		RGR32	1 @ 70°C	10Ω–2.7MΩ	±1%	±2%	100
MIL-R-55182 - Precision MIL Qualified Metal Glaze							
TH55		RNC55H/S	1/10 @ 125°C	10Ω–2MΩ	±.1, .5, 1%		50
TK55		RNC55K/S	1/10 @ 125°C	10Ω–2MΩ	±.1, .5, 1%		100
TJ55		RNC55J/S	1/10 @ 125°C	10Ω–2MΩ	±.1, .5, 1%		25
TH60		RNC60H/S	1/8 @ 125°C	10Ω–3.01MΩ	±.1, .5, 1%		50
TK60		RNC60K/S	1/8 @ 125°C	10Ω–3.01MΩ	±.1, .5, 1%		100
TJ60		RNC60J/S	1/8 @ 125°C	10Ω–3.01MΩ	±.1, .5, 1%.		25
TH65		RNC65H/S	1/4 @ 125°C	10Ω–3.01MΩ	±.1, .5, 1%		50
TK65		RNC65K/S	1/4 @ 125°C	10Ω–3.01MΩ	±.1, .5, 1%		100
TJ65		RNC65J/S	1/4 @ 125°C	10Ω–3.01MΩ	±.1, .5, 1%		25
MAR5		MAR5	1/10 @ 85°C	10Ω–3.01MΩ	±.1, .5, 1%		25, 50, 100

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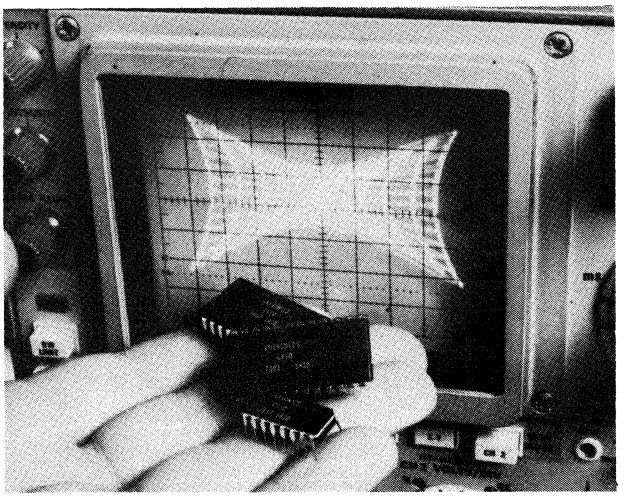
MILITARY QUALIFIED RESISTIVE PRODUCTS

MIL Style	RCL Type	Wattage	Resistance	Tolerance	Max. Working Voltage
MIL-R-39007					
RWR 81	PR268	1	.1 - 1K	±.1 to ±1%	31.6
RWR 82	PR66	1.5	.1 - 1.3K	±.1 to ±1%	44.2
RWR 71	PR462	2	.1 - 16.2K	±.1 to ±1%	180.0
RWR 80	PR249	2	.1 - 3.16K	±.1 to ±1%	79.5
RWR 89	PR261	3	.1 - 4.12K	±.1 to ±1%	111.2
RWR 74	PR446	5	.1 - 12.1K	±.1 to ±1%	246.0
RWR 84	PR246	7	.1 - 12.4K	±.1 to ±1%	294.6
RWR 78	PR433	10	.1 - 39.2K	±.1 to ±1%	626.1
MIL-R-26					
RW 81	T 1/2-A81	1	.1 - 2K	±.1 to ±1%	31.6
RW 70	T 1A-70	1	.1 - 6.5K	±.1 to ±1%	56.2
RW 80	T-1-80	2	.1 - 10K	±.1 to ±1%	79.4
RW 69	T-2A-69	3	.1 - 18K	±.1 to ±1%	77.5
RW 79	T-2B-79	3	.1 - 22K	±.1 to ±1%	177.5
RW 74	T-5-74	5	.1 - 45K	±.1 to ±1%	437.6
RW 67	T-6-67	5	.1 - 65K	±.1 to ±1%	230.9
RW 55	T-7A-55	7	.1 - 120K	±.1 to ±1%	188.9
RW 78	T-10-78	10	.1 - 150K	±.1 to ±1%	953.4
RW 68	T-10-68	11	.1 - 150K	±.1 to ±1%	469.0
MIL-R-18546					
RE-60G	AL-5	5	.1 - 16K	±1%	128.9
RE-65G	AL-10	10	.1 - 25K	±1%	237.1
RE-70G	AL-25	20	.1 - 55K	±1%	490.1
RE-75G	AL-50	30	.1 - 180K	±1%	1085.0
MIL-R-39009					
RER-40	ALN5ER	5	1.0 - 1.65K	±1%	90.8
RER-60	AL5ER	5	.1 - 3.32K	±1%	128.9
RER-45	ALN10ER	10	1.0 - 2.80K	±1%	167.3
RER-65	AL10ER	10	.1 - 5.62K	±1%	237.1
RER-50	ALN25ER	20	1.0 - 6.04K	±1%	347.6
RER-70	AL25ER	20	.1 - 12.1K	±1%	490.1
RER-55	ALN50ER	30	1.0 - 19.6K	±1%	766.8
RER-75	AL50ER	30	.1 - 39.2K	±1%	1085.0
MIL-R-93					
RB56	7009/VA	.125	.1 - 1.4M	±.01 to ±1%	200
RB75	VA	.125	.1 - 500K	±.01 to ±1%	150
RB55	7020/VA	.150	.1 - 3M	±.01 to ±1%	300
RB54	7020/VA	.250	.1 - 4.4M	±.01 to ±1%	300
RB53	7030/VA	.330	.1 - 3M	±.01 to ±1%	500
RB52/VA	7040	.500	.1 - 12M	±.01 to ±1%	750
RB71(radial)	PC	.125	.1 - 150K	±.01 to ±1%	300
RB81(radial)	4060	.125	.1 - 500K	±.01 to ±1%	300
RB70	4065	.250	.1 - 1.5M	±.01 to ±1%	150
MIL-R-39005					
RBR56	HR10	.125	.1 - 840K	±.01 to ±1%	200
RBR75	HR11	.125	.1 - 500K	±.01 to ±1%	150
RBR55	HR12	.150	.1 - 1M	±.01 to ±1%	300
RBR54	HR14	.250	.1 - 2M	±.01 to ±1%	300
RBR53	HR34	.330	.1 - 3M	±.01 to ±1%	500
RBR52	HR36	.500	.1 - 3M	±.01 to ±1%	750
RBR71(radial)	HR8	.125	.1 - 150K	±.01 to ±1%	300
RBR81(radial)	HR340	.100	.1 - 500K	±.01 to ±1%	300
RBR80	HR341	.100	.1 - 120M	±.01 to ±1%	150

*Commercial equivalents are available with higher resistance values and wattage ratings, consult factory for special applications.

Intronics C 300/400 SERIES

MONOLITHIC WIDEBAND CRT DISTORTION CORRECTION DEVICE



FEATURES

- 16 pin ceramic dip (C300 Series)
- Minimum of external components required
- Easily adjusts for yoke errors
- Accuracy better than 0.5% Max (C312)
- Bandwidth compatible with 10MHz systems
- Both geometry and focus available
- MIL 883C available
- Low cost

APPLICATIONS (for Vector Displays Only)

- Military Displays

  HUDS ATC

  HDDS PPI

- Simulators

  Shadow mask

- Phototypesetting equipment
- Computer Output Microfilm displays
- Computer driven graphic displays
- Medical monitors
- CAD displays
- TV Cameras and projection systems

TRANSFER FUNCTION:

GEOMETRY CORRECTION

$V_X = -x(x^2+y^2)$

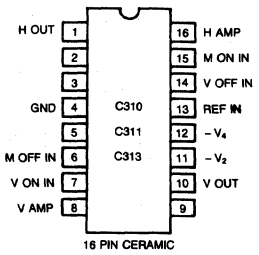
$V_Y = -y(x^2+y^2)$

FOCUS CORRECTION

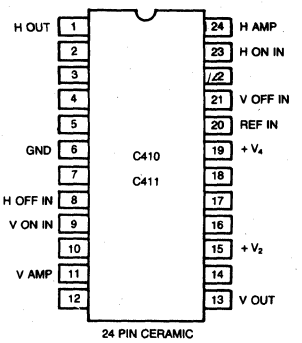
$V_F = -(x^2+y^2)$

PINOUT

H = HORIZONTAL
V = VERTICAL



16 PIN CERAMIC



24 PIN CERAMIC

DESCRIPTION

The Intronics C300/400 Series are monolithic devices that accurately correct for geometric or focus distortion in CRT displays. The C300 (16 pin DIP) series provides wideband, accurate full face geometry or focus correction with few external components. These units connect between the horizontal and vertical inputs and their deflection amplifiers. Simple external adjustments provide for correction magnitude, horizontal/vertical keystone and curvature symmetry. The C400 series (24 pin DIP) is a full Mil temp range. −55°C to +125°C device.

The principle of operation is based on circuitry which smoothly synthesizes a correction function that closely approximates the exact mathematical correction function.

SPECIFICATIONS

Bandwidth	
Correction only	2MHZ Min.
Resulting corrected signal	6MHZ Min.
Slow Rate	
Correction only	15V/μs
Resulting corrected signal	120V/μs
Setting Time To 1%	
Correction only	300ns
Resulting corrected signal	2μs
Delay Time	50ns
Accuracy	
Horizontal	2% F.S.
Vertical	2% F.S.

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- MIL-C-27500
- MIL-W-81044
- MIL-W-16878

Judd Wire manufactures a complete line of wire and cable for military electronic and electrical systems. Under the ZELRAD® (MIL-W-22759/32-46) and AERORAD® (MIL-W-81044/8-13) trade names, Judd can fill virtually any requirement for dual and single insulation systems including irradiation cross-linked modified ethylene-tetrafluoroethylene (XLETFE) or polyalkene and cross-linked polyvinylidene fluoride (XLPVDF) insulation systems that meet or exceed stringent military specifications.

Key performance characteristics of ZELRAD and AERORAD are:

- Lightweight.
- Small Size.
- Great Flexibility.
- Excellent High and Low Temperature Properties.
- Resistance to Flame, Mechanical Abrasion, Solder Iron, Chemical Degradation and Radiation.
- Ease of Processability.

Judd cables are comprised of ZELRAD or AERORAD wires that meet or exceed QPL military specification MIL-C-27500. Data Bus or other multiconductor cables that require special electrical, shielding or testing capabilities are available upon request.

For ground support and communications systems requiring temperature ranges from 105 °C to 125 °C, and voltage ratings to 3000, Judd offers MIL-W-16878 with FLEXRAD 125® an irradiation cross-linked polyethylene (XLPE), and PCA, an irradiation cross-linked polyvinyl chloride (XLPVC).

SPECIFICATION GUIDE

SPECIFICATION	CONDUCTOR	VOLTAGE	TEMPERATURE RATINGS	AWG SIZES
ZELRAD MIL-W-22759/32 thru 46	Tinned copper. Silver coated high strength copper alloy. Silver coated copper. Nickel coated high strength copper alloy. Nickel coated copper.	600	150 °C-200 °C	30-2/0
AERORAD MIL-W-81044/8 thru 13	Tinned copper. Silver coated high strength copper alloy. Silver coated copper.	600	150 °C	30-14
FLEXRAD 125 MIL-W-16878/14-16	Tinned copper.	600-3000	125 °C	30-12
PCA MIL-W-16878/1 thru 3	Tinned copper.	600-3000	105 °C	30-2

To discuss your requirements, please write or call us.

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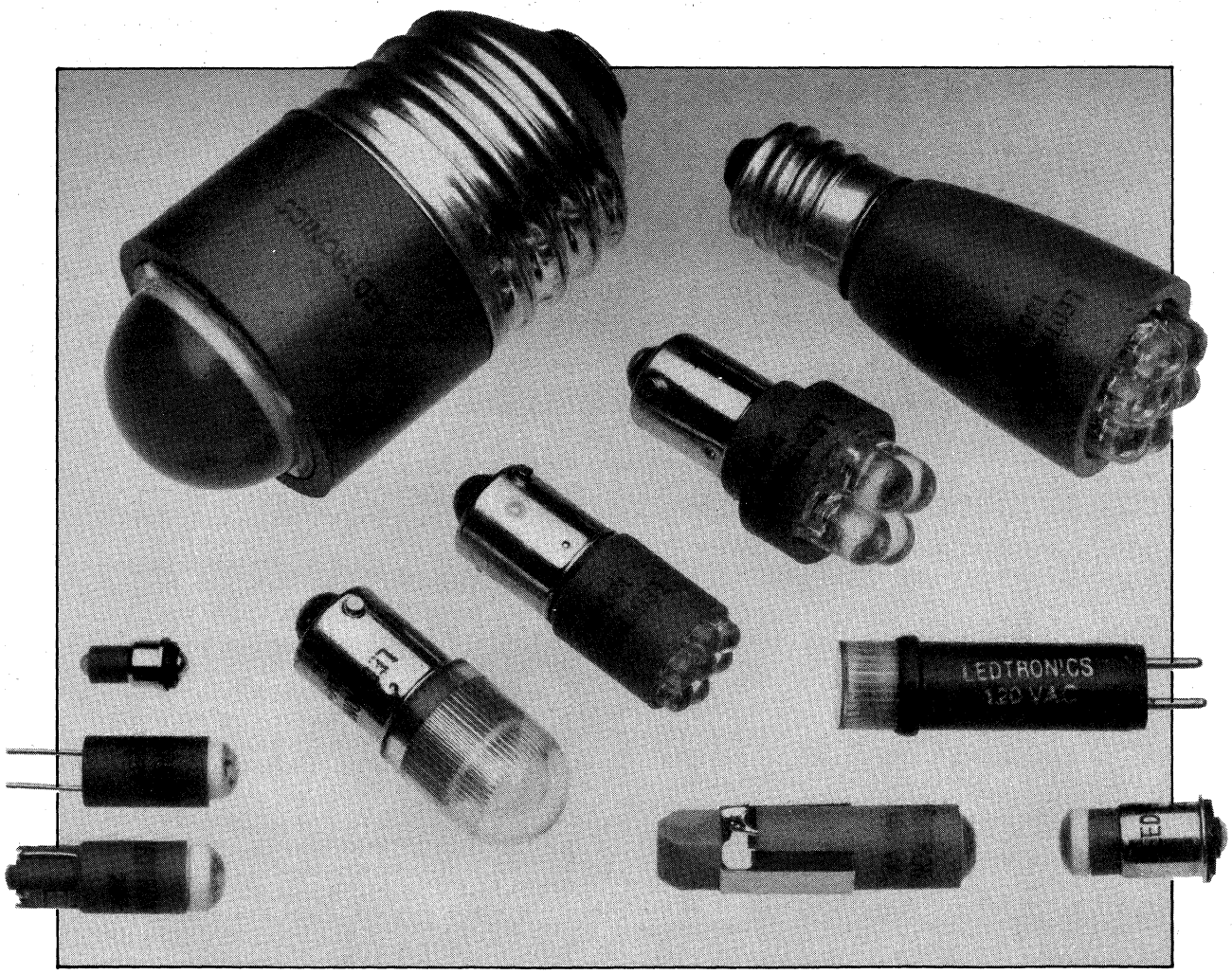

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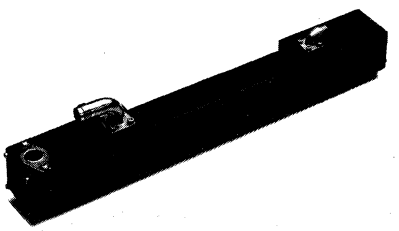
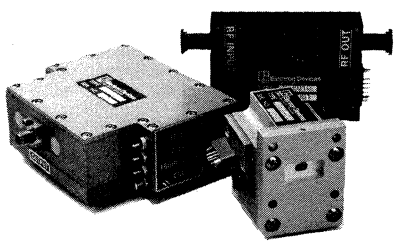
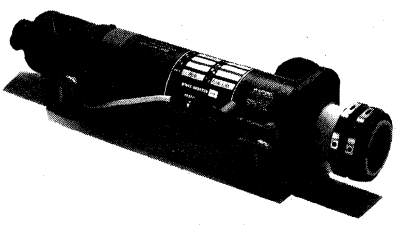


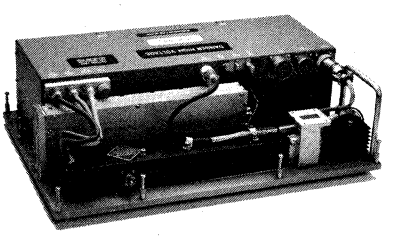
Helix Traveling Wave Tubes



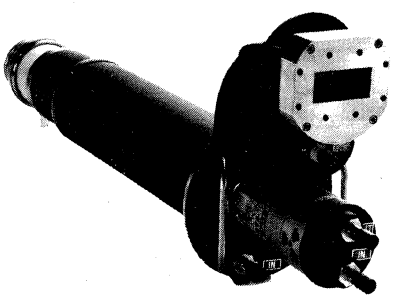
Solid State Amplifiers and Oscillators



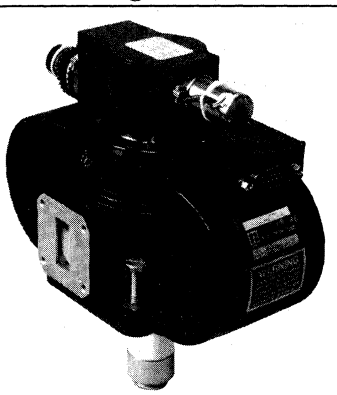
Coupled Cavity Traveling Wave Tubes



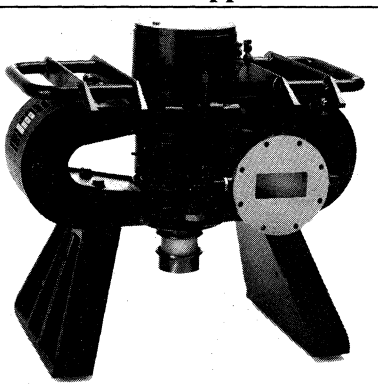
Traveling Wave Tube Amplifiers and Power Supplies



Klystrons



Magnetrons



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Electron Devices

MEPCO/CENTRALAB
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STANDARD RESISTOR MIL SPECIFICATION APPROVALS

RESISTORS:	RL standard military: 2% and 5% metal film resistor —RL07 (¼ watt) and RL20 (½ watt) —temperature coefficient: ±100 ppm/°C	MIL-R-22684
	RN standard military: 0.1% to 1% metal film resistor —RN50, RN55, RN60, RN65 styles	MIL-R-10509
	RLR established reliability: 1% and 2% metal film resistor —RLR05, RLR07 and RLR20 —temperature coefficient: ±100 ppm/°C —failure rate: S (.001% per 1000 hrs)	MIL-R-39017
	RNC established reliability: 0.1% to 1% metal film resistor —RNC50, RNC55, RNC60, RNC65 —resistance tolerance: ±0.1%, 0.5%, 1.0% —failure rate: S (.001% per 1000 hrs.) —temperature coefficient: K (±100 ppm/°C), H (±50 ppm/°C), J (±25 ppm/°C) —non-hermetic seal	MIL-R-55182
	RNR/RNN established reliability: 0.1% to 1% metal film resistor —RNR55, RNR60, RNR65 —resistance tolerance: ±0.1%, 0.5%, 1.0% —failure rate: S (.001% per 1000 hrs) —temperature coefficient: C (±50 ppm/°C, E (±25 ppm/°C) —glass hermetic seal	MIL-R-55182
NETWORKS:	Single-In-Line (S.I.P.'s) —RZ040, RZ050, and RZ060 (High Profile); RZ070, RZ080, RZ090 (Low Profile) —resistance tolerance: ±1.0%, 2.0%, 5.0% —temperature coefficient: ±100 ppm and ±300 ppm/°C —resistance range: 10 ohm — 1M —6 pin, 8 pin, and 10 pin	MIL-R-83401/04/05/06/07/08/09
	Flat Packs —RZ030 —resistance tolerance: ±1.0%, 2.0%, 5.0% —temperature coefficient: ±100 ppm and ±300 ppm/°C —resistance range: 100 ohm — 100K —14 pin	MIL-R-83401/03
TRIMMER RESISTORS:	RJ24/RJR24 cermet trimmer —multiturn, ⅜" square —resistance range: 10 ohm — 1M —resistance tolerance: ±10% —temperature coefficient: ±100 ppm/°C (standard) RJ24 RJR24—approved to Failure Rate R	MIL-R-22097/MIL-R-39035
	RJ26/RJR26 cermet trimmer —multiturn, ¼" square —resistance range: 10 ohm — 1M —resistance tolerance: ±10% —temperature coefficient: ±100 ppm/°C (standard) RJ26 RJR26—approved to Failure Rate R	MIL-R-22097/MIL-R-39035
	RJ50 cermet trimmer —single turn, ¼" diameter round —resistance range: 10 ohm — 1M —resistance tolerance: ±10% —temperature coefficient: ±100 ppm/°C (standard)	MIL-R-22097

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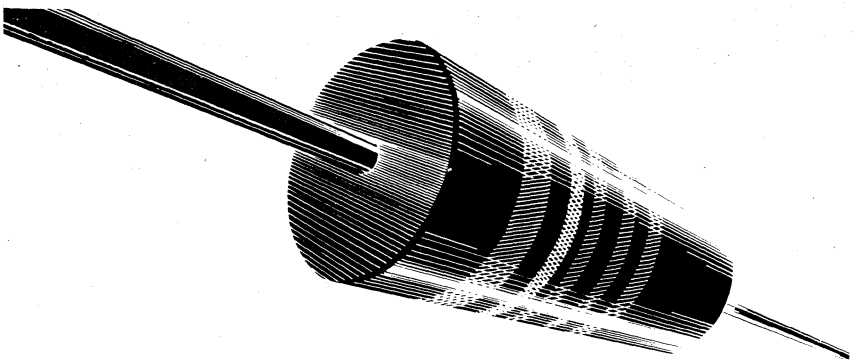
STANDARD CAPACITOR MIL SPECIFICATION APPROVALS

TANTALUM:

Wet Slug		MIL-C-3965
CL14/CL16	hermetic seal, screw mount, cylindrical case	
CL17/CL18	hermetic seal, stud mount, cylindrical case	
CL55	hermetic seal, rectangular module	
CL64/CL65	elastomer seal, axial lead, tubular case	
CL66/CL67	hermetic seal, axial lead, tubular case	
Wet Slug, established reliability		MIL-C-39006
CLR10	extended range, cylindrical case, solder lug terminal	
CLR14	extended range, cylindrical case, solder lug terminal	
CLR17	extended range, cylindrical case, solder lug terminal	
CLR65	glass-to-tantalum hermetic seal, axial lead, tubular case	
CLR79	hermetic seal, tantalum case, axial lead, tubular case	
CLR81	extended range, hermetic seal, tantalum case, axial lead, tubular case	
Wet Foil		MIL-C-3965
CL20/CL21	polar, etched foil, tubular case, axial lead	
CL22/CL23	non-polar, etched foil, tubular case, axial lead	
CL30/CL31	polar, plain foil, tubular case, axial lead	
CL32/CL33	non-polar, plain foil, tubular case, axial lead	
CL51	polar, plain foil, KSR, hermetic rectangular module	
CL52	non-polar, plain foil, KSR, hermetic rectangular module	
CL53	polar, etched foil, KSR, hermetic rectangular module	
CL54	non-polar, etched foil, KSR, hermetic rectangular module	
CL70/CL71	polar, high etched foil, tubular case, axial lead	
CL72/CL73	non-polar, high etched foil, tubular case, axial lead	
Wet Foil, established reliability		MIL-C-39006
CLR25	polar, etched foil, hermetic and non-hermetic, axial lead	
CLR27	non-polar, etched foil, hermetic and non-hermetic, axial lead	
CLR35	polar, plain foil, hermetic and non-hermetic, axial lead	
CLR37	non-polar, plain foil, hermetic and non-hermetic, axial lead	
CLR71	polar, high etched foil, hermetic and non-hermetic, axial lead	
CLR73	non-polar, high etched foil, hermetic and non-hermetic, axial lead	
Solid Slug		MIL-C-26655
CS12/CS13	hermetic seal, axial lead, tubular case	
Solid Slug, established reliability		MIL-C-39003
CSR09	polar, miniature, hermetic seal, axial lead, tubular case	
CSR13	polar, hermetic seal, axial lead, tubular case	
CSR21	polar, high frequency, hermetic, tubular case, axial lead	
CSR23	polar, extended range, hermetic seal, axial lead, tubular case	
CSR33	polar, extended range, hermetic seal, for low impedance application	
CSR91	non-polar, hermetic seal, axial lead, tubular case	
Solid Chip, established reliability		MIL-C-55365
CWR06	polar hybrid tantalum chip	

For information on Mepco/Centralab's RESISTORS/CAPACITORS, SEE PAGES A•1981-A•1984, A•1120-A•1124

Nytronics Inductors



HI-REL . . .
Nytronics Inductors are fully qualified to the established reliability spec MIL-C-39010 in styles /1 through /10. But, Nytronics Inductors also meet the requirements of a **higher authority!** They are widely used in heart pacers to provide RF protection. . . . It's a life or death matter. . . . Literally.

AVAILABILITY . . .
Off-the-shelf from a distributor near you.

NCG part number. The military part number shall consist of the letter "M", the basic document number, and an assigned dash number as shown in the following:

M	39010/02	A	1R0	K	S
Military designator	Document sheet number	Class	Inductance	Inductance tolerance	Failure rate level

Class. The classes of coils denoting the maximum operating temperatures are identified by a single letter in accordance with MIL-C-39010 slash sheets.

Maximum operating temperature

Class	Temperature
A ------	105°C
B ------	125°C

UPDATE

UNITS HOURS: 603, 770, 090
Date: 12-30-88

New High Reliability Qualification	
MIL-C-39010-1	MIL-C-39010-6
MIL-C-39010-2	MIL-C-39010-7
MIL-C-39010-3	MIL-C-39010-8
MIL-C-39010-4	MIL-C-39010-9
MIL-C-39010-5	MIL-C-39010-10

BROAD LINE . . .

There's a Nytronics Inductor to meet every need from 0.10uH to 180kuH.

With sizes ranging from the world's smallest shielded inductor to the most complex variable inductor . . . shielded, unshielded and variable, in hundreds of off-the-shelf values . . . it makes good sense to check first with Nytronics or your local distributor.

FIXED SHIELDED INDUCTORS
Super Wee Ductor
MS75087, MS75088, MS75089
MS90537
Super Wee Wee Ductor MS21399-21401
Wee Ductor
Wee Wee Ductor
Pee Wee Ductor
Pee Cee Ductor
SDD

FIXED NON-SHIELDED INDUCTORS
Deci Ductor
Mili Ductor
MS75083, MS75084, MS75085
RFC-SS MS18130, MS14046, MS90538
RFC-S MS21389, MS21390
MS75008, MS75101, MS90539
RFC-M MS21388
RFC-L MS21380
Pee Dee Ductor

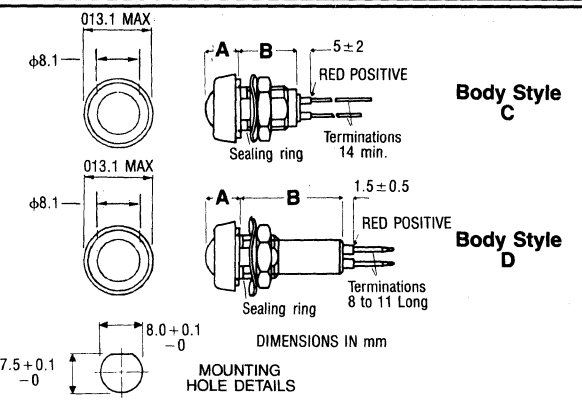
VARIABLE INDUCTORS
Wee V-L (Shielded) MS21381, MS21402
H Wee V-L (Shielded) MS21381, MS21402
VIV (Non-Shielded)
VIH (Non-Shielded)

Nytronics Components Group, Inc.
700 ORANGE STREET, DARLINGTON, S.C. 29532
(803) 393-5421 -- TWX 810-665-2182 -- FAX (803) 393-4123

OXLEY MILITARY COMPONENTS

Approved LED Indicators

- U.S. DoD DESC and EUROPEAN APPROVALS
- HIGH RELIABILITY, FULLY BURNT-IN TO MIL-S-19500
- SUNLIGHT READABLE TO 100,000 lux
- HIGH BRIGHTNESS
- E.M.I. and TEMPEST PROTECTION
- ENVIRONMENTALLY SEALED
- SECURE I.R. FREE AND N.V.G. COMPATIBLE
- PANEL SEALING
- RUGGED CONSTRUCTION



DESC PART NO. (SEE NOTE)	FEATURES								DIMENSIONS IN mm			OXLEY SIMILAR PART NO.
	HIGH BRIGHTNESS	SUNLIGHT READABLE	EMC MESH	SECURE IR FREE	WIDE ANGLE VIEWING	NARROW ANGLE VIEWING	REAR SEAL	ANTI-REFLECTION COATING	BODY STYLE	A	B	
85122-X01	●				●				C	6.5	11	PS/LH/8
85122-X02	●				●		●		D	6.5	19	STR/LH/8
85122-X03		●				●			C	5.5	11	PS/LH/8/RAF
85122-X04		●			●				C	5.5	11	PS/LH/8/RAPP
85122-X05		●				●	●		D	5.5	19	STR/LH/8/RAF
85122-X06		●			●		●		D	5.5	19	STR/LH/8/RAPP
85122-X07		●				●	●	●	D	5.5	19	STR/LH/8/HS/RAF
85122-X08		●			●		●	●	D	5.5	19	STR/LH/8/HS/RAPP
85122-X09		●	●			●	●	●	D	5.5	19	STR/LH/8/RAF/SES
85122-X10		●	●		●		●	●	D	5.5	19	STR/LH/8/RAPP/SES
85122-X11	●		●		●		●		D	6.5	19	STR/LH/8/SES
87019-X01		●		●			●	●	D	5.5	19	STR/LH/8/XIR
87019-X02		●	●	●			●	●	D	5.5	19	STR/LH/8/XIR/SES

NOTE: When ordering replace X in DESC No with letter to signify color R = Red, Y = Yellow, G = Green.

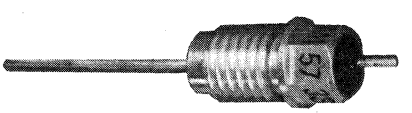
MIL-F-15733 Qualified EMI Suppression Filters

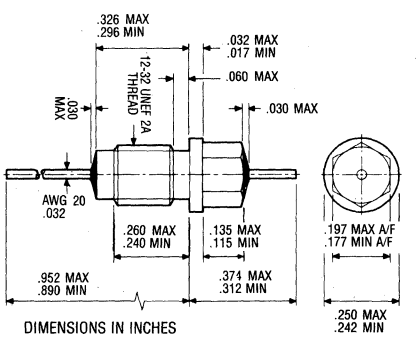
OXLEY chassis mounting pi-section EMI suppression filters are suitable for applications where high insertion loss is necessary from 10MHz to 10GHz, guaranteed over the military temperature range −55°C to 125°C. Fully qualified against MIL-F-15733 Revision G, all types are supplied with 168 hours burn-in (voltage conditioning) and 100% electrical testing, including insertion loss.

GENERAL CHARACTERISTICS

Dielectric	: CERAMOX K6000, : CERAMOX K3000
Body, Nut	: brass. QQ-B-626D
Finish	: silver to QQ-S-365
Lockwasher	: steel
Finish	: silver to QQ-S-365
Current rating	: 10A

When ordering please specify QPL designation eg. M15733/61-0007
Filters are supplied with lockwasher and hex nut.





QPL Designation (Style)	Oxley Type No.	Minimum Capacitance (pF)	Rated Voltage Vd.c.	Rated Voltage Vrms	Minimum Insertion Loss (dB) at 25°C 50 MHZ	100 MHz	200 MHz	500 MHz	1 GHz	10 GHz
M15733/61-0005	FLT8/P/1500	1500	200	140	32	45	58	70	70	70
M15733/61-0006	FLT8/P/1500	1500	200	140	32	45	58	70	70	70
M15733/61-0007	FLT8/P/5000	5000	100	70	50	65	70	70	70	70
M15733/61-0010	FLT8/P/5000	5000	100	70	50	65	70	70	70	70
M15733/61-0011	FLT8/P/5000/RP	5000	100	70	50	65	70	70	70	70

OTHER OXLEY MILITARY COMPONENTS INCLUDE:
Inductors, Trimmer Capacitors, Terminals, Test Points and Elapsed Time Indicators.

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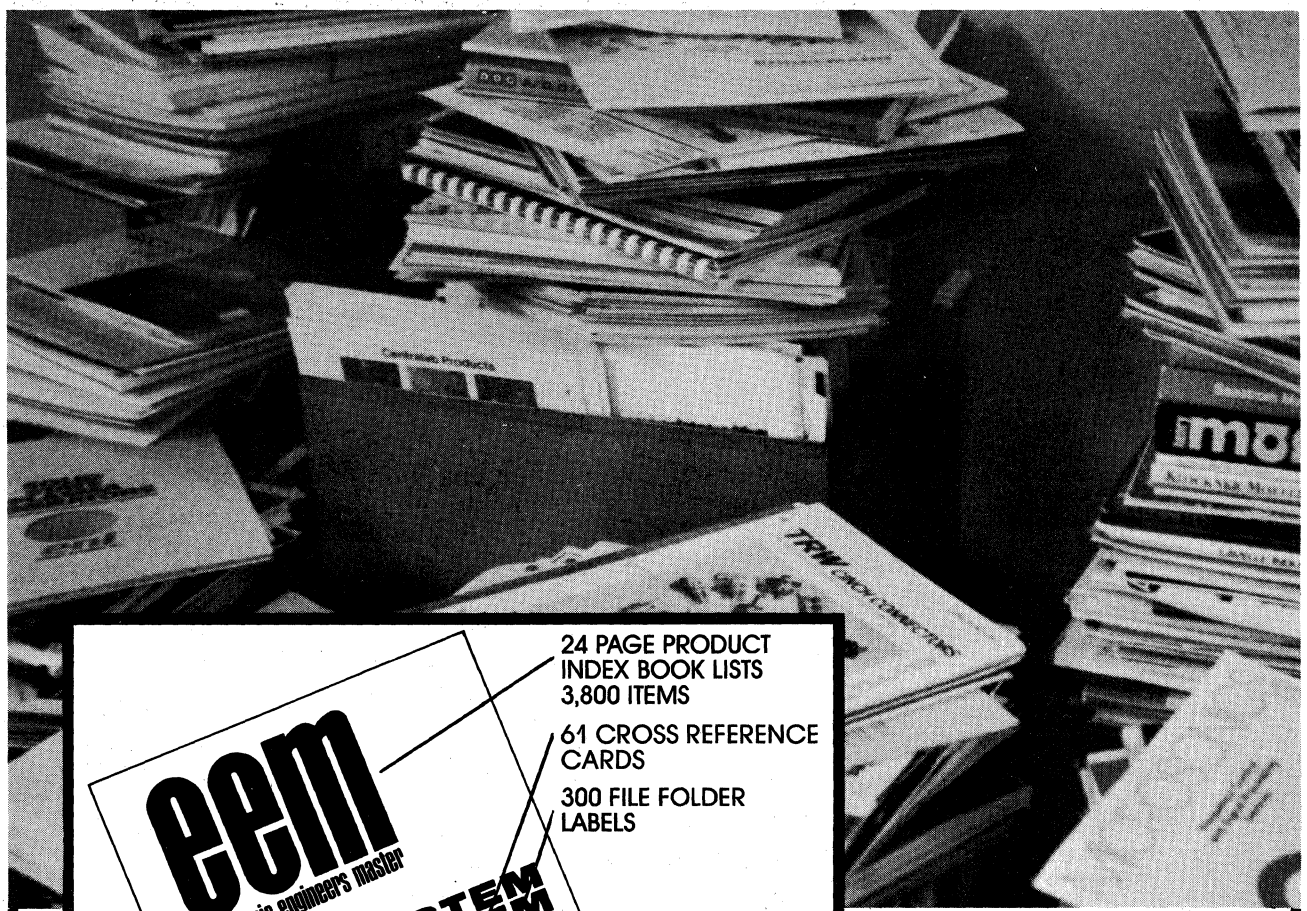
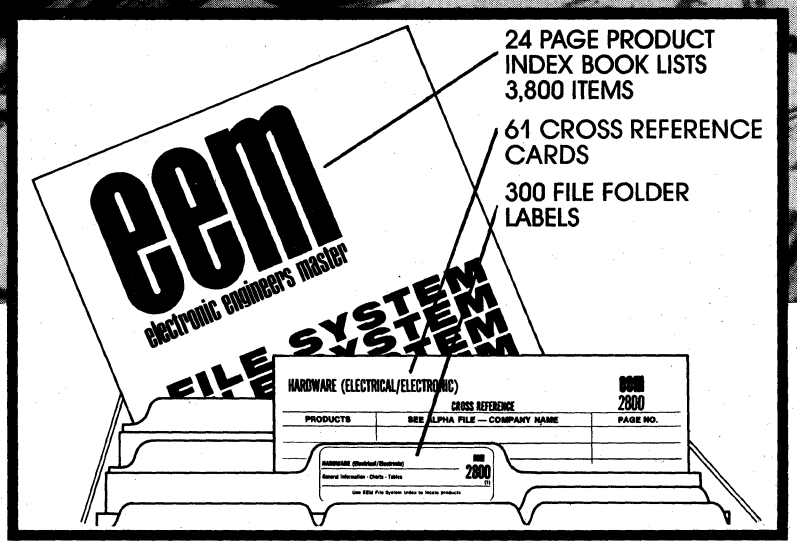
OXLEY





24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS

61 CROSS REFERENCE CARDS

300 FILE FOLDER LABELS

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The EEM File System is shipped in one neat package. The package contains everything you need to set up your very own filing system. Best of all, it's easy to get and very affordable. Send a check or money order for $25.00 and EEM will pay the postage and sales tax. If you must use a purchase order, please add $2.00 for postage and handling. An invoice will be mailed to you under separate cover.

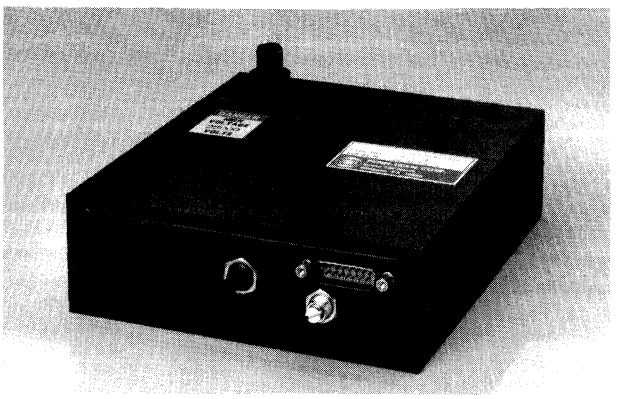
Don't waste any more time. Get organized now!

EEM FILE SYSTEM,

645 stewart ave., garden city, ny 11530

30 Watt High Voltage Power Supply for Military and Airborne Applications

MIL HVS 2825

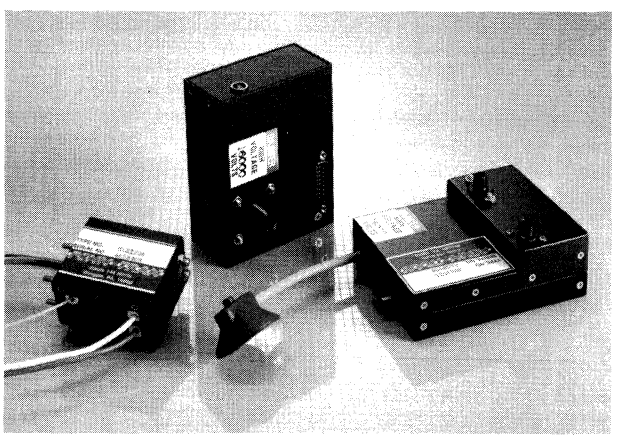


Performance Specifications

Input	28VDC ± 2 Volts
Anode Voltage	25KV (less than ± 1%
Anode Current	0-1.2 MA
Ripple (P-P)	7.5 Volts (P-P) @ 1.2 MA
Temperature Coefficient	100 PPM/°C
Line Regulation	.05%
Focus Voltage	5-8 KV
G2 Voltage	200-1000 VDC
G1 Voltage	−150 VDC
Operation Temperature	−55° to 70°C

TTL Compatible Shutdown
High Bit Fail Safe
High Level Limit
Isolated Case Ground
Full Load Efficiency greater than 50%
Military Connectors as per your specifications
Weight: Less than 5 lbs.
Other options are available

Miniature MIL Spec High Voltage Supplies Made to your Specifications



These supplies are designed to function in your drive circuit. They provide all the features of a flyback and will meet all Military Specifications for vibration and shock. Light weight for heads-up displays and airborne applications.

PENN TRAN HAS QUALIFIED PERSONNEL TO DESIGN AND MANUFACTURE HIGH VOLTAGE SUPPLIES TO DOD 2000-WS 6536 E

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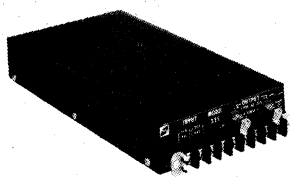
MILITARY/MIL-STD-810

INFORMATION HOTLINE
(408) 744-1450

25 years experience ■
Low profile ■

MIL-STD-810C QUALIFIED



75-150
WATTS

FEATURES

- Meets MIL-STD's
- Low profile 1.7"
- Ruggedized design
- 115/230 VAC input without any strapping
- Fully protected
- Full power out at 80°C case temperature
- Brownout protection to below 95 or 190 VAC
- Parallelable (consult factory for procedure)
- Up to 1.6 W per cubic inch
- Soft start limits inrush to 13 amps max.

COMMON SPECIFICATIONS

Input
105 to 130/198 to 265 VAC (selectable on barrier block) 47-1000 Hz also 300 VDC ± 10%. Brownout protection to 90/180 VAC.

Protection
All outputs are current limited, continuous overload and short circuit proof. Single outputs have self-recovering overvoltage protection. Thermal protection is provided by a thermal relay which opens the power input if the case temperature goes above 80°C. Multiple outputs have self-recovering OVP on the 5V output only.

Operating temperature
−40°C to +80°C case (no derating).

EMI filter
Will meet VDE 0871(A) and FCC spec for conducted emissions using an external filter. Corcom filter 3 SPIA is recommended. For MIL 461A, Captor A4581 is recommended.

Mounting
Mounting on bottom by means of 6, 10-32 tapped inserts.

Storage temperature
−55°C to +85°C

Cooling
Maximum mounting base temperature for full output is 80°C. For no (air or conductive cooling), maximum ambient temperature of 30°C for full power output.

Temperature stability
Better than .02%/°C.

Size
11.12" × 5.29" × 1.75". Single outputs. (28.3 cm × 13.5 cm × 4.3 cm).
10.55" x 5.29" × 1.75". Multiples.

Weight
5.5 lbs.

MTBF
115,000 hours as calculated by MIL-HDBK-217C. (Model 325).

Remote sensing
All models have remote sensing.

SINGLE OUTPUTS

Model	Volts	Amps	Regulation		Ripple & Noise
			Load	Line ± 10%	DC-10MHz
325ST	5VDC	25	5mV	3mV	60mV p-p
325STC	6VDC	20	5mV	3mV	60mV p-p
350ST	12-15VDC	10	10mV	5mV	50mV p-p
351ST	24-28VDC	5	20mV	10mV	100mV p-p

DUAL OUTPUTS

302ST	±15VDC	±3A	10mV	5mV	50mV p-p 10mV rms
303ST	±12VDC	±3A	10mV	5mV	50mV p-p 10mV rms

MULTIPLE OUTPUTS

312ST	(A) 5VDC (B) ±12VDC	10A ±1A	5mV 10mV	5mV 5mV	60mV p-p 60mV p-p
313ST	(A) 5VDC (B) ±15VDC	10A ±1A	5mV 10mV	5mV 5mV	60mV p-p 60mV p-p
314ST	(A) 5VDC (B) 12VDC	10A 2A	5mV 10mV	5mV 5mV	60mV p-p 60mV p-p
315ST	(A) 5VDC (B) 12VDC	8A 3A	5mV 10mV	5mV 5mV	60mV p-p 60mV p-p
316ST	(A) 5VDC (B) 12VDC	12A 1A	5mV 10mV	5mV 5mV	60mV p-p 60mV p-p

MILITARY SPECIFICATIONS

Mil Spec		Method/Procedure	
MIL-STD-810C	Low Pressure	Method 500.1	Proc. I
MIL-STD-810C	High Temp.	Method 501.1	Proc. I, II
MIL-STD-810C	Low Temp.	Method 502.1	Proc. I
MIL-STD-810C	Temp. Shock	Method 503.1	Proc. I
MIL-STD-810C	Temp. Alt.	Method 504.1	Proc. I Class 2 (−20°C operating)
MIL-STD-810C	Humidity	Method 507.1	Proc. I, II
MIL-STD-810C	Fungus	Method 508.1	Proc. I
MIL-STD-810C	Salt Fog		
MIL-STD-810C	Sand & Dust	Method 510.1	Proc. I
MIL-STD-810C	Explosive Atmosphere	Method 511.1	Proc. I
MIL-STD-810C	Vibration	Method 514.2	Proc. VIII Curve W, XI
MIL-STD-810C	Shock	Method 516.2	Proc. I, IV Ground Equip. Fig. 516.2-2
MIL-STD-810C	Temp.-Humidity-Alt.	Method 518.1	Proc. I
MIL-STD-901C	High Shock	Grade A, Class 1	Type A
MIL-STD-461	RFI Conducted		With external filter
MIL-STD-1399	Voltage Transient	Type I	Single Phase
MIL-T-288CC	Random Vibration	Nav. Mat. Pub. P-9492 May, 1979 4.5.3.1.C	

SEE OUR HI REL POWER SUPPLIES & CONVERTERS ON PGS. D•2042-2045

RO ASSOCIATES, INCORPORATED 246 CASPIAN DRIVE, SUNNYVALE, CA 94086 / (408) 744-1450 TWX 910-339-9304 FAX (408) 744-1521

MILITARY/RUGGEDIZED

- Ruggedized Design
- High MTBF

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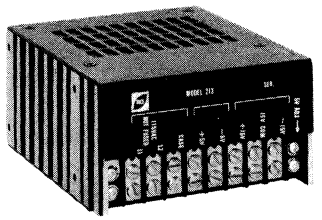
37-60 WATTS MINIATURE



SINGLE OUTPUTS

Model	DC Out Volts DC	Amps	Regulation		Ripple & Noise DC-10MHz
			Load*	Line ±10%	
210	3.5-5.5 adj.	10A	0.1% or 5mV	±0.1%	25mV p-p
250	12-15 adj.	4A	0.2%	±0.05%	50mV p-p
251	24-28 adj.	2A	0.2%	±0.05%	50mV p-p

MULTIPLE OUTPUTS

Model	DC Out Volts DC	Amps	Regulation		Ripple & Noise DC-10MHz
			Load*	Line ±10%	
213	4.5-5.5 adj.	5A	0.2%	±0.1%	25mV p-p
	±15 or ±12 (213C)	400 ma each side	0.1%	±0.05%	20mV p-p

*LOAD REGULATION is from 0.5A to FL on all 5 volt outputs, 0 to FL on all other outputs, from 0 to 0.5A on 5 volt output better than 1%.
**220 VAC input is available on special order. Ripple specification is 16% greater for 50 Hz operation ($10.00 additional).

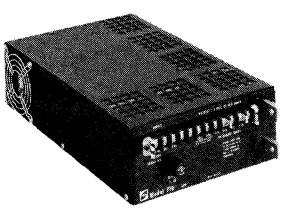
FEATURES

- 55 watts in 45 cubic inches
- 5 1/16" x 4" x 2 1/4", weighs 2.5 lbs.
- Multiple outputs
- High efficiency
- Fully protected
- 20KHz operation, no audible noise
- RFI filtered

500-840 WATTS RUGGEDIZED HIGH POWER

SINGLE OUTPUTS

Model	Volts	Amps	Regulation		Ripple & Noise DC-10MHz
			O-FL	Line ±10%	
710R	5V	100A	10mV	5mV	100mV p-p
715R	5V	150A	10mV	5mV	100mV p-p
750R	12-15V	40A	15mV	10mV	100mV p-p
751R	24-28V	20A	20mV	10mV	150mV p-p



MULTIPLE OUTPUTS

Model	Volts	Amps	Regulation***		Ripple & Noise DC-10MHz
			O-FL	Line ±10%	
713R	5V	50A	10mV	±5mV	100mV p-p
	+(12-15)VDC	10A	0.5%	±0.2%	2%
	−(12-15)VDC	10A	0.5%	±0.2%	2%
724R	5V	50A	10mV	±5%	100mV p-p
	+24	4A	10%	±2%	2%
	+(12-15)VDC	6A	0.5%	±0.2%	2%
	−(12-15)VDC	6A	0.5%	±0.2%	2%
725R	5V	50A	10mV	±5mV	100mV p-p
	+(12-15)VDC	6A	0.5%	±0.2%	2%
	−(12-15)VDC	6A	0.5%	±0.2%	2%
	(2-5)VDC	10A	50mV	±10mV	100mV p-p
753R	22VDC	10A	20mV	±10mV	100mV p-p
	15VDC	10A	75mV	±30mV	150mV p-p

***MINIMUM 5A load on +5V is required for auxiliary outputs to regulate.

FEATURES

- Ruggedized design
- Low profile (3.34" high)
- Upgraded parts
- Random vibration tested
- Thermal shock tested
- Brownout protection to below 95 or 190 VAC

SEE OUR HI REL POWER SUPPLIES & DC-DC CONVERTERS ON PGS. D•2042-2045

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DC-DC CONVERTERS

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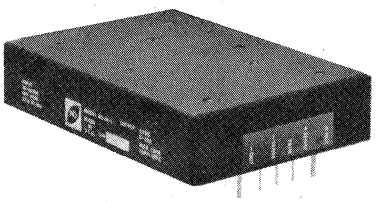
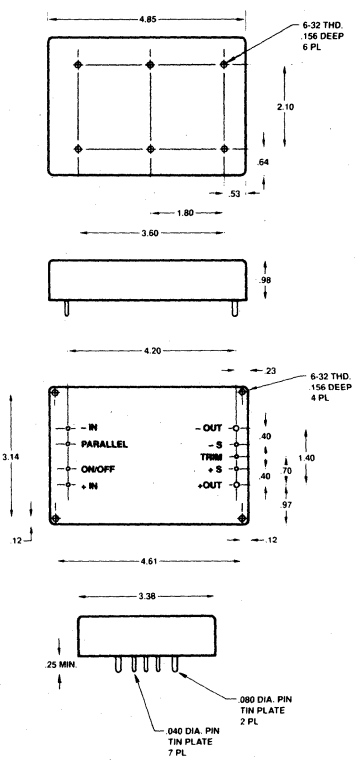
25 years experience ■
Low profile ■

125-150 WATT HIGH DENSITY/ PC BOARD MOUNTED



FEATURES

- Lowest Thermal Resistance – *2.5°C/Watt*
- Parallelable – Current Mode Control
- Fault Tolerant – True N + 1 Redundancy
- Hot Plug in Capability
- Current Sharing – No Master/Slave
- Compatible – Industry Standard Pin-Out
- Non-Shutdown OVP
- Logic ON/OFF
- 5 Sided Shielding
- Ruggedized Design – Meets MIL-810D
- UL/CSA/VDE Compliance
- Thermal Protection – Auto Reset
- Input Overvoltage Protection
- Optional Output Good Signal, ± 10%



SPECIFICATIONS

	RO 48 SERIES	RO300 SERIES	UNITS
INPUT:			
Input voltage	36-66	200-400	VDC
In rush charge	2.1×10^{-4}	3×10^{-6}	Coulombs
Input reflected ripple (f.l. nom line)	20	10	% P-P
No load power dissipation	3.1	6.2	watts
Logic disabled current (sink)	1	1	ma
Logic disabled power in	0.35	1.2	watts
Input ripple rejection (120Hz)	55	55	dB
Input Overvoltage (No damage to unit)	66-100	400-450	VDC
OUTPUT:			
Set point accuracy	±1	±1	%
Load regulation (0-100%)	10	10	mv
Line regulation (over range)	10	10	mv
Ripple (0-10MHz)	1	1	% p-p
Trim Range	±10	±10	%
Remote Sense compensation	0.5	0.5	V total
OVP (non shutdown auto rec.)	120	120	%
Current Limit (auto rec.)	110-120	110-120	% f.l.
Current sharing (automatic)	±10	±10	%
Transient response (20-80% load) Vout 1%	200	200	µs
Transient response (LL to HL) Vout 1%	200	200	µs
Transient response (50-100% load) Vout 1%	200	200	µs
Temperature drift	.02	.02	%/°C
CONTROL:			
Turn on time (power applied) Vout 1%	60	60	ms
Logic turn on time Vout 1%	6	6	ms
ISOLATION:			
Input to output	5500	5500	VDC
Input to case	2500	2500	VDC
Output to case	500	500	VDC
Input to output capacity	2200	2200	pF
THERMAL:			
Operating temperature	−55 to 100	−55 to 100	°C case
Automatic shut down temperature	105-110	105-110	°C case
Thermal resistance case to ambient (f.l.)	2.5	2.5	°C/watt
WEIGHT:	24	24	oz.

MODEL SELECTION

INPUT VOLTAGE	OUTPUT VOLTAGE / CURRENT		MODEL
48VDC	5V	25A	RO48-5
48VDC	12V	12A	RO48-12
48VDC	15V	10A	RO48-15
48VDC	24V	6A	RO48-24
48VDC	28V	5A	RO48-28
300VDC	5V	25A	RO300-5
300VDC	12V	12A	RO300-12
300VDC	15V	10A	RO300-15
300VDC	24V	6A	RO300-24
300VDC	28V	5A	RO300-28

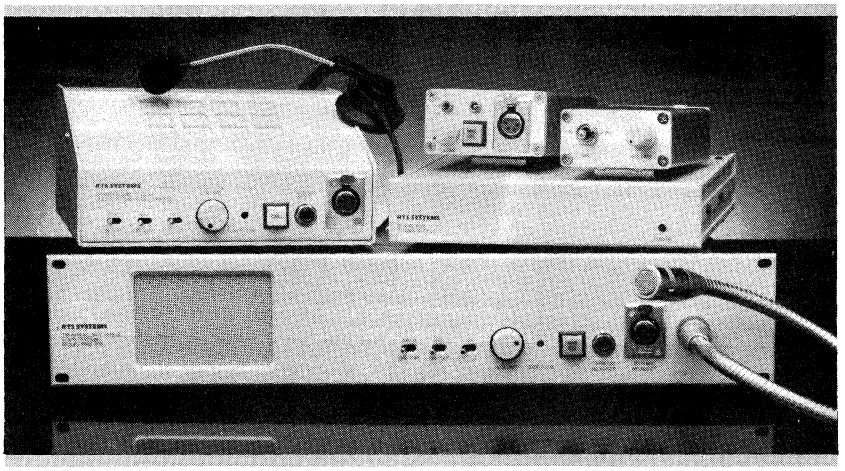
RO ASSOCIATES, INCORPORATED 246 CASPIAN DRIVE, SUNNYVALE, CA 94086 / (408) 744-1450 TWX 910-339-9304 FAX (408) 744-1521

RTS SYSTEMS
INCORPORATED

CONFERENCE-LINE INTERCOMMUNICATIONS

TW Intercom System

A high performance two-wire conference-line (party-line) intercommunication system designed for use in broadcast, teleproduction, aerospace operations, and industrial applications.



User Stations

- Eight different packages available
- Headset and headset/speaker stations available
- Each station (10,000 ohms) bridges the line (200 ohms)
- Up to 75 units on a line without loading
- Two channels on three-conductor cable
- Full-duplex operation: simultaneous talk and listen to and from each station
- Powerful headphone amplification
- Dynamic and/or carbon headset capability
- Mic-level limiting
- 12-volt power operation capability
- Many options available

Power Supplies

- PS8 powers 12 user stations
  Two channels – one dry channel at 200 ohms audio impedance – one powered channel at 32 volts at 200 ohms audio impedance
- PS31 powers 30 headset user stations
  Three powered channels at 32 volts at 200 ohms audio impedance

System Interface Units

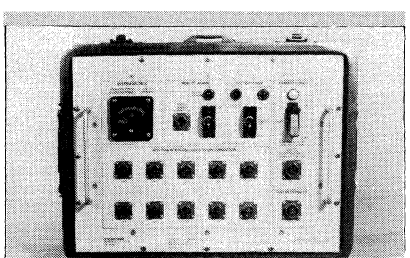
- Interface between two-wire, three-wire, and four-wire lines
- Works with virtually any impedance, level, or type of line

Special Designs

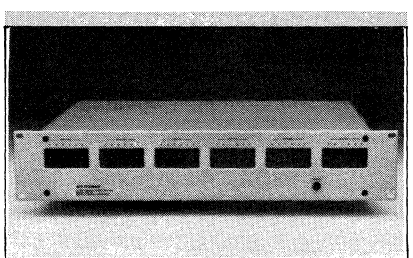
- A number of standard products are available for special applications including station-isolate, source assignment, retrofit user stations, multiple channels, etc.
- Modified standard product and custom products available to customer specifications

RTS SYSTEMS
INCORPORATED

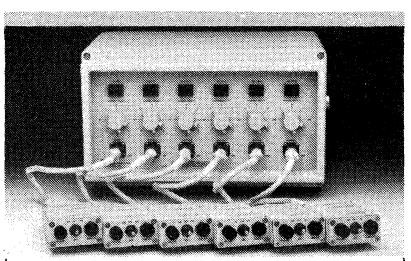
INTRINSICALLY SAFE / MULTI-CHANNEL GROUND SUPPORT INTERCOMMUNICATIONS



ICS 100A Central Electronics



TCC100 Test Control Electronics



MPS100 Nose Pit Switch Box | HCU265 Headset Station

Fuel Tank Entry Intercom System

Self-standing battery-backed I/C system intended for use with up to 10 ground support personnel; normally, 5 outside and 5 inside fuel tank. (System includes externally controllable alarm tone.) Applications include military and commercial aircraft fuel tank entry and ground support intercommunications. Custom product and systems available to meet customer specifications.

Non-Hazardous Area Intercom Systems

Conventional multi-station, multi-channel and single-channel I/C Systems for use in:

- simulators
- test flight operations
- ground test firing ranges
- mobile communications centers
- trainers
- aircraft assembly and test
- satellite tracking operations

Hazardous Area Intercom Systems

Portable and permanent installation ground support I/C equipment for checking out systems on fueled aircraft:

- Manufacturing support equipment for aircraft assembly
- Preliminary checkout and test
- Ramp operations – final checkout (typically interfaced with conventional non-hazardous I/C system)

RTS SYSTEMS □ 1100 West Chestnut Street □ Burbank, California 91506 □ Tel 818 566-6700 □ Fax 818 843-7953 □ Telex 194855

Technitrol

1952 East Allegheny Avenue
Philadelphia, PA 19134
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QPL MIL-STD-1553B INTERFACE TRANSFORMERS

Technitrol interface transformers have been placed on the QPL as a result of successful testing to MIL-T-21038/27.

Described here are the approved Technitrol Q1553 pc-mountable, SMQ1553 and FPQ1553 surface-mountable coupling and interface transformers.

Low profile H1553 surface-mount hermetic models, although not listed on the QPL, have the same electrical performance as the QPL products.

NEW!

For 5V transceiver applications see part numbers Q1553-5, SMQ1553-10, FPQ1553-10, H1553-5, Q1553-25, Q1553-35, Q1553-51, and Q1553-52.

Applicable specifications satisfied:
Mil-Std-1553B
MIL-T-21038/27
MIL-T-10727
MIL-I-45208
Mil-Std-202

SUMMARY SPECIFICATIONS

Impedance	see table below
Droop	≤20%
Overshoot	±1V max
Common mode rejection (CMR)	≥45dB
Frequency range (no load)	75kHz to 1MHz
Temperature range	−55 to +130°C
Weight	less than 5 grams

PART NUMBERS, CHARACTERISTICS, PACKAGE CONFIGURATIONS
The table below lists the selection of Technitrol interface transformers available, their packaging configurations, and their electrical characteristics.

Military designation number	Technitrol part number	Package	Height (in.) maximum	Terminals	Ratio (±3%)	RDC (ohms) maximum	Impedance (ohms) minimum
M21038/27-01	Q1553-1	A	.300	1-3:4-8 1-3:5-7	1CT:1CT 1CT:.707CT	1-3 3.0 4-8 3.0	(1-3) 4,000
M21038/27-02	Q1553-2	A	.250	1-3:4-8 1-3:5-7	1.4CT:1CT 2CT:1CT	1-3 3.5 4-8 3.0	(1-3) 7,200
M21038/27-03	Q1553-3	A	.250	1-3:4-8 1-3:5-7	1.25CT:1CT 1.66CT:1CT	1-3 3.2 4-8 3.0	(1-3) 4,000
M21038/27-04	Q1553-4	A	.300	4-8:1-3 5-7:1-3	2.3CT:1CT 3.2CT:1CT	1-3 1.2 4-8 3.0	(5-7) 3,000
M21038/27-05	Q1553-20	C	.250	1-2:3-4	1:1.41	1-2 2.2 3-4 2.7	(3-4) 3,000
M21038/27-06	Q1553-21	D	.250	1-5:2-6	1CT:1CT	1-5 2.5 2-6 2.8	(1-5) 3,000
M21038/27-07	Q1553-22	D	.250	1-5:2-6	1CT:1.41CT	1-5 2.2 2-6 2.7	(2-6) 3,000
M21038/27-08	Q1553-23	D	.250	1-5:2-6	1CT:1.66CT	1-5 1.5 2-6 2.4	(2-6) 3,000
M21038/27-09	Q1553-24	D	.250	1-5:2-6	1CT:2CT	1-5 1.3 2-6 2.6	(2-6) 3,000
M21038/27-10	Q1553-5	A	.250	4-8:1-3 5-7:1-3	2.12CT:1CT 1.5CT:1CT	1-3 1.0 4-8 3.5	(4-8) 4,000
M21038/27-11	SMQ1553-6	B	.275	1-3:4-8 1-3:5-7	1CT:1CT 1CT:.707CT	1-3 3.0 4-8 3.0	(1-3) 4,000
M21038/27-12	SMQ1553-7	B	.275	1-3:4-8 1-3:5-7	1.4CT:1CT 2CT:1CT	1-3 3.5 4-8 3.0	(1-3) 7,200
M21038/27-13	SMQ1553-8	B	.275	1-3:4-8 1-3:5-7	1.25CT:1CT 1.66CT:1CT	1-3 3.2 4-8 3.0	(1-3) 4,000
M21038/27-14	SMQ1553-9	B	.275	4-8:1-3 5-7:1-3	2.3CT:1CT 3.2CT:1CT	1-3 1.2 4-8 3.0	(5-7) 3,000
M21038/27-15	SMQ1553-10	B	.275	4-8:1-3 5-7:1-3	2.12CT:1CT 1.5CT:1CT	1-3 1.0 4-8 3.5	(4-8) 4,000
M21038/27-16	FPQ1553-6	F	.275	1-3:4-8 1-3:5-7	1CT:1CT 1CT:.707CT	1-3 3.0 4-8 3.0	(1-3) 4,000
M21038/27-17	FPQ1553-7	F	.275	1-3:4-8 1-3:5-7	1.4CT:1CT 2CT:1CT	1-3 3.5 4-8 3.0	(1-3) 7,200
M21038/27-18	FPQ1553-8	F	.275	1-3:4-8 1-3:5-7	1.25CT:1CT 1.66CT:1CT	1-3 3.2 4-8 3.0	(1-3) 4,000
M21038/27-19	FPQ1553-9	F	.275	4-8:1-3 5-7:1-3	2.3CT:1CT 3.2CT:1CT	1-3 1.2 4-8 3.0	(5-7) 3,000
M21038/27-20	FPQ1553-10	F	.275	4-8:1-3 5-7:1-3	2.12CT:1CT 1.5CT:1CT	1-3 1.0 4-8 3.5	(4-8) 4,000
—	H1553-1	E	.175	1-3:4-8 1-3:5-7	1CT:1CT 1CT:.707CT	1-3 3.0 4-8 3.0	(1-3) 4,000
—	H1553-2	E	.175	1-3:4-8 1-3:5-7	1.4CT:1CT 2CT:1CT	1-3 3.5 4-8 3.0	(1-3) 7,200
—	H1553-5	E	.175	4-8:1-3 5-7:1-3	2.12CT:1CT 1.5CT:1CT	1-3 .80 4-8 2.4	(4-8) 3,000
—	Q1553-25	D	.250	1-5:2-6	1CT:1.5CT	1-5 .90 2-6 2.5	(2-6) 3,000
—	Q1553-35	A	.250	4-8:1-3 5-7:1-3	2.5CT:1CT 1.79CT:1CT	1-3 .80 4-8 1.7	(4-8) 3,000
—	Q1553-51	D	.250	1-5:2-6	.57:1	1-5 .90 2-6 2.5	(2-6) 3,000
—	Q1553-52	D	.250	1-5:2-6	.40:1	1-5 1.0 2-6 2.8	(2-6) 3,000

Contact factory for Mil-Std-1553B product catalog number 2001A.
See Volume A for information on Technitrol surface-mount and pc-mount delay lines.

Technitrol

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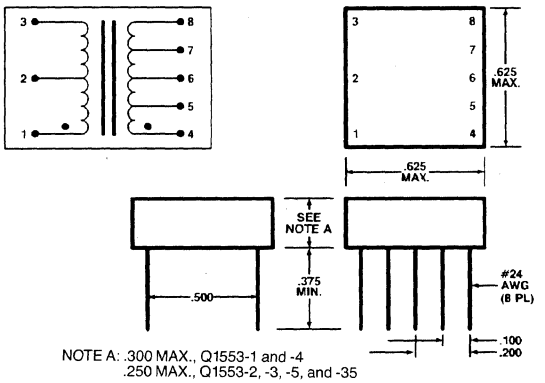
QPL MIL-STD-1553B INTERFACE TRANSFORMERS

SCHEMATICS & DIMENSIONS

Shown are the packaging configurations of Technitrol Mil-Std-1553 coupling and interface transformers, their schematics, and dimensions. Please cross reference to the table and summary specifications (opposite page) for model numbers and electrical characteristics.

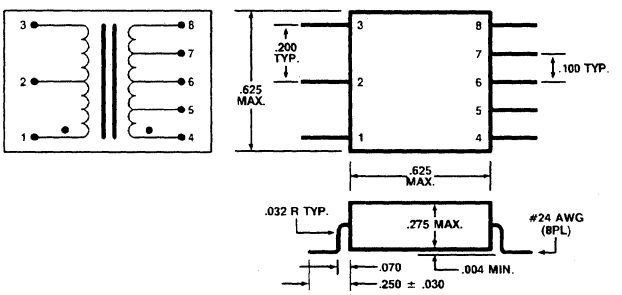
PACKAGE A



NOTE A: .300 MAX., Q1553-1 and -4
.250 MAX., Q1553-2, -3, -5, and -35

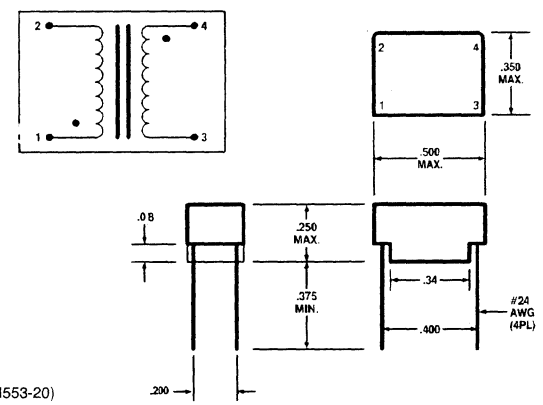
(Q1553-1 thru -5, and -35)

PACKAGE B



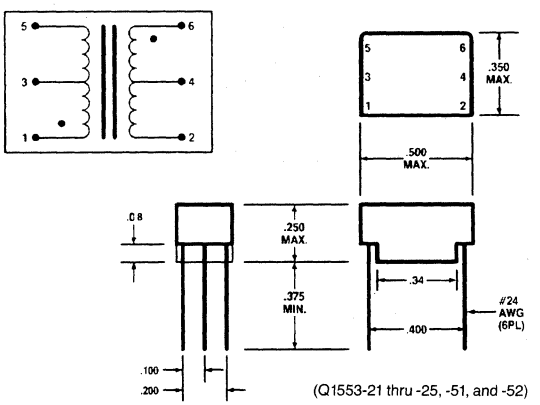
(SMQ1553-6 thru -10)

PACKAGE C



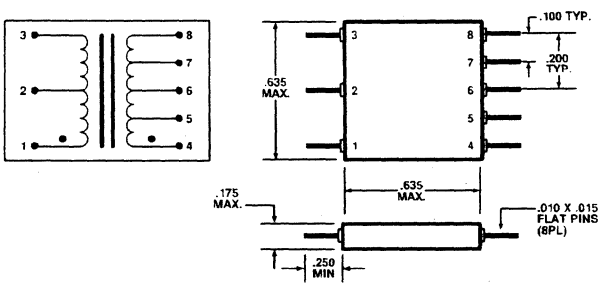
(Q1553-20)

PACKAGE D



(Q1553-21 thru -25, -51, and -52)

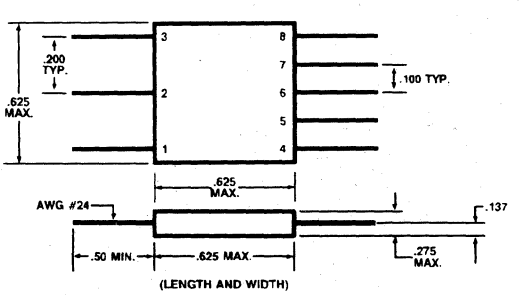
PACKAGE E (surface-mount hermetically-sealed)



Case and cover are nickel-plated KOVAR. Leads are nickel-plated KOVAR.

(H1553, -1, -2, and -5)

PACKAGE F



(FPQ1553-6 thru -10)

Dimensions provided in inches.
Tolerances: .xx = ±.01; .xxx = ±.008.

All specifications and dimensions subject to change without notice.

Contact factory for Mil-Std-1553B product catalog number 2001A.
See Volume A for information on Technitrol surface-mount and pc-mount delay lines.

Technitrol

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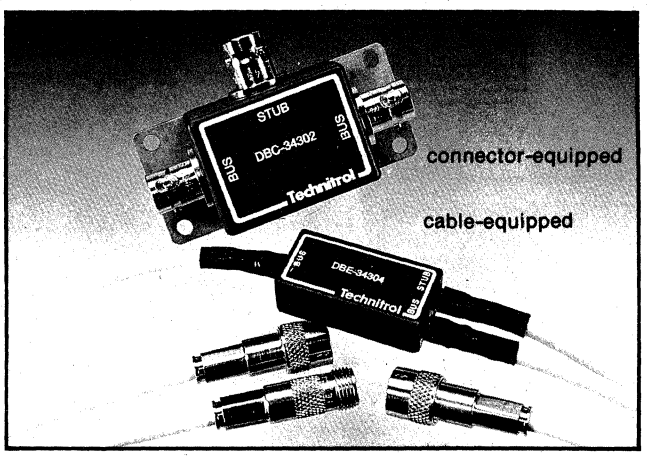
MIL-STD-1553B DATA BUS COUPLERS

All Technitrol data bus couplers incorporate QPL transformers and meet all the requirements of Mil-Std-1553B.

SUMMARY SPECIFICATIONS

Open circuit impedance (transformer)	≥3000Ω
Droop	≤20%
Overshoot/ringing	±1V max
Common mode rejection (CMR)	±45 dB
Frequency range (no load)	75kHz to 1MHz
Temperature range	−55 to +130°C

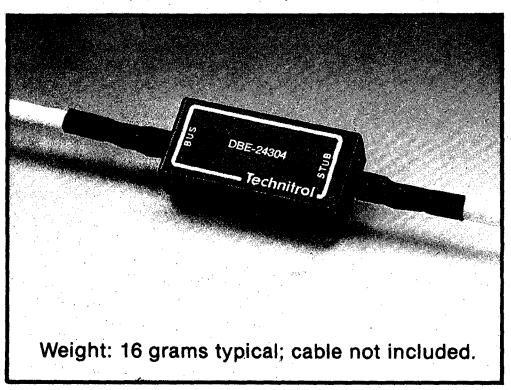


CUSTOM MODELS AVAILABLE

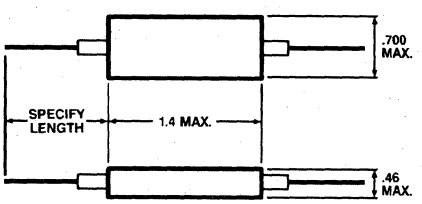
CABLE-EQUIPPED COUPLERS:

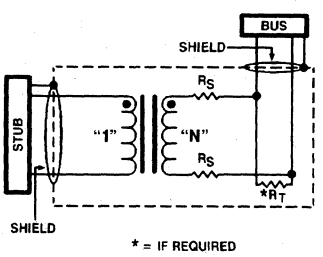
- Use QPL coupling transformers.
- Industry's smallest and lightest bus couplers.
- EMI and EMP shielding standard.
- Allow direct installation in cable runs and wire-bundle mounting.
- Permit decreased stub lengths.
- Supplied with flying leads of specifiable length and shielding.
- Cable terminations with contacts or cable-end connectors available.
- Immersion protection available, compliant with Mil-Std-810.
- Provide high installation-positioning flexibility.

TWO PORT: (one bus/one stub)

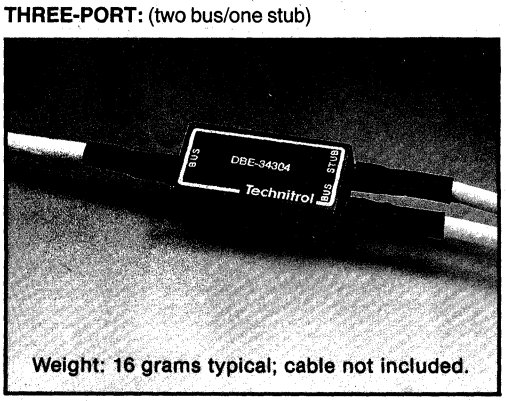


Weight: 16 grams typical; cable not included.

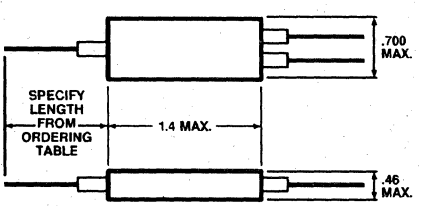


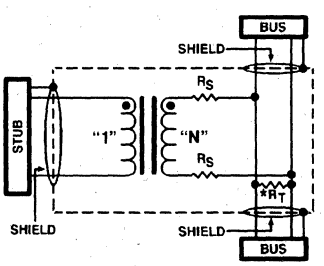


THREE-PORT: (two bus/one stub)



Weight: 16 grams typical; cable not included.





Dimensions provided in inches.
Note: Contact factory for part numbers.

Contact factory for Mil-Std-1553B product catalog number 2001A.
See Volume A for information on Technitrol surface-mount and pc-mount delay lines.

Technitrol

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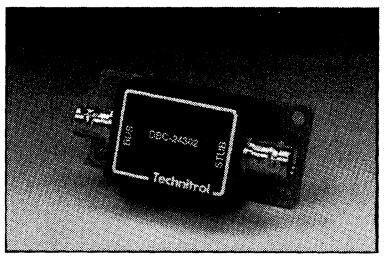
CONNECTOR-EQUIPPED DATA BUS COUPLERS

Technitrol connector-equipped data bus couplers are provided with mechanical connectors for rapid and convenient installation.

Like Technitrol cable-equipped couplers, these connector-equipped couplers use QPL coupling transformers and meet all the requirements of Mil-Std-1553B.

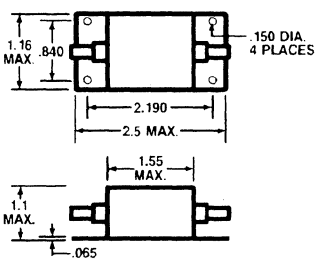
- Use QPL coupling transformers.
- Several connector types available.
- EMI shielded.
- Permit secure installation on bulkheads and at other fixed locations.
- Maximum interconnection convenience.
- Custom configurations available. Consult factory.

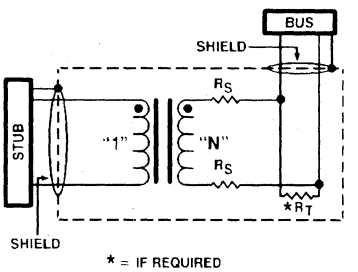
TWO-PORT: (one bus/one stub)



100 grams maximum.

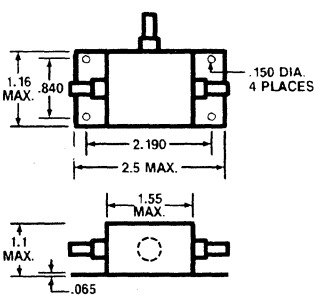
Dimensions provided in inches.
Tolerances: .xx = ±.015; .xxx = ±.010.

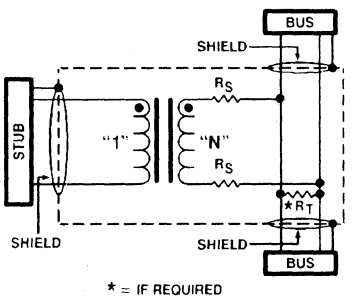




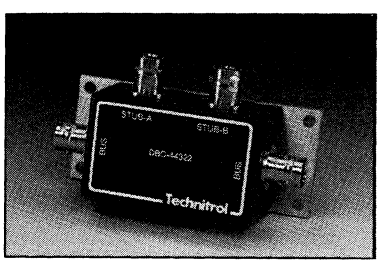
THREE-PORT: (two bus/one stub)

100 grams maximum.

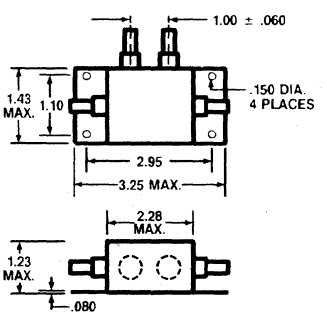


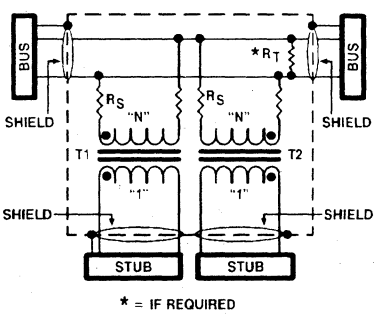


FOUR-PORT: (two bus/two stub)



160 grams maximum.





PART NUMBER INFORMATION

(connector-equipped couplers)

EXAMPLE: **DBC – 3 4 3 0 2**

- connector-equipped coupler
- three connectors, positioned as shown on three-port standard model
- transformer ratio – 1.41:1
- R_S – 56.2 ohms
- R_T – none
- connector type – BJ-77

Digit	Option	Selection code 0	1	2	3	4	5 (note A)
#1	Number of connectors	–	–	2	3	4	custom
#2	Transformer ratio (note B)	–	1.1	2.1	3.1	1.41:1	custom
#3	R_S (ohms) (note C)	58.5	53.6	54.9	56.2	51.1	custom
#4	R_T (ohms) (note C)	none	69.8	76.8	75	78.7	custom
#5	Connector type	BJ-377	D-621-0014 (note D)	BJ-77	BJ-150	BJ-3150	custom

A. Specified at time of order.
B. All transformers within these couplers are QPL, Mil-T-21038/27.
C. All resistors are military-grade type designation RWR80N..FS (non-inductive, failure Class S). Tolerances are ±1%. All resistors rated for 2 watt dissipation.
D. D621-0014 connectors are supplied with D602-55 contacts.

Contact factory for Mil-Std-1553B product catalog number 2001A.
See Volume A for information on Technitrol surface-mount and pc-mount delay lines.

Technitrol

1952 East Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105
FAX (215) 426-2836

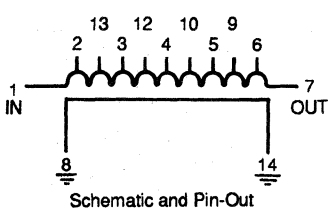
TECHNITROL QPL DELAY LINES

- Technitrol — the first delay line supplier to be QPL'd.
- Superior reliability assured through a fully implemented program in accordance with Mil-Std-790.*
- Passive 10 tap, 14-pin DIP delay lines manufactured to Mil-D-83531.
- Standard impedance 100 ohms. Other values available.
- All units transfer molded for maximum reliability.
- Standard total delay values ranging from 10 to 200 nanoseconds and tap delay values from 1 to 20 nanoseconds.
- All military part numbers from M83531/01-001 through M83531/01-425 available upon request.

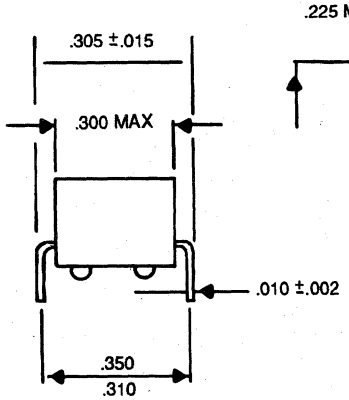
Reliability Assurance Program for Electronic Parts Specifications.

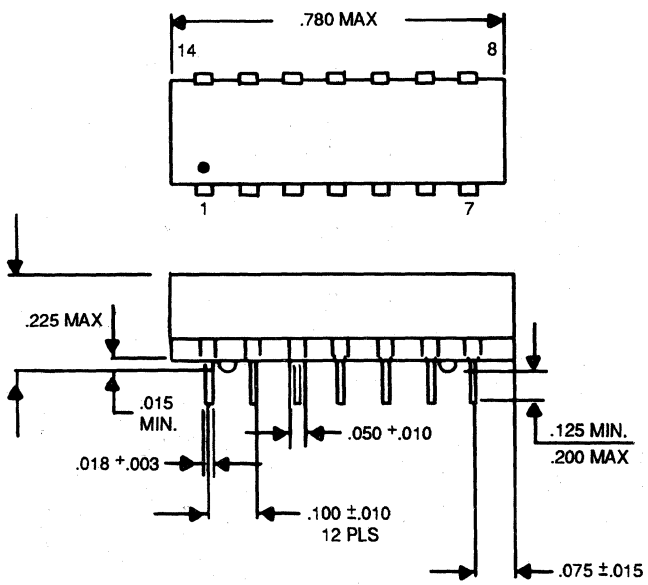
PASSIVE MIL-D-83531 QPL DELAY LINES

Military Designation No.	Technitrol Part No.	Total Delay (ns)	Tap Delay (ns)	Rise Time (ns-Max.)	Impedance (Ohms) ±10%	DCR (Ohms Max.)
M83531/01-102	LF10D9	10	1.0	2.5	100	5.2
M83531/01-104	LF10F9	20	2.0	5.0	100	5.2
M83531/01-105	LF10G9	25	2.5	6.2	100	5.2
M83531/01-110	LF10K9	50	5.0	12.5	100	5.2
M83531/01-120	LF10M9	100	10.0	25	100	5.2
M83531/01-130	LF10P9	200	20.0	50	100	5.2



Schematic and Pin-Out





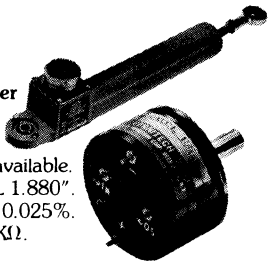
See Volume A for information on Technitrol surface-mount and pc-mount delay lines.

VERNITECH

Division of VERNITRON CORPORATION

"TECHNOLOGY IN MOTION"

POTENTIOMETERS



employing Vernitech's unique conductive film and precious metal wipers... respond to wiper motions as small as .000005".

Rotary Single Turn
Linear, non-linear, sine/cosine available.
Sizes 0.5", L 0.5" to Dia 5.0", L 1.880".
Linearity or conformity ±2% to 0.025%.
Resistance range 1KΩ to −250KΩ.

Rotary Multi-Turn
10 to 100 turns available.
Sizes Dia 0.5", L 1.5" to Dia 2.0", L 2.625".
Linearity or conformity ±0.5% to 0.015%.
Resistance range 1KΩ to 500KΩ.

Linear Motion
Electrical stroke lengths 1" to 60".
Linearity or conformity ±0.2% to 0.01%.
Resistance range 250Ω/in to 250KΩ/in.

CLUTCHES AND BRAKES

(electromagnetic)

hundreds of models and sizes available from stock.

Precision Instrument Type
Sizes 5, 8, 11, 13, 15, and 18.
Standard length and wafer types. Spring and magnetic.
Meet MIL-E-5272C. Zero backlash.
Torque 5 to 150 oz. in. Response time 5 to 142 ms.

Industrial Types — open frame
Sizes 8, 12, 17, 22, 26. Torque to 75 in. lb.
Response time 6-30 ms at rated voltage.

Industrial Types — enclosed frame
Hybrid or special units designed for particular applications when MIL-SPECS and close tolerances are not essential, but where having a complete "self-contained" unit is desirable: cassette tape decks, analog devices actuators, etc.

Fail Safe
Braking action occurs 10 ms after coil is de-energized or power fails. Sizes 8, 17, 30, and 45.
Torque up to 50 in. lb. Zero backlash. Adjustable to compensate for wear.

PRESSURE TRANSDUCERS

potentiometer type,

featuring infinite resolution, long life, and high reliability through the use of conductive film resistance elements, multiple wipers, and direct coupling of pressure sensing element to potentiometer wipers.

Pressure ranges from 0.1 to 10,000 psi in gage, absolute and differential types.
Linearity to ±0.3%. Air speed, altitude and low cost types available.

MOTORS

Many Standard Designs or Custom Designed to your requirements.

Synchronous — for laser scanning
Sizes 5, 8, 11, 15, 18, 20, 25, 35.
Speeds 100 to 48,000 rpm.
5 through 1600 Hz. 2, 4, 8, 12 poles.

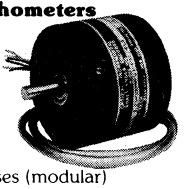
Servo
Viscous damped — sizes 8, 10, 11, 15, 18.
Speeds 3000 to 10,000 rpm.
Inertially damped — sizes 8, 11, 15, 18.
Speeds 3000 to 9500 rpm.

Stepper
Sizes 5, 8, 11, 15. Stepping angles 7.5°, 15°, 45°, 90°.
Stepping rates 100, 110, 125, 130, 175, 180, 225, 240, 260, 400, 725, 800, 1000 pps.

Precision Motor Generators Sizes 8, 10, 11, 15, 18, 23.

Integrating and Computer Motor Tachometers
Sizes 8, 10, 11, 15, 18, 23.

SHAFT ANGLE ENCODERS



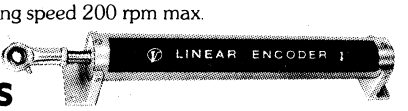
featuring precision chrome on glass discs for highest accuracy.

Optical Incremental
VOE 005 — Dia. 0.500", 0.550" L. To 256 pulses (modular)
VOE 05 — Dia. 0.500", 0.85" L. To 256 pulses
VOE 11 — Dia. 1.062", L. 1.80". To 1024 pulses
VOE 015 — Dia. 1.510", L. 0.88". To 1080 pulses (modular)
VOE M15 "Dial Coder" — panel mounted, 1.500" dia., L. 1.08" 127-256 pulses
VOE 023 — Dia. 2.25", L. 80". To 1250 pulses (modular)
VOEL 023—Dia. 2.25", L. 88". To 1000 pulses (modular)
VOE 23 — Dia. 2.250", L. 1.875". To 1250 pulses (available sealed)
VOE L 23 "Thrift-Line" Dia. 2.250" L. 1.875". To 1024 pulses
VOE 25 — Dia. 2.500", L. 2.500". To 3000 pulses (available sealed)

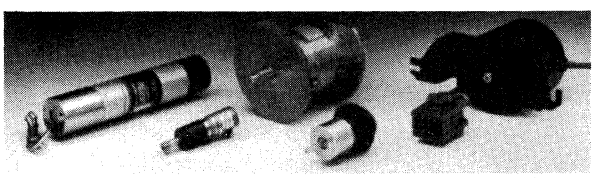
Optical Absolute
VOE 23: Binary, Gray or BCD to 512 counts per turn.
Counting speed: 3000 rpm.
VOE 30: Single or multi-turn; Binary, Gray or BCD. To 1024 counts per turn. Max count (2^{19}) in 512 turns.
Counting Speed: 30KHz.

Contacting Absolute
Sizes 11, 18, 23, & 31. Binary, Gray, and BCD. Single or multi-turn. Max count (2^{19}) in 2048 turns. 64 to 1024 counts per turn. Operating speed 200 rpm max.

LINEAR ENCODERS



BINARY, GRAY OR B.C.D. OUTPUT CODES
1", 2", 4", 8", 12", 24", 36" and 48" STROKE LENGTHS
RESOLUTIONS TO 12 BITS. TTL COMPATIBLE OUTPUT



SUB-SYSTEMS AND ASSEMBLIES

Vernitech is a major manufacturer of Electro-Mechanical and Electro-Magnetic products which are supplied to the Commercial and Military markets for diverse applications. As a leading supplier of vital components, Vernitech is also providing high quality, well engineered assemblies and packages utilizing in-house designed and manufactured components that cover the entire spectrum of analog and digital controls.

Quality Control All VERNITECH products are manufactured to strictly monitored internal controls and with adherence to MIL-Q-9858A. All test equipment is maintained and calibrated per MIL-C-45662.

Special Design Capability VERNITECH has achieved a reputation for superior engineering, high reliability products, and on-time delivery. Unique innovations in product design and performance has given us the experience to meet the demanding needs of our customers and their requirements, with quality products at the lowest possible cost.

Custom designs available to your specifications.

Refer to sections 3500, 4750, 5500 for additional product listings.

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Quality trimmer and precision potentiometers, attenuators and custom resistive devices.

VERNITRON CORPORATION
VRN INTERNATIONAL DIVISION

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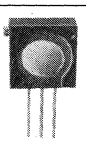
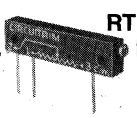
P.O. Box 44000
St. Petersburg, Florida 33743

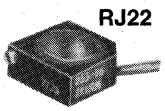
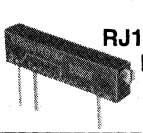
PHONE 813/347-2181 TWX 310-681-5306 TELEX 6815306 FAX 813/347-7520

VRN CIRCUITRIM® MILITARY TRIMMER POTENTIOMETERS

MIL-R-27208/MIL-R-39015* WIREWOUND TRIMMERS

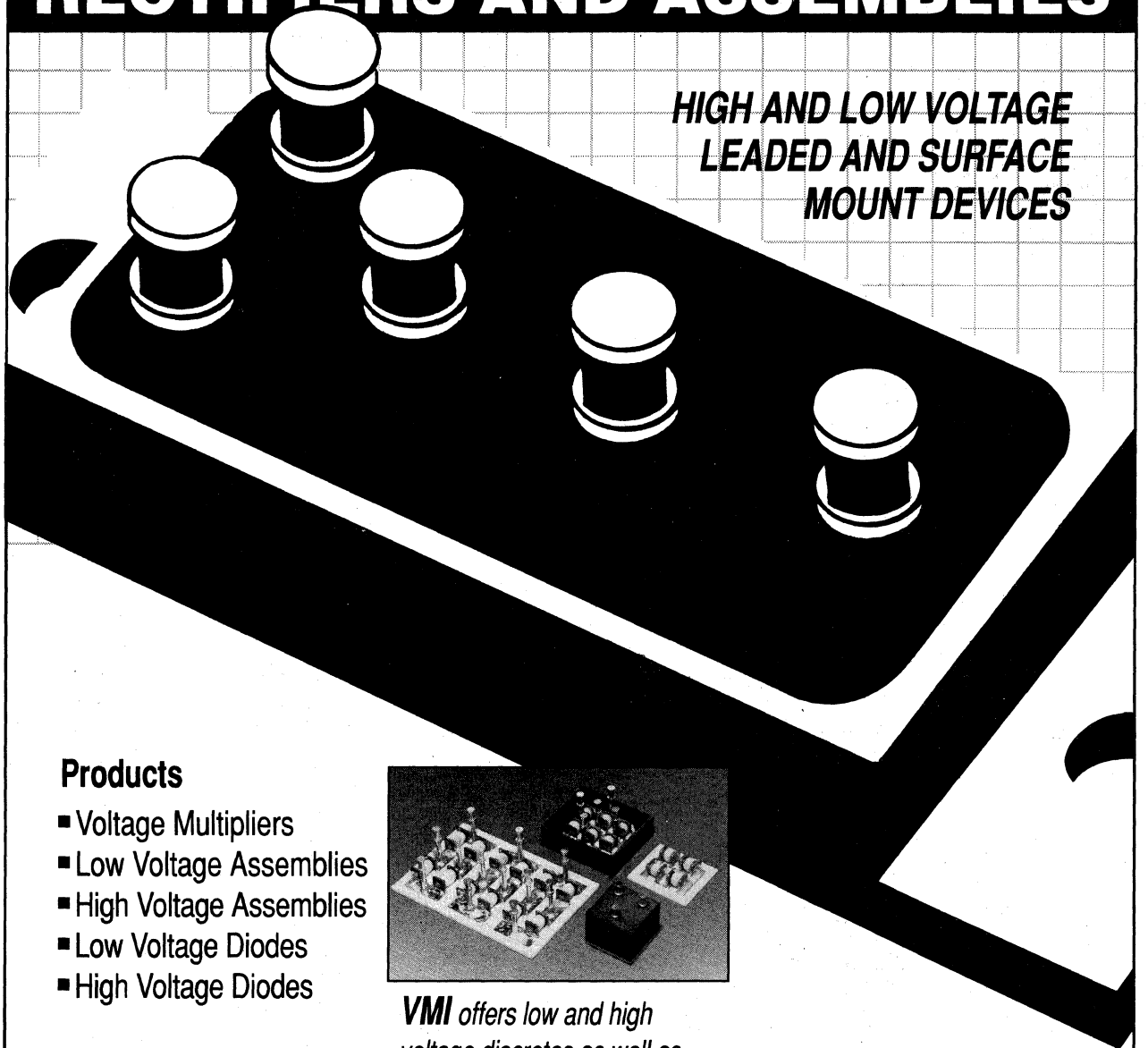
Size	Series	No. Turns	Std. Res. (Ω)	Tol.	Pwr. Rating	Temp. Coeff.	Termination
3/8" Square	RT24 RTR24	23	10-10K	±5%	1.0W	±50	3 PC pin styles, flexible leads (top & side adjust)
1/2" Square	 RT22 RTR22	24	50-20K	±5%	1.0W	±50	3 PC pin styles, flexible leads (top & side adjust)
1 1/4" Rect.	 RT12 RTR12	22	10-20K	±5%	1.0W	±50	2 PC pin styles, flexible leads (side adjust)

MIL-R-22097/MIL-R-39035** CERMET TRIMMERS

Size	Series	No. Turns	Std. Res. (Ω)	Tol.	Pwr. Rating	Temp. Coeff.	Termination
1/4" Square	RJ50 RJR50	1	10-1M	±10%	.5W	±100	3 PC pin styles (top & side adjust)
1/4" Square	RJ26 RJR26	16	10-1M	±10%	.5W	±100	3 PC pin styles (top & side adjust)
3/8" Square	RJ24 RJR24	24	10-1M	±10%	.5W	±100	3 PC pin styles (top & side adjust)
1/2" Square	 RJ22	24	10-1M	±10%	1.0W	±100	3 PC pin styles, flexible leads (top & side adjust)
1 1/4" Rect.	 RJ12 RJR12	22	100-1M	±10%	1.0W	±100	2 PC pin styles, flexible leads (side adjust)

*Failure rate: RTR12 & RTR22 approved to P level; RTR24 approved to R level
**Failure rate: Approved to R level
FOR COMMERCIAL EQUIVALENTS, SEE OUR LISTING IN VOL. A, SECTION 4750

RECTIFIERS AND ASSEMBLIES



HIGH AND LOW VOLTAGE LEADED AND SURFACE MOUNT DEVICES

Products

- Voltage Multipliers
- Low Voltage Assemblies
- High Voltage Assemblies
- Low Voltage Diodes
- High Voltage Diodes

***VMI** offers low and high voltage discretes as well as custom assemblies built and processed to meet MIL-S-19500.*

*See Vol. A, section 4800, pages **A**•2208, 2209 for a partial list of our product line.*

QPL List

1N5415-1N5420 MIL-S-19500/411
1N5550-1N5554 MIL-S-19500/420
1N5614-1N5622 MIL-S-19500/427
1N5615-1N5623 MIL-S-19500/429

Low Thermal Impedance H.V. & L.V.

Surface mount diodes to 3°c/w
1 Phase Bridge to 0.75°c/w
3 Phase Bridge to 0.50°c/w

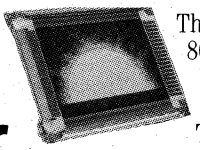
For a ***FREE*** Catalog or Engineering Information call:

VMI *VOLTAGE MULTIPLIERS INC.*

209 651-1402

8711 W. Roosevelt Ave. • Visalia, CA 93291 • Telex 530484 • FAX 209 651-0740

ONCE YOU'VE SEEN FUJITSU'S AC PLASMA DISPLAY, YOU'LL TAKE A DIM VIEW OF ANYTHING ELSE.



The only way our bright new 8050 display looks anything like the others is through a pair of sunglasses.

That's because the 8050 is without a doubt the brightest, most readable display in its class.

It's the first 10-inch, AC-memory, flat panel display to deliver 640 x 400 resolution with an extraordinary 44 foot-lamberts of brightness. Along with a contrast ratio of greater than 20:1. All in a package just over one inch thick.

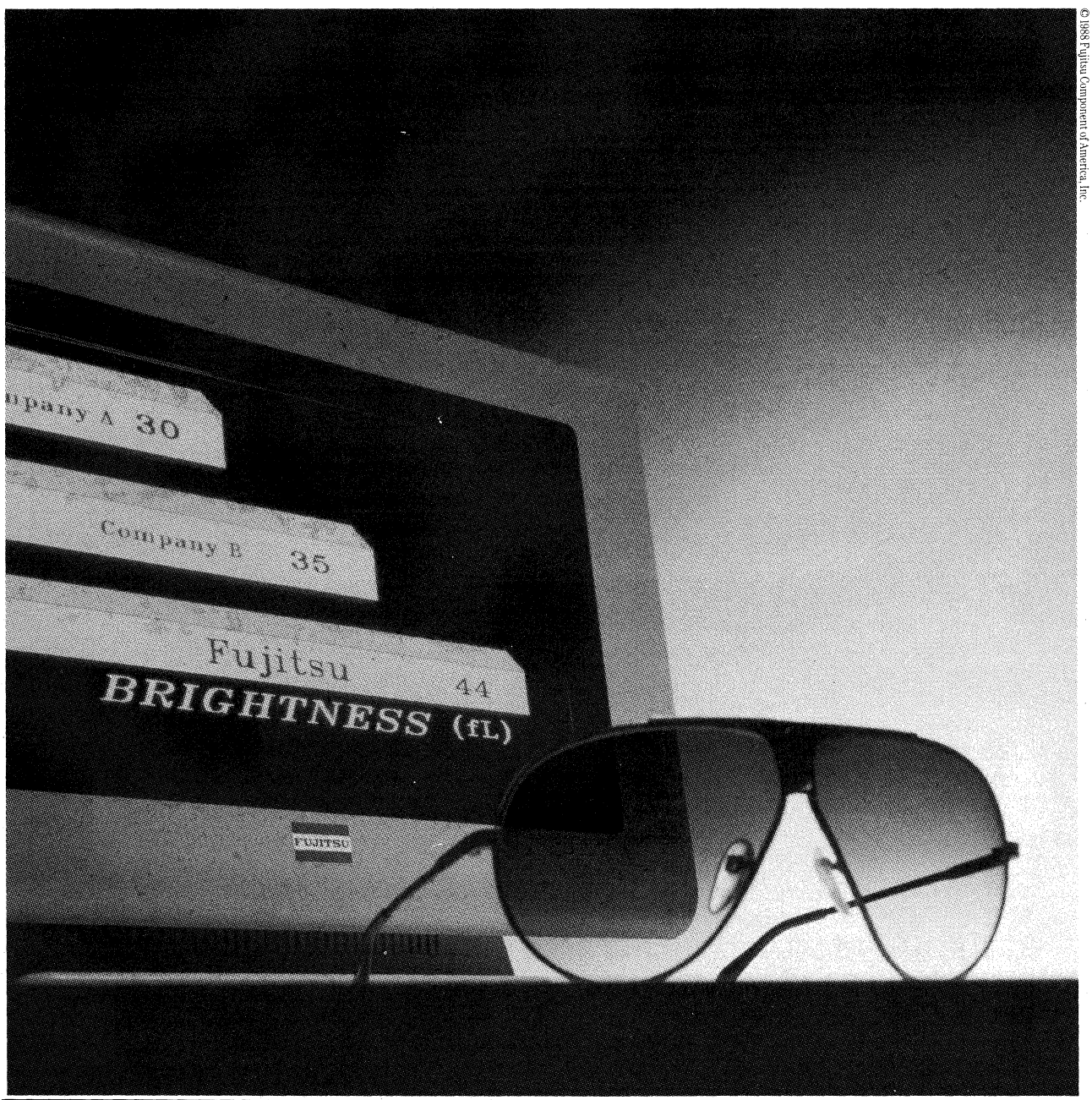
In fact, the only thing more impressive than these numbers is looking at the display yourself. Then you'll really appreciate its exclusive solid black background. And the brightness and flicker-free clarity of text and graphics.

And what's truly amazing is that you'll get this remarkable performance under some of the worst possible conditions. Like bright sunlight. And viewing angles up to 120 degrees.

So if your application calls for the clearest images with maximum contrast, call us today at **1-800-556-1234, Ext. 238.** Inside California call, **1-800-441-2345, Ext. 238.** Or write Fujitsu Component of America, Inc., 3330 Scott Boulevard, Santa Clara, CA 95054-3197.

We'll brighten your day.

FUJITSU
FUJITSU
COMPONENT OF AMERICA, INC.



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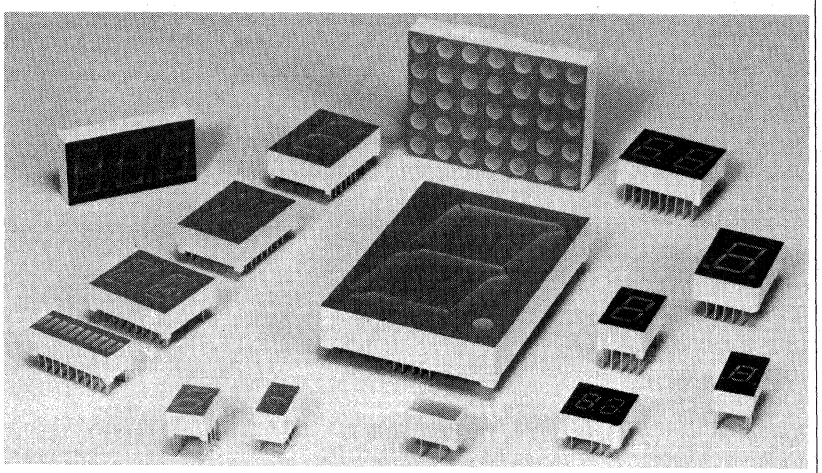
DISPLAYS

Manufacturer	Starting EEM Page No.	Single Character	Multi-character	Multi-line	Height			Segmented	Dot Matrix	Graphics	Light Type						Custom Design	Panels: Back/ Edge Lighted
					1/2" or less	>1/2" <1in.	1 in. or more				Electro-magnetic	Incandescent	LED	LCD	Plasma/ Planar Gas Discharge	Vacuum Fluorescent		
Altair Exchange Corp.	B•1042	√	√	√	√	√	√	√	√	√			√		√			
American Control Technology Inc.	B•1679	√	√		√			√						√			√	
Amperex Electronics	B•1046	√	√	√	√	√	√		√	√				√			√	
AND	B•1048	√	√	√	√	√	√	√	√	√				√				√
Applied Data Systems	B•1050		√	√	√	√	√			√				√	√		√	
Canyon Electronics	B•1051		√		√	√	√	√	√				√		√		√	
Cherry Elec. Prods.	B•1052		√	√	√	√	√	√	√	√					√		√	
Dale Electronics	B•1055	√	√	√	√	√	√	√	√	√					√		√	√
Data Ray Corp.	B•1058						√		√							√		
DCI Inc.	B•1061	√	√	√	√	√	√	√	√	√				√			√	
Densitron Corp.	B•1062		√	√	√				√	√			√	√	√		√	√
Dialight	B•1065	√	√	√	√	√		√					√				√	
Digitran & Computron	B•1053								√	√						√	√	
Dio-Rey/Info-Lite	B•1066	√	√	√		√	√	√	√			√	√				√	√
Electronic Research	B•1075	√	√	√	√	√	√		√	√				√	√	√	√	
Endicott Research Grp.	B•1076	√	√	√	√	√	√		√	√				√	√	√	√	
Excel Technology Int'l	B•1078	√	√	√	√	√	√	√	√					√			√	√
Fujitsu Components of America	B•1080		√				√			√					√		√	√
Hamlin LCD	B•1081		√				√	√	√	√				√			√	√
Hitachi America Ltd.	B•1082		√	√		√	√	√	√	√	√			√				√
Homalite	B•1085	√			√	√			√				√	√		√	√	
IDEA Inc.	B•1086	√	√		√	√	√	√	√				√				√	
Industrial Electronic Engineers	B•1087		√	√	√	√	√		√					√	√	√		
Infodex Inc.	B•1088																√	
IVO Industries Inc.	B•1089	√	√			√		√	√				√				√	
Microdimensions	B•1091		√				√											
NEC Electronics	B•1092		√	√	√	√	√	√	√						√	√		
NEI	B•1095	√					√	√	√	√	√						√	
NES Inc.	B•1098	√	√	√		√		√				√	√	√		√	√	
Ocular Inc.	B•1099	√	√	√	√	√	√	√	√					√			√	
Optrex/Satori	B•1102	√	√	√	√	√	√		√	√			√	√			√	√
Samsung Electron Devices	B•1106	√	√	√	√	√	√	√	√	√				√	√	√	√	√
Seiko Instruments	B•1109		√	√	√				√	√				√			√	√
Sharp Electronics, Microelectronics Div.	B•1110		√	√			√		√	√	√			√				√
Shelly Associates	B•1122		√	√	√	√		√	√			√	√	√			√	
The Staver Co., Inc.	B•1117	√	√	√	√	√	√	√	√	√	√	√	√	√			√	√
VL Electronics	B•1123	√	√	√	√	√	√	√	√	√		'	√	√			√	√
World Products Systems Div. Group	B•1124	√	√	√	√	√	√	√	√	√				√	√		√	√

ALTAIR™ CORPORATION

LED DISPLAYS
For More Information Call
Toll Free (800) 824-5620 or (818) 701-6977

ALTAIR offers a complete assortment of Numeric and Alphanumeric LED Displays compatible with most major manufacturers. All units are available in High-Efficiency Red, Standard Red (GaAsP or GaP), Green, Yellow and Orange. The light output of each unit is measured and bin categorized for consistent and even brightness so that each lot will not contain units with visible differences between individual displays. All units shown are completely epoxy encapsulated and offer clear bold segments for maximum light output. Call for information on pinouts or ask for a data sheet giving complete specifications on units of your choice.



Please note that individual data sheets are available upon request for each product giving specific details on brightness, operating voltages and currents, maximum ratings, package sizes, tolerances, and pinouts. For some displays, companion overflow digits are available for popular sizes. Multiple packages that appear on the same line indicates there are variations in pinouts or drive circuitry. This is especially true in the case of multi-digit models where it is common to use multiplex, duplex or direct drive schemes. Call us for specifics.

7-SEGMENT MULTI-DIGITS

Char. Size	Pkg Style	Pin Compat.	Cross Reference Guide
0.30"	31	Toshiba	TLR32X Series (Dual Digit)
0.40"	32,33	Toshiba	TLR42X Series (Dual Digit)
0.50"	34,35	Litronix	DL72X Series (Dual Digit)
0.56"	38	GI	MAN6XXX Series (Dual Digit)
0.56"	39	GI	MAN6XXX Series (1 1/2 Digit)
0.56"	41	NA	New Product (3-Digit Direct Drive)
0.56"	42	NA	New Product (3-Digit Multiplex)
0.56"	45	NA	New Product (4-Digit Direct Drive)
0.56"	46	NA	New Product (4-Digit Multiplex)
0.80"	40	NA	New Product (Dual Digit)

DOT MATRIX

Char. Size	Pkg Style	Pin Compat.	Cross Reference Guide
0.30"	52	IEE	LR1704X Series (5x7)
0.68"	53,54	IEE	LR7057X Series (5x7)
1.16"	55	IEE	LR1257X Series (5x7)
2.00"	57	IEE	LR2057X Series (5x7)
2.30"	59	NA	New Product (8X8)
2.40"	60,61	NA	New Product (5X8)
4.00"	62	NA	New Product (5X7)

BAR GRAPHS & LIGHT BARS

Char. Size	Pkg Style	Pin Compat.	Cross Reference Guide
0.50"	63	GI	MV5X173(Light Bar)
0.75"	64	NA	New Product (Light Bar)
1.00"	65	GI	HPMV5X164,HDSP48XX (Bar Graph)

PLEASE SELECT DISPLAYS BY *Package Style.*
(Complete data sheets are available for all other information).

AVAILABLE COLORS IN MOST DISPLAYS:

R= RED (GaAsP)
P = RED (GaP)
H = HIGH EFFICIENCY RED
E = ORANGE
G = GREEN
Y = YELLOW

SPECIFY COMMON (or COLUMN) ANODE OR CATHODE

7-SEGMENT SINGLE DIGITS

Char. Size	Pkg Style	Pin Compat.	Cross Reference Guide
0.30"	01	TI,HP	TIL3xxx ,HP5082-7XXX Series
0.30"	02,03	GI	MAN3XXX Series
0.36"	06	Fairchild	FND3XX Series
0.40"	08	GI	MAN4XXX Series
0.43"	10	HP	HP5082-7XXX Series
0.50"	12	TI	TIL3XX Series
0.56"	16	GI	Man6XXX Series
0.63"	19	IEE	R18XX Series
0.80"	21,22	HP,GI	HDSP-XXXX, MAN8400 Series
1.02"	26	IEE	LR17XX Series
2.30"	29	NA	New Product
4.00"	30	NA	New Product

SEGMENTED ALPHANUMERIC

Char. Size	Pkg Style	Pin Compat.	Cross Reference Guide
0.39"	47	Litronix	HD14101X Series
0.54"	50	IEE	LR3784X Series(Dual Digit)
0.80"	48	NA	New Product
2.30"	49	NA	New Product

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ALTAIR™ CORPORATION

LED DISPLAYS
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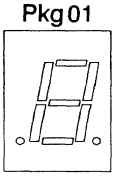
PACKAGE STYLES

NOT TO SCALE
SEE FACING PAGE FOR CHARACTER HTS.

Pkg 01


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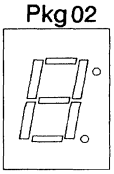

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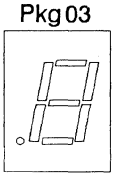

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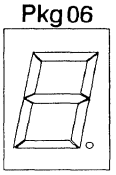

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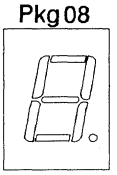

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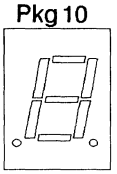

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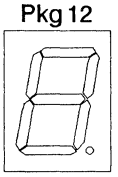

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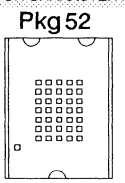

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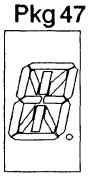

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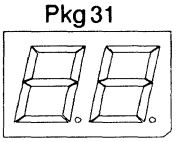

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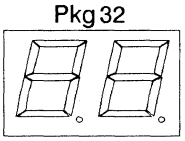

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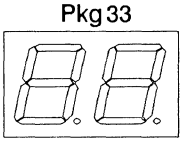

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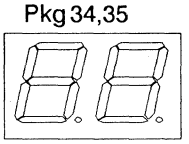

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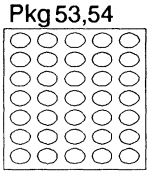

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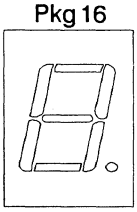

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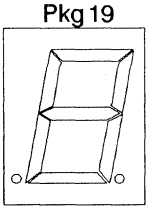

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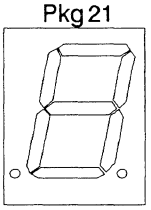

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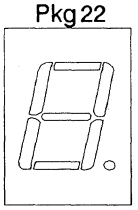

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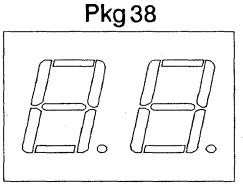

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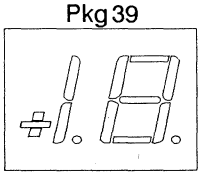

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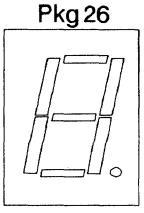

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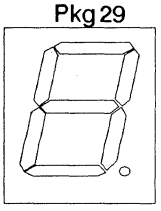

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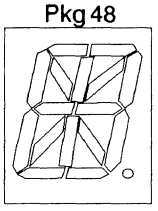

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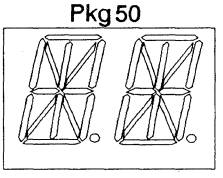

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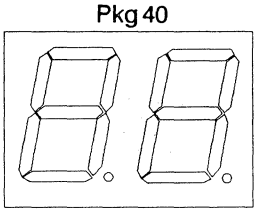

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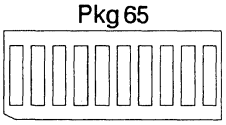

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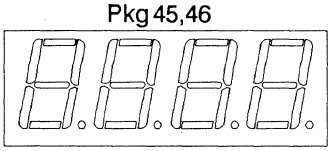

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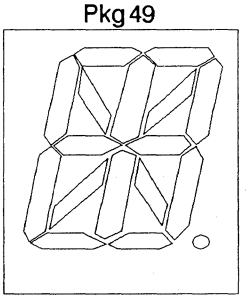

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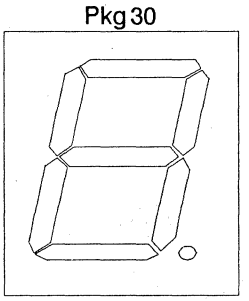

Pkg 63

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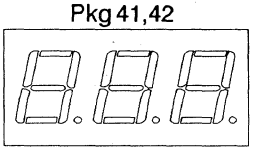

Pkg 64

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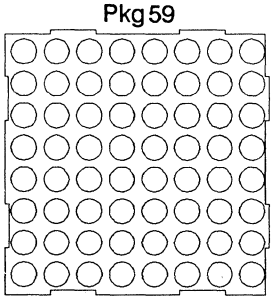

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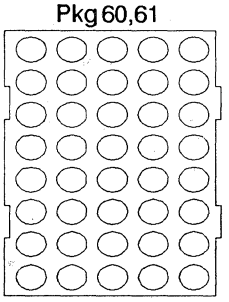

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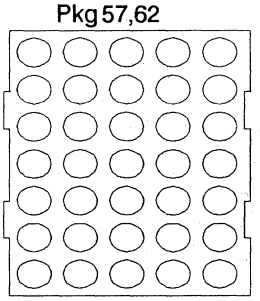

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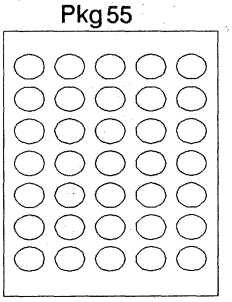

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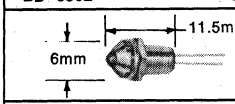
5mm HOLE SIZE

BD 0502 2 VOLT



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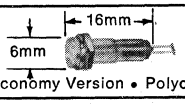
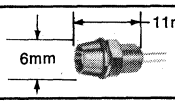


Economy Version • Polycarbonate

BD 0501 2 VOLT



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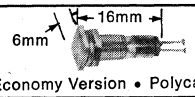
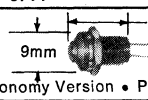


Economy Version • Polycarbonate

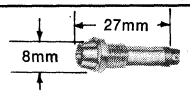
7mm HOLE SIZE

BD 0714 2 VOLT

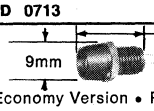


Economy Version • Polycarbonate

BD 0701 6V, 12V, 24V

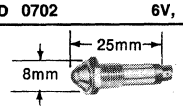


BD 0713 2 VOLT



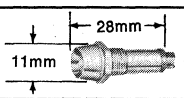
Economy Version • Polycarbonate

BD 0702 6V, 12V, 24V

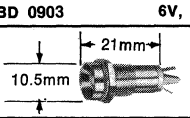


9mm HOLE SIZE

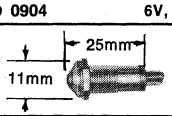
BD 0905 2 VOLT



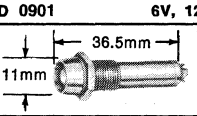
BD 0903 6V, 12V, 24V



BD 0904 6V, 12V, 24V

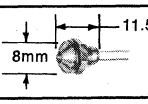


BD 0901 6V, 12V, 24V



6mm HOLE SIZE

BD 0603 2 VOLT



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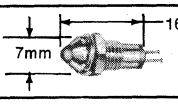
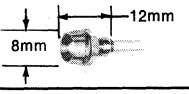
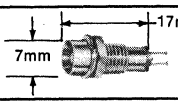


BD 0601 2 VOLT

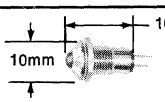


BD 0604 2 VOLT

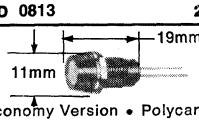


8mm HOLE SIZE

BD 0806 2 VOLT

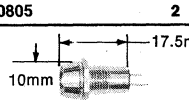


BD 0813 2 VOLT

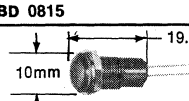


Economy Version • Polycarbonate

BD 0805 2 VOLT

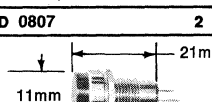


BD 0815 2 VOLT

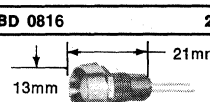


Economy Version • Polycarbonate

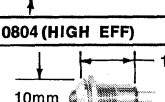
BD 0807 2 VOLT



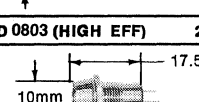
BD 0816 2 VOLT



BD 0804 (HIGH EFF) 2 VOLT



BD 0803 (HIGH EFF) 2 VOLT

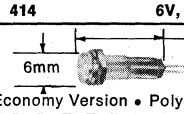


INCANDESCENT Type

Standard Voltages include 5V, 6V, 8V, 12V & 24V. Specific Voltage and currents are available. Please Specify. Leaded units come standard with 6″ stripped. Specify other lengths. Available Colors — Blue, Green, Orange, Red & Clear.

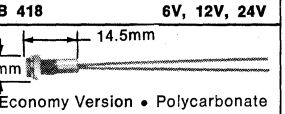
5mm HOLE SIZE

B 414 6V, 12V, 24V



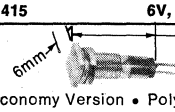
Economy Version • Polycarbonate

B 418 6V, 12V, 24V



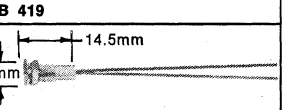
Economy Version • Polycarbonate

B 415 6V, 12V, 24V

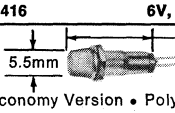


Economy Version • Polycarbonate

B 419

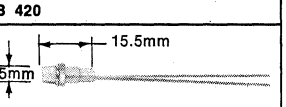


B 416 6V, 12V, 24V

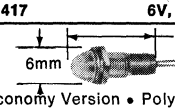


Economy Version • Polycarbonate

B 420

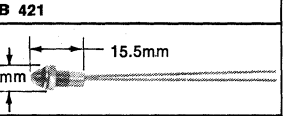


B 417 6V, 12V, 24V



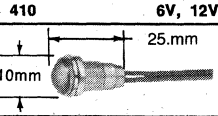
Economy Version • Polycarbonate

B 421

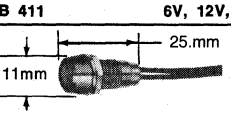


8mm HOLE SIZE

B 410 6V, 12V, 24V

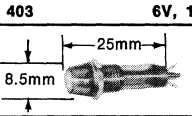


B 411 6V, 12V, 24V

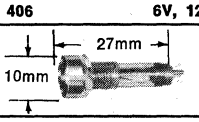


7mm HOLE SIZE

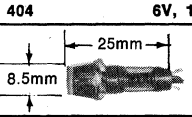
B 403 6V, 12V, 24V



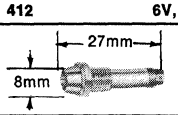
B 406 6V, 12V, 24V



B 404 6V, 12V, 24V



B 412 6V, 12V, 24V



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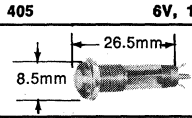
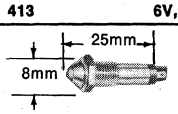
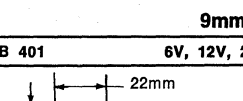


B 413 6V, 12V, 24V

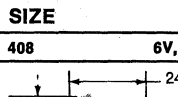


9mm HOLE SIZE

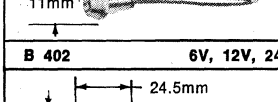
B 401 6V, 12V, 24V



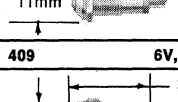
B 408 6V, 12V, 24V



B 402 6V, 12V, 24V



B 409 6V, 12V, 24V



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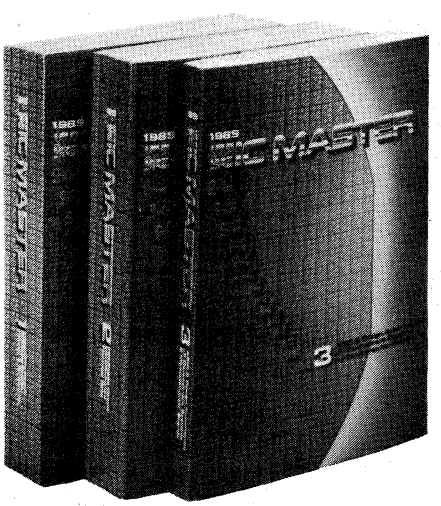

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LIQUID CRYSTAL DISPLAYS, STANDARD

Type	Glass Size (mm)	Character Size (mm)	Viewing Mode	Temp. Range	Connection Type	Display Format: DIGITS	DP's	COLONS	+/−	LO BAT.	OTHER	Duty
LTD211R-11	38.0×20.3	6.0	Reflective	STD	Elastomer	8	8	—	—	—	2	1/2
R-21				EXT								
F-11			Transflective	STD								
F-21				EXT								
LTD233R-11	69.8×20.3	6.0	Reflective	STD	Elastomer	16	16	—	—	—	—	1/2
R-21				EXT								
F-11			Transflective	STD								
F-21				EXT								
LTD234R-11	69.8×20.3	6.0	Reflective	STD	Elastomer	16	16	—	—	—	—	1/4
R-21				EXT								
F-11			Transflective	STD								
F-21				EXT								
LTD201R-11	23.9×14.0	6.8	Reflective	STD	Elastomer	4	3	—	—	—	—	DD
R-21				EXT								
F-11			Transflective	STD								
F-21				EXT								
LTD203R-11	38.0×20.3	8.0	Reflective	STD	Elastomer	4	3	1	2	1	1	DD
R-21				EXT								
F-11			Transflective	STD								
F-21				EXT								
LTD101R-11	50.8×22.9	8.9	Reflective	STD	Elastomer	3¾	—	1	—	—	3	DD
R-21				EXT								
F-11			Transflective	STD								
F-21				EXT								
LTD227R-11	50.8×30.4	10.0	Reflective	STD	Elastomer	4½	4	2	2	1	—	DD
R-12					Fixed Pins							
R-21				EXT	Elastomer							
R-22					Fixed Pins							
F-11			Transflective	STD	Elastomer							
F-12					Fixed Pins							
F-21				EXT	Elastomer							
F-22					Fixed Pins							
LTD228R-12	50.8×30.4	10.0	Reflective	STD	Fixed Pins	5	4	—	—	—	—	DD
R-22				EXT								
F-12			Transflective	STD								
F-22				EXT								
LTD231R-12	50.8×30.4	10.2	Reflective	STD	Elastomer	3½	3	—	1	1	6	1/3
R-21				EXT								
F-11			Transflective	STD								
F-21				EXT								
LTD232R-11	50.8×30.4	11.0	Reflective	STD	Elastomer	4½	4	—	1	1	1	1/3
R-21				EXT								
F-11			Transflective	STD								
F-21				EXT								
LTD202R-12	27.9×30.4	12.7	Reflective	STD	Fixed Pins	2	2	—	—	—	—	DD
R-22				EXT								
F-12			Transflective	STD								
F-22				EXT								
LTD225R-11	50.8×30.4	12.7	Reflective	STD	Elastomer	3½	3	1	2	1	—	DD
R-21				EXT								
F-11			Transflective	STD								
F-21				EXT								
LTD222R-11	50.8×30.4	12.7	Reflective	STD	Elastomer	3½	3	1	2	1	—	DD
R-12					Fixed Pins							
R-21				EXT	Elastomer							
R-22					Fixed Pins							
F-11			Transflective	STD	Elastomer							
F-12					Fixed Pins							
F-21				EXT	Elastomer							
F-22					Fixed Pins							

Type	Glass Size (mm)	Character Size (mm)	Viewing Mode	Temp. Range	Connection Type	Display Format: DIGITS	DP's	COLONS	+/−	LO BAT.	OTHER	Duty
LTD221R-11	50.8×30.4	12.7	Reflective	STD	Elastomer	3½	3	1	2	1	2	DD
R-12					Fixed Pins							
R-21				EXT	Elastomer							
R-22					Fixed Pins							
F-11			Transflective	STD	Elastomer							
F-12					Fixed Pins							
F-21				EXT	Elastomer							
F-22					Fixed Pins							
LTD224R-11	50.8×30.4	12.7	Reflective	STD	Elastomer	3½	3	—	1	1	5	DD
R-21				EXT								
F-11			Transflective	STD								
F-21				EXT								
LTD226R-11	50.8×30.4	12.7	Reflective	STD	Elastomer	4	3	1	—	—	1	DD
R-12					Fixed Pins							
R-21				EXT	Elastomer							
R-22					Fixed Pins							
F-11			Transflective	STD	Elastomer							
F-12					Fixed Pins							
F-21				EXT	Elastomer							
F-22					Fixed Pins							
LTD229R-12	69.8×30.4	12.7	Reflective	STD	Fixed Pins	6	5	2	—	—	—	DD
R-22				EXT								
F-12			Transflective	STD								
F-22				EXT								
LTD262R-12	93.8×30.4	12.7	Reflective	STD	Fixed Pins	8	7	3	—	—	—	DD
R-22				EXT								
F-12			Transflective	STD								
F-22				EXT								
LTD241R-12	69.8×38.0	17.8	Reflective	STD	Fixed Pins	3½	3	1	2	1	2	DD
R-22				EXT								
F-12			Transflective	STD								
F-22				EXT								
LTD242R-12	69.8×38.0	17.8	Reflective	STD	Fixed Pins	4	3	1	—	—	—	DD
R-22				EXT								
F-12			Transflective	STD								
F-22				EXT								
LTD263R-12	93.8×38.0	17.8	Reflective	STD	Fixed Pins	8	5	2	—	—	—	DD
R-22				EXT								
F-12			Transflective	STD								
F-22				EXT								
LTD264R-12	114.0×46.0	25.0	Reflective	STD	Fixed Pins	5	4	—	—	—	4	DD
R-22				EXT								
F-12			Transflective	STD								
F-22				EXT								
LTD261R-12	76.2×101.6	76.0	Reflective	STD	Fixed Pins	1	1	—	—	—	—	DD
R-22				EXT								
F-12			Transflective	STD								
F-22				EXT								
LTD132R-11	46.8×54.8	—	Reflective	STD	Elastomer	Analog and Digital Clock Display						1/2
R-21				EXT								
F-11			Transflective	STD								
F-21				EXT								
LTD321R-12	69.8×30.4	—	Reflective	STD	Fixed Pins	Bar Graph 2×20 Elements						DD
R-22				EXT								
F-12			Transflective	STD								
F-22				EXT								
LTD351R-11	114.0×26.0	—	Reflective	STD	Elastomer	Bar Graph 2×103 Elements						1/2
R-21				EXT								
F-11			Transflective	STD								
F-21				EXT								
LTD141R-12	50.8×80.0	—	Reflective	STD	Fixed Pins	Dot Matrix 5×7 Elements						DD
R-22				EXT								
F-12			Transflective	STD								
F-22				EXT								

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LIQUID CRYSTAL DISPLAYS, STANDARD CHARACTER TYPE MODULES

Type	Module Size (mm)	Character Size (mm)	Viewing Mode	Character* Format	Display Format	
					Lines	Characters Per Line
LTM233R-10	92.5×25.0×10.5	3.2×6.0	Reflective	7-Segment	1	16
LTN111R-10	80.0×36.0×12.0	3.07×5.73	Reflective	5×7 Dot Matrix	1	16
LTN111F-10	80.0×36.0×12.0	3.07×5.73	Transflective, for use with EL Backlight LXL111-G	5×7 Dot Matrix	1	16
LTN211R-10	84.0×44.0×12.0	2.96×4.86	Reflective	5×7 Dot Matrix	2	16
LTN211F-10	84.0×44.0×12.0	2.96×4.86	Transflective, for use with EL Backlight LXL211-G	5×7 Dot Matrix	2	16
LPH3511-1	84.0×44.0×12.0	—	Reflective, Black Bezel	5×7 Dot Matrix	2	16
LP-3511-E	84.0×44.0×12.0	—	Reflective, 12 O'clock Viewing Direction	5×7 Dot Matrix	2	16
LTN221R-10	116.0×37.0×11.0	—	Reflective	5×7 Dot Matrix	2	20
LTN221F-10	116.0×37.0×11.0	—	Transflective, for use with EL Backlight LXL221-G	5×7 Dot Matrix	2	20
LTN222R-10	116.0×37.0×11.0	—	Reflective	5×7 Dot Matrix	2	24
LTN222F-10	116.0×37.0×11.0	—	Transflective, for use with EL Backlight LXL221-G	5×7 Dot Matrix	2	24
LTN242R-10	182.0×33.5×11.0	—	Reflective	5×7 Dot Matrix	2	40
LTN242F-10	182.0×33.5×11.0	—	Transflective, for use with EL Backlight	5×7 Dot Matrix	2	40

LIQUID CRYSTAL DISPLAYS, STANDARD GRAPHIC TYPE MODULES

Type	Module Size (mm)	Viewing Mode	Display Format (Dots)	Dot Pitch (mm)	Technology
LTG201R-10	180.0×75.0×10.5	Reflective	240×64	0.53×0.53	Twisted Nematic
LTG201F-10	180.0×75.0×10.5	Transflective, for use with EL Backlight	240×64	0.53×0.53	Twisted Nematic
LBG201R-10	180.0×75.0×10.5	Reflective	240×64	0.53×0.53	Super Twisted Nematic (Yellow and Blue)
LBG201F-10	180.0×75.0×10.5	Transflective, for use with EL Backlight	240×64	0.53×0.53	Super Twisted Nematic (Yellow and Blue)
LBG402R-10	256.0×125.0×18.0	Reflective	640×200	0.35×0.49	Super Twisted Nematic (Yellow and Blue)
LBG402F-10	256.0×125.0×18.0	Transflective, for use with EL Backlight LXL401-W	640×200	0.35×0.49	Super Twisted Nematic (Yellow and Blue)
LBG403R-10	256.0×125.0×22.0	Reflective	640×200	0.35×0.49	Double Super Twisted Nematic (Black and White)
LBG403F-10	256.0×125.0×22.0	Transflective, for use with EL Backlight LXL401-W	640×200	0.35×0.49	Double Super Twisted Nematic (Black and White)

GEORGE WASHINGTON HWY., SMITHFIELD, RI 02917, 401/232-0500, FAX 401/232-0505, TWX 710-381-8808.

AND
ONE OF THE PURDY GROUP OF COMPANIES

Liquid Crystal Display Modules (Alphanumeric and Graphics)

770 AIRPORT BLVD., BURLINGAME, CA 94010 • TEL (415) 347-9916 • FAX (415) 340-1670 • MCI/TLX 677-1439 (PURDY UW)

LCD MODULE QUICK REFERENCE GUIDE

Type No.	Number of Characters/ Dots	Character/Dot Size (mm)	Viewing Area (mm)	Outline Dimension (mm)	Driving Voltage (V)	Power Consum. (mW)	Controller	–30	–EO
Character Displays With Controller/Ram									
AND241	16 × 1	3.15 W × 7.9 H	64.5 W × 13.8 H	80 W × 36 H × 12 D	+5	4		—	—
AND671	16 × 1	3.15 W × 5.76 H	64.5 W × 13.8 H	80 W × 36 H × 12 D	+5	5		Yes	—
AND691	24 × 1	3.2 W × 7.95 H	100 W × 13.8 H	126 W × 36 H × 12 D	+5	10	HD44780	Yes	—
AND601	40 × 1	3.2 W × 7.95 H	154.8 W × 17.5 H	182 W × 33.5 H × 13 D	+5	10		Yes	—
AND491	16 × 2	2.95 W × 4.29 H	64.5 W × 15 H	80 W × 36 H × 12 D	+5	10	or	Yes	—
AND501	20 × 2	3.21 W × 5.55 H	83 W × 18.6 H	116 W × 37 H × 12.5 D	+5	10		Yes	—
AND771	24 × 2	3.21 W × 5.07 H	93.5 W × 16.5 H	118 W × 36 H × 12 D	+5	10	equivalent	Yes	—
AND591	40 × 2	3.2 W × 5.55 H	154.8 W × 17.5 H	182 W × 33.5 H × 13 D	+5	12		Yes	—
AND731	16 × 4	2.96 W × 4.51 H	61.8 W × 26.6 H	87 W × 60 H × 12 D	+5	17.5		Yes	—
AND721	20 × 4	2.96 W × 4.51 H	76 W × 27 H	98 W × 60 H × 12 D	+5	15		Yes	—
AND1001	40 × 4	3.95 W × 5.55 H	199 W × 44 H	221 W × 76 H × 12.5 D	+/–5	—	T6963C	—	—
LED Backlight Character Displays With Controller/Ram									
AND493-JO	16×2	2.95 W × 4.29 H	64.5 W × 15 H	80 W × 36 H × 16 D	+5	10	HD44780	LED	
AND673-JO	16×1	3.15 W × 5.76 H	64.5 W × 13.8 H	80 W × 36 H × 16 D	+5	5	HD44780	LED	
Graphic Displays With Controller/Ram									
AND1021	120 W × 64 H	0.44 W × 0.56 H	62.5 W × 43.5 H	85 W × 70 H × 20 D	+5/–8.5	35	T6963C	Yes	Yes
AND682	160 W × 64 H	0.41 W × 0.41 H	75 W × 32 H	125 W × 50 H × 18 D	+5/–12	40	T6963C	—	—
AND711A	240 W × 64 H	0.49 W × 0.49 H	132 W × 39 H	180 W × 65 H × 12 D	+5/–8.5	60	T6963C	Yes	Yes
AND1013	160 W × 128 H	0.56 W × 0.56 H	101 W × 82 H	129 W × 104.5 H × 14 D	+5/–8.5	45	T6963C	Yes	Yes
AND1091	240 W × 128 H	0.66 W × 0.66 H	179.9 W × 101.5 H	241 W × 125.3 H × 12 D	+5/–8.5	50	T6963C	Yes	—
AND1101	160 W × 32 H	0.46 W × 0.46 H	82 W × 21 H	140 W × 40 H × 12 D	+5/–5	—	T6963C	Yes	—
Graphic Displays With Super Twist Nematic With Controller									
AND711AST	240 W × 64 H	0.49 W × 0.49 H	132 W × 39 H	180 W × 65 H × 12 D	+5/–8.5	—	T6963C	Yes	Yes
AND1021ST	120 W × 64 H	0.44 W × 0.56 H	62.5 W × 43.5 H	85 W × 70 H × 20 D	+5/–8.5	35	T6963C	Yes	Yes
AND103ST	160 W × 128 H	0.56 W × 0.56 H	101 W × 82 H	129 W × 104.5 H × 14 D	+5/–8.5	45	T6963C	Yes	Yes
AND1301-VST	240 W × 128 H	0.66 W × 0.66 H	179.9 W × 101.5 H	241 W × 125.3 H × 12 D	+5/–14.5	—	T6963C	Yes	Yes
AND1391ST	128 W × 128 H	0.40 W × 0.40 H	62.0 W × 62.0 H	85 W × 100 H × 14 D	+5/–14.5	—	T6963C	Yes	Yes
Graphic Displays With Super Twist Nematic Without Controller									
AND1241ST	480 W × 128 H	0.48 W × 0.48 H	236 W × 67 H	277 W × 83 H × 14 D	+5/–14.5	—	(T7779)	—	—
AND1461ST*	240 W × 200 H	0.45 W × 0.45 H	144 W × 96 H	158 W × 113 H × 14 D	+5/–22.5	—	(T7779)	—	—
AND932ST	640 W × 200 H	0.345 W × 0.345 H	249 W × 82 H	293 W × 97.6 H × 14 D	+5/–22.5	—	(T7779)	—	—
AND561ST	640 W × 200 H	0.32 W × 0.46 H	231 W × 105 H	275 W × 126 H × 14 D	+5/–22.5	—	(T7779)	Yes	Yes
AND1181ST	640 W × 400 H	0.32 W × 0.32 H	230 W × 146 H	276 W × 186 H × 14 D	+5/–22.5	—	(T7779)	Yes	Yes

–30 designates a module with a transflective backing rather than a reflective one. The transflective backing makes viewing possible both normally, using ambient light or by using a backlight, EL or AND Fiber Optic Backlight. The backlight slips between the LCD and the PC Board making viewing possible in dark or dim lighting conditions.

–EO designates a module which has a transflective backing and an electroluminescent lamp installed. Normally an inverter is necessary to generate the high frequency AC signal needed by the EL lamp.

LED Backlight modules have a transflective backing and an LED Backlight is installed. The backlight operates on 4.1 V and a max current of 125 mA.

See our page on Lamps, Section 2460, page B•1129

Liquid Crystal Display Panels
Fiber Optic Backlighting System FOR UNIVERSAL APPLICATIONS

AND
ONE OF THE PURDY GROUP OF COMPANIES

770 AIRPORT BLVD., BURLINGAME, CA 94010 • TEL (415) 347-9916 • FAX (415) 340-1670 • MCI/TLX 677-1439 (PURDY UW)

Liquid Crystal Display Panels

Display Font	Digit Height (inches)	Part Number	Package Dimensions L x W (inches)
.8.8	0.5	FE1901	1.2 x 1.2
÷1.8:8.8	0.2 0.5 0.7 1.0	FE2201 FE0201 FE0501 FE0701	1.6 x 0.7 2.0 x 1.2 2.75 x 1.5 3.7 x 1.8
LO BAT ÷1.8:8.8	0.5	FE0203	2.0 x 1.2
DC ACD 1.8.8.8 mVAC MKΩF	0.4	FE0801	2.0 x 0.95
8.8:8.8	0.3	Fe0101 (pinless only)	1.57 x 0.7
8.8:8.8	0.35 0.5 0.5 0.7 1.0	FE0804 FE0202 FE0204* FE0502 FE0703	2.0 x 0.95 2.0 x 1.2 2.0 x 1.2 2.75 x 1.5 3.7 x 1.8

Display Font	Digit Height (inches)	Part Number	Package Dimensions L x W (inches)
FAB4	0.5	FE0205	2.0 x 1.2
LO BAT ÷1.8:8:8.8	0.4	FE0206	2.0 x 1.2
8:8:8.8.8	0.4	FE0208	2.0 x 1.2
.8.8:8.8:8.8	0.3 0.5 0.7	FE0803 FE0401 FE0601	2.0 x 0.95 2.75 x 1.2 3.7 x 1.5
8.8:8.8:8.8:8.8	0.5	FE1001	3.7 x 1.2
	0.15	FE0405	2.75 x 1.2

* TRIPLEX

Ordering Information:

PART Number FEXXXX X-X X

Model Number: _____
Liquid Crystal Material—Polarizer Options: _____
Leave digit blank—Standard Grade (–20 to +60°C)—Standard Polarizer
W-__U—Wide Temperature (–30 to +85°C)—High Temp./High Humidity Polarizer
Viewing Mode (see configuration chart): _____

Example: Model FE0203, with wide temperature fluid, pinned reflective foil configuration and high temp./high humidity polarizer: FE0203W-DU

Custom LCD'S. Contact our representatives or consult factory for your custom LCD'S

Configuration Chart

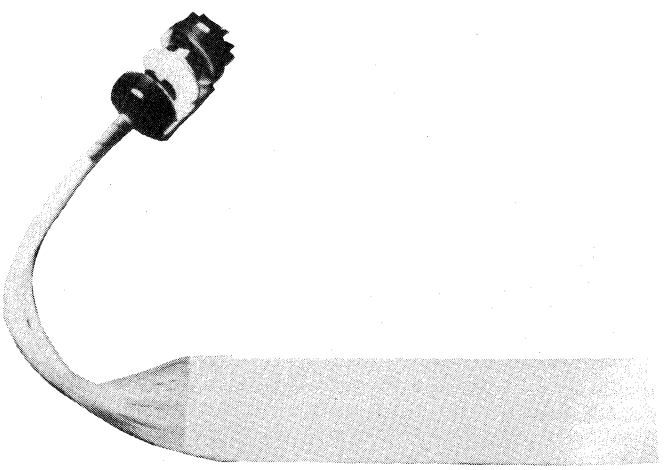
Viewing Mode	Configuration	
	Pinned	Pinned
Transmissive	A	F
Reflective Frosted	K	
Reflective Aluminum Foil	D	I
Transflective	E	J

FIBER OPTIC BACKLIGHT

FOR ALL TYPES OF BACKLIGHTING APPLICATIONS

Features

- Usable in virtually any application requiring a high intensity backlight
- Usable in either AND or competing LCDs, both LCD dot matrix modules and panel displays.
- VERY BRIGHT—45–120 Ft-L with 2.5W source
- Bulb life—5,000 hrs at 5 VDC
  40,000 hrs at 4 VDC
  Intensity is variable
  Lamp is easily replaceable
- Life of panel is unlimited
- No heat—EMI-RMI at illuminated area
- Highly shock resistant
- Upper temperature limit +80°C
- Panel can be used under water
- Color easily changed through multiple sources of changeable filters
- Available light sources
  —2.5W, 5 VDC halogen lamp (standard source)
  —5.0W, 5 VDC halogen lamp
  —4.22W, 4.5 VDC halogen lamp
  —20mA, 2 VDC LED lamp (under development)



Selection Guide

Module Part Number	Fiber Optic Backlight P/N	Approximate Dimensions (A x B) in mm
AND591-30	BL591	166.0 x 22.0
AND721-30	BL721	97.0 x 31.8
AND771-30	BL771	104.5 x 21.0
AND711-30	BL711	162.5 x 44.3
AND1021-30	BL1021	76.8 x 50

Module Part Number	Fiber Optic Backlight P/N	Approximate Dimensions (A x B) in mm
AND1013-30	BL1013	109.5 x 87.2
AND1181ST-30	BL1181	266.0 x 148.0
AND1301VST-30	BL1301	209.3 x 105.5
AND561ST-30	BL561	265.5 x 106.0
AND1391ST-30	BL1391	64.0 x 64.0

NOTE: Fiber optic backlights for all other AND LCD modules can be supplied. Check with AND or its reps for specifics.

See our page on Lamps, Section 2460, page B•1129

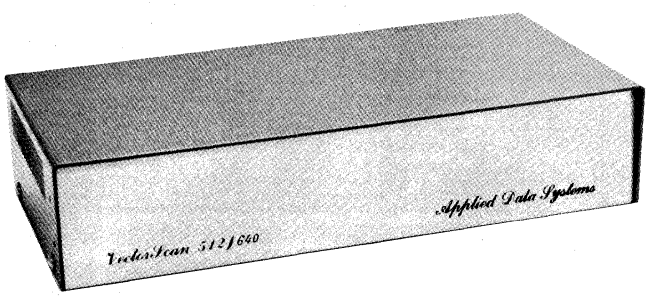
Applied Data Systems, Inc.

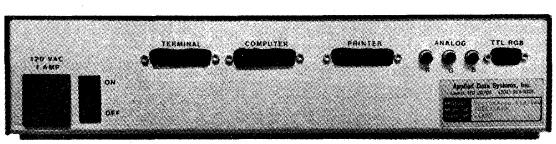
Display Controllers for Color and Monochrome video monitors. Various LCD, Plasma and other flat technologies can also be supported.

409A Preston Street • Baltimore, MD 21202 • 1-800-541-2003

VectorScan 512/640

Graphic Controller with RS-232 Interface



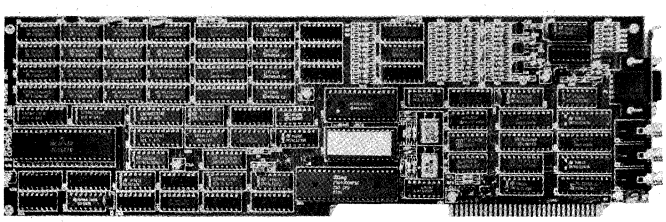


FEATURES:

- 512/640/640 x 480/350/400 x 4 bits per pixel resolution to display up to 16 colors/intensities simultaneously from a 4,096 color palette.
- Supports Interlaced and Non-Interlaced monitors.
- Internal 8 MHZ Processor and firmware.
- Color mapping register for selective image viewing, highlighting, and limited animation.
- Graphic image creation in any language on any operating system.
- 512K bytes of self-contained on-board video RAM.
- 4 independent image buffers which can be selectively displayed and modified.
- Provide image hardcopy on many dot matrix printers.
- A loop-through feature that saves an RS232 port, displays commands on your terminal, and enables remote workstation connection over RS-232 circuits.

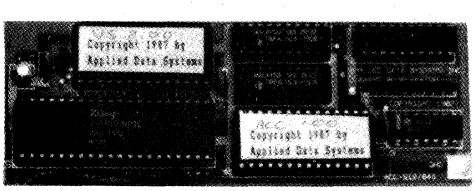
VectorScan PC512/PC640

Graphic Controllers for the IBM-PC/XT/AT



- 512/640/640 x 480/350/400 x 4 bits per pixel resolution to display up to 16 colors/intensities simultaneously from a 4,096 color palette.
- Supports Interlaced and Non-Interlaced monitors.
- Emulates an IBM-PC printer adapter.
- Easy to install plug-in style board.
- Color mapping register for selective image viewing, highlighting and limited animation.
- Graphic image creation in any language on any operating ystem.
- 512K bytes of self-contained on-board video RAM expandable to 2 M bytes.
- 4 independent image buffers which can be selectively displayed and modified.
- Uses no PC RAM address space.
- IBM-PC TTL or analog output for monochrome or color monitors.

VectorScan Accelerator



(Optional Drawing Accelerator)

Applied Data Systems Inc. supplies customized hardware and software for process control, research and development, and OEM applications. Our library of custom software can be used to optimize display system performance.

CANYON electronics

READOUT ASSEMBLIES

MINI-PAK DISPLAY ASSEMBLIES

The MINI-PAK® series are gas discharge or LED readout modules, specifically designed for use on low-to-medium volume industrial or commercial instruments. The display and associated electronic drive are packaged in a black thermoplastic case available in two styles; a rear panel mount and a front panel mount. The modules are available in 1½-, 2-, 2½ and 3-digit configuration that can be mounted individually or stacked horizontally to form any number of digits. The MINI-PAK® series are designed for direct interface compatibility with TTL or LSI integrated circuits with 4 line output information in the 8-4-2-1 BCD code format.

GAS DISCHARGE SERIES CE-1000/CE-2000

The MINI-PAK® series CE-1000/CE-2000 include a 0.55" high character gas discharge display and the BCD to seven segments Decoder/Driver. The interface terminals are brought out to 14 pin dual-in-line header or socket. All components are soldered to the P.C. Board.

GAS DISCHARGE SERIES CE-3000/CE-4000

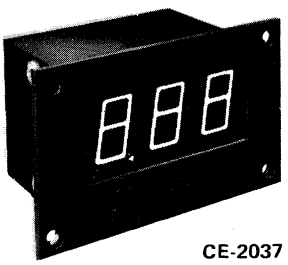
The MINI-PAK® series CE-3000/CE-4000 include a 0.55" high character gas discharge display and socket mounted BCD to seven segments Decoder/Driver. The interface terminals are brought out to wire wrap pins. The gas discharge display can be very easily and efficiently replaced, thereby, minimizing down time.

LED SERIES CE-5000/CE-6000

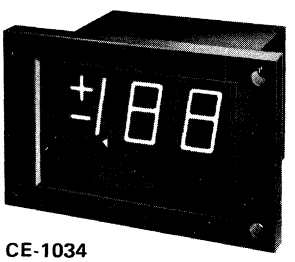
The MINI-PAK® series CE-5000/CE-6000 include a socket mounted 0.43", 0.625" or 0.8" character high LED display, a socket mounted BCD to seven segments Decoder/Driver and current limitting resistors, whenever applicable. The interface terminals are brought out to wire wrap pins. The series is available with or without latch or in 5 mA, 15 mA or 20 mA per segment.

FOR CUSTOM MADE ASSEMBLIES, LARGER CHARACTERS OR OTHER REQUIREMENTS, CONSULT FACTORY

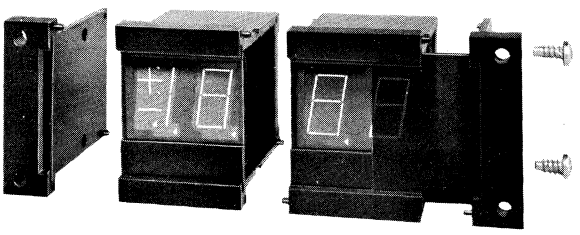
DOUBLES YOUR OPTION TO YOUR PANEL DESIGN WITH THE MINI-PAK® LED AND GAS DISCHARGE DISPLAYS.



CE-2037

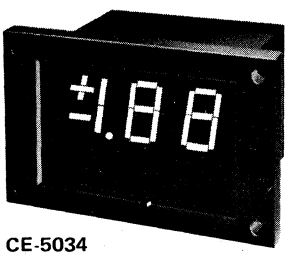


CE-1034



INSTALLATION DRAWING

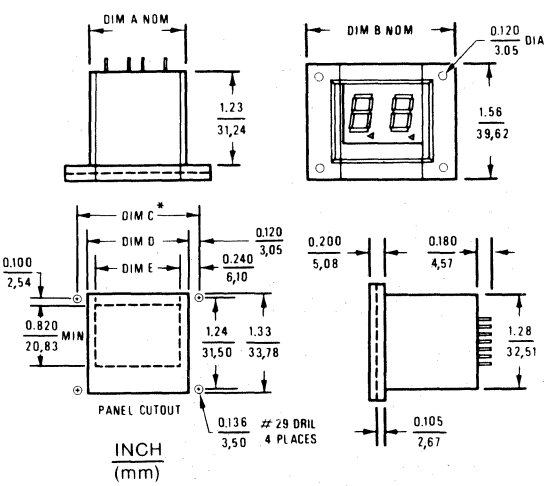
CE-6037



CE-5034

MECHANICAL SPECIFICATIONS

NO DIGITS	BEZEL WIDTH DIM. B NOM.		PANEL CUTOUT † DIM. D		PANEL CUTOUT †† DIM. E	
2	1.94	49,28	1.38	35,1	1.14	28,96
3	2.48	62,99	1.92	48,8	1.68	42,68
4	3.04	77,22	2.48	63,0	2.24	56,90
5	3.58	90,93	3.02	76,70	2.78	70,62
▲ 6	4.12	104,65	3.56	90,42	3.32	84,33
7	4.68	118,87	4.12	104,7	3.8ℰ	98,56
▲ 8	5.22	132,59	4.66	118,4	4.42	112,27



▲ Assumes maximum 3 digits modules per assembly.

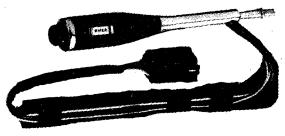
† D Dimension applies to CE-1000/3000/5000 series.

†† E Dimension applies to CE-2000/4000/6000 series.

CANYON ELECTRONICS 2001 W. North Lane, Phoenix, Arizona 85021 (602) 944-4421 FAX (602) 943-0739

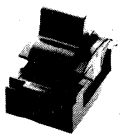
CHERRY ELECTRICAL PRODUCTS
3600 Sunset Ave., Waukegan, IL 60087
312/360-3500 • FAX 312-360-3566

Automotive Products



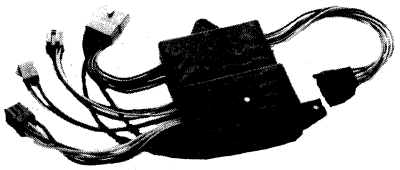
Washer wiper

Power mirror



Door lock

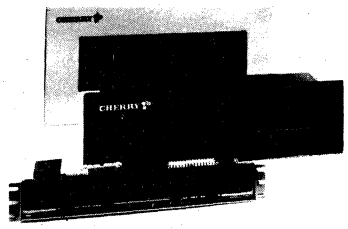
Window lift



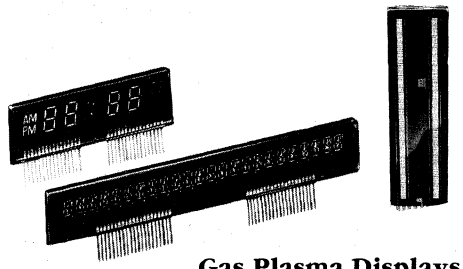
Memory seat module

Quality, Engineering and Service are the backbone of Cherry Automotive. Bolstered by 35 years experience, Cherry designs and manufactures a broad range of electrical and electronic components, assemblies and systems. Cherry's facility features a high degree of vertical integration, automation, just-in-time technology and robotics. Cherry maintains quality by controlling its in-house moldings, stampings, printed circuit boards, springs and automation. Our CAD, CAM, CIM automotive test lab, surface mount technology and plastics lab are second to none in the industry. A long time supplier to the Big Three, Cherry's Detroit metro based office staff serves our customers' needs.

Displays



Industrial Control Products including intelligent and non-intelligent alphanumeric displays, display accessories and thumbwheel and pushwheel assemblies.

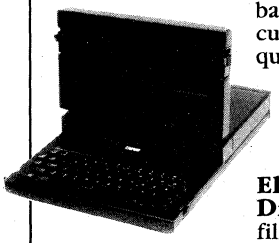


Gas Plasma Displays
7 Segment Numeric (4 to 11 digits)

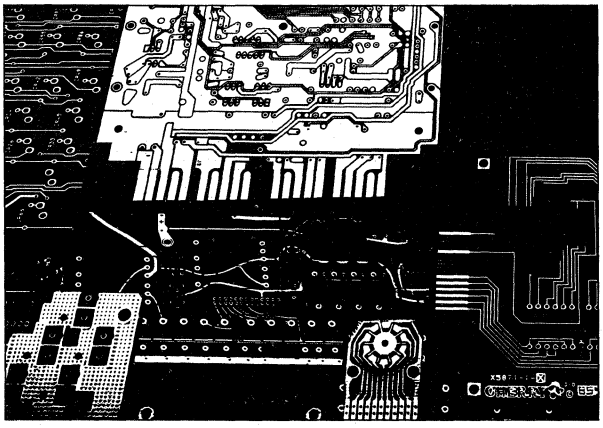
14 Segment Numeric (to 24 characters)

One and four line non-intelligent displays requiring ASCII input.

Also—Bar Graph Displays—flat panel indicators containing one or two bars. Four basic standards plus custom designs in production quantities.



Electroluminescent Displays—High luminance, Thick film, Flat panel DC EL Display Systems. 640 x 200 Pixel organization. Simple, rugged and reliable construction.



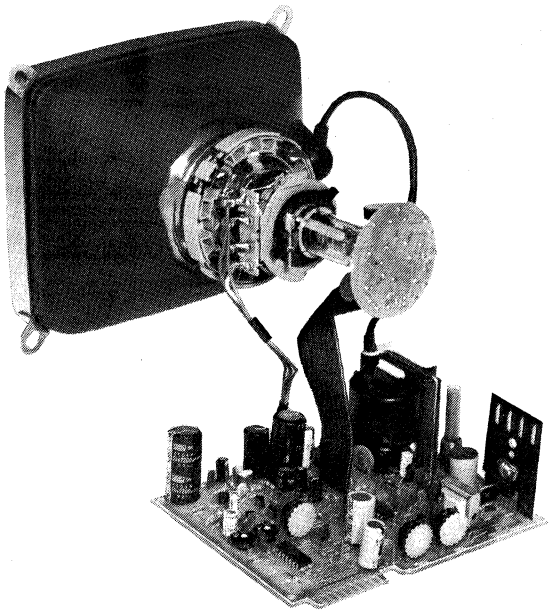
Printed Circuit Boards

Cherry has been providing quality printed circuit boards for over 20 years. Our facility supplies high reliability plated through hole, multilayer, double-sided and single-sided printed wiring boards.

Surface mount or conventional lead designs. Full panel or selective plating finishes. High density, fine line small hole designs in a variety of finishes including gold, palladium, rhodium, copper, solder or nickel.

State-of-the-art operation includes extensive use of automated equipment and the latest technological methods that result in on-time, cost effective product delivery.

Unique wet processing capabilities have been acknowledged as one of the best in industry.



High Performance Monitors For Militarized General Purpose, and High Resolution Applications

GENERAL DESCRIPTION—Model 130DMX Militarized Video Monitor.

The 130DMX offers state of the art militarized performance for rugged environments. This line of monitors features high brightness P43 phosphor, sunlight readability, EMI/RFI shielding, low power consumption and splashproof front panel mounting. This line is available with flat screen in a variety of sizes. All monitors are built to custom specifications. This line of monitors is designed to meet or exceed the following military specifications; MIL-E-6051D, MIL-P-11268, MIL-C-14806A, MIL-STD-461B, MIL-STD-810D.

Specifications:

Electrical:

Signal Interface: RS170A/RS375A composite BNC
Power Input: 15VDC @ 1.2 Amp nominal
CRT Type: 6 inch/20mm Display grade
P43 Phosphor color
OCLI optical notch filter
EMI/RFI Mil-C-14806A
Front panel splashproof seal
Operating Humidity Range: 100% non-condensing
Operating Temp Range: −33°C to +71°C
Temperature Shock Range: −46°C to +71°C
Operating Altitude: 25,000 feet
MECHANICAL (6 inch display)
Overall Length: 10.2″ (260mm)
Overall Width: 5.9″ (151mm)
Overall Height: 4.9″ (125mm)
Weight: 6 lbs

GENERAL DESCRIPTION—Model 118DMX-110° Monochrome Display Module...from $179.00*

Model 118 is designed for high density, large screen, monochrome applications where superb performance, wide deflection angle CRT's are required. Landscape or portrait formats are available.

Performance Characteristics:

- Time Base Range: Horiz. 15kHz to 35kHz
  Vert. 40Hz to 100Hz
- Video System
  - Bandwidth to 50MHz
  - Digitally balanced and phase corrected for inverse video display
  - Analog display of multilevel video attributes
- Sync compatibility
  - Horizontal and vertical are positive edge triggered at TTL levels
- Deflection System
  - CRT high acceleration voltage range from 12 to 18kV.
  - Dual axis dynamic focus correction.
  - Linearity 10% or better, horizontal and vertical axis.
- HV fault sensing auto shutdown.
- System power requirement
  24VDC at 1.0-1.5 A max.

GENERAL DESCRIPTION—Model 115DMX-90° Monochrome Display Module...from $99.00*

Model 115 is a high performance, general purpose monitor compatible with the full range of 20mm CRT's. Landscape or portrait formats are available.

Performance Characteristics:

- Time base range:
  - Vertical: 40-100Hz
  - Horizontal: 15-40 kHz (see options)
- Sync compatibility
  - Horizontal and vertical are positive edge triggered at TTL levels
- Video System
  - Bandwidth; 50MHz (min).
  - Digitally balanced and phase corrected for inverse video display
  - Analog display of multilevel video attributes
  - Discrete dual intensity capability
- Deflection System
  - CRT high acceleration voltage range from 9 to 16kV
  - Linearity 10% or better, horizontal and vertical axis.
  - HV fault sensing auto shutdown
- System power requirement
  12-15V DC at 700mA to 1.5 A max.

Mechanical:

CRT Satellite PCB (circular)
Model 115DMX 2.0″ (50.8mm)
118DMX 2.1″ (53.34mm)
Main Sweep PCB (rectangular)
Model 115DMX 5.7″ (144.8mm)×4.55″ (114.3mm)
Model 118DMX 7.00″ (77.80mm)×4.55″ (115.57mm)
Model 130DMX 7.2″ (182.7mm)×5.60″ (142.13mm)

Safety:

- All models are UL, CSA, DHHS, FCC certifiable

Environmental Specification: (115DMX and 118DMX)

- Operating temperature: 65°C to −20°C
- Storage temperature: 80°C to −55°C
- Operating altitude: 20,000 ft. max.

Configurations:

- Kit form—Pre-aligned CRT packaged with display electronics circuit (PCB) board
- Chassis assembly—As above with standard or custom sheet metal designs
- Cabinet model—Complete display and power electronics integrated and supplied in a finished housing.

Available Options:

- Bipolar sync interface: Provides buffered sync compatibility to any combination of positive or negative going signals.
- Composite signal interface: Provides A/D conversion of low level composite sync and video wave forms and adds vertical and horizontal retrace blanking signals.
- Low power, auto standby capability: CRT controller can logic switch monitor to energy conserving (40 mA) standby mode. (Model 115DMX only)
- CRT Options (Model 115DMX)
  Data Grade 5″, 7″, 8″, 9″, 10″, 12″ and 14″ sizes
- CRT Options (Model 118DMX)
  Data Grade 12″, 15″, 17″, 19″ and 23″ sizes
- CRT Options (Model 130DMX)
  Data Grade 5″, 7″, 8″, 9″, 10″, 12″, and 14″ sizes
- CRT options—all units
  - High contrast optical enhancements
  - All EIA and special phosphors

Optional Power Supply(s)

- Hybrid single rail switcher
  120/240V AC (selectable), 50/60Hz compatibility
- Output: single output regulated for 12, 15, 18, or 24 VDC
- Full range international switcher
  - Input: 90-265 VAC continuous
    Available as single or multiple (4) outputs with up to 120 watts total
- Additional features:
  - Soft start limits in-rush current
  - Over voltage and current foldback protection
  - Input line filter limits EMI to meet FCC20780 Class B
  - High efficiency operation 75-80% typical.

Above specifications represent nominal performance. Please check for current performance capability.

*OEM quantity price for monitor and kit configuration effective Jan. 1989. Prices subject to change. Consult factory.

†The unit can be signal driven through a standard card edge connector or alternately via 10-pin or 20-pin square wire terminals.

COMPUTRON DISPLAY SYSTEMS

A DIVISION OF
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TWX: 910-222-1425 FAX 312-952-0832 Tel: (312) 952-8800
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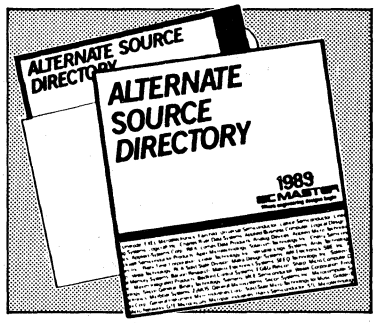

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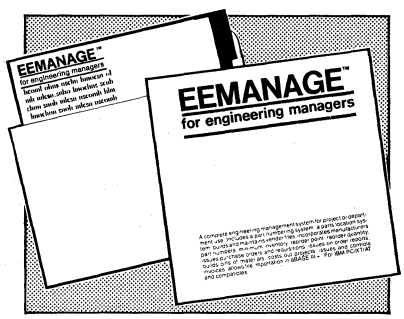

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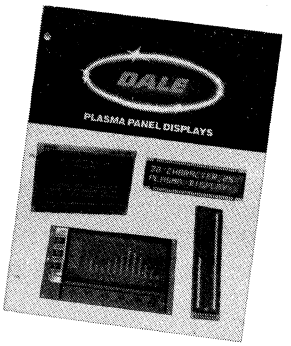
645 Stewart Avenue Garden City, NY 11530 Att: Marie Botta FAX (516) 227-1901

*Taxable in NY, MA, IL, CA

DALE® PLASMA PANEL DISPLAYS AND MODULES

Dale Flat Panel Plasma Displays provide wide viewing angles, high contrast and reliable, cost-effective operation for a wide range of uses. Many models are available with drive electronics and controllers for "turn-key" installation in your application. In addition to supplying the standard models listed here, we are ready to give immediate attention to your special requirements. Our screened image technology makes it easy to meet custom requirements — allowing maximum freedom to display symbols, messages and characters unique to your application. For complete information and design assistance, contact the factory.



Write for your copy of **New Display Catalog**

STANDARD MODELS

SEGMENTED DISPLAYS

PD-04A200, 4 characters, 2.00″ high

PD-16A040, 16 characters, .400″ high

PD-32A025, 32 characters, .250″ high

DISPLAYS WITH DRIVE ELECTRONICS/ INTERFACES

APD-016M040, 16 character dot matrix module with controller

APD-32A025, 32 character segmented module

PDS-200, Standard Bus interface card for APD-32A025

APD-192G088, 192 column x 88 row dot matrix, graphics module

APD-192G088-1, APD-192G088 with controller and DC-DC converter

APD-240M026, 240 character (6 x 40) dot matrix module

APD-240M026A, 240 character (6 x 40) enhanced brightness dot matrix module

APD-240M026A-1, APD-240M026A with controller and DC-DC converter

APD-256M026, 256 character (8 x 32) dot matrix module

APD-256M026-1, APD-256M026 with controller and DC-DC converter

BAR GRAPH DISPLAYS

PBG-16101, 101 element dual linear bar graph

PBG-12201, 201 element dual linear bar graph

PBG-12203, 203 element dual linear bar graph

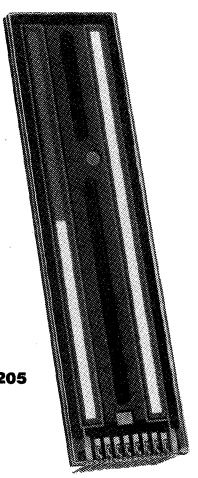
PBG-12205, 201 element dual linear bar graph

PBG-C7005, 201 element single linear bar graph, extra long column

PBG-C7008, 201 element dual linear bar graph, extra long columns

DALE® LINEAR BAR GRAPH DISPLAYS

Dale linear bar graphs are flat panel plasma indicators each displaying one or two separate bar graphs. Depending on the model, they contain 101, 201 or 203 elements with resolution of 1/2% and 1%. At normal viewing distances, their glow blends into a continuous but precisely controlled bar length. The unique scanning technique minimizes the number of drivers required.



Model PBG-12205

APPLICATIONS

- Process Control
- Depth Indicators
- Panel Meters
- Level Indicators
- Analog Indicators

	PBG-12201	PBG-12203	PBG-12205	PBG-16101	PBG-C7005	PBG-C7008
Elements	201	203	201	101	201	201
Resolution	1/2%	1/2%	1/2%	1%	1/2%	1/2%
Segment Length	.100″	.150″	.100″	.100″	.250″	.120″
Segment Width	.011″	.010″	.011″	.020″	.020″	.020″
Segment Spacing	.020″	.020″	.020″	.050″	.050″	.0394″
Column Length	4.000″	4.040″	3.937″	5.000″	10.000″	7.874″
Columns	2	2	2	2	1	2
Drivers Required	6	12	8	6	7	8
Light Output	35 fl	30 fl	70 fl	60 fl	30 fl	30 fl
Viewing Angle	120°					
Color	Neon Orange					

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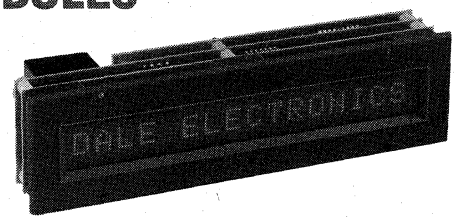
DALE® PLASMA PANEL DISPLAY MODULES



MODEL APD-016M040

16 character display with drive electronics and controller

The APD-016M040 display module is a 1 line by 16 character 5 x 7 dot matrix display. It includes drive electronics, a microprocessor-based controller consisting of a character generator, control logic and a 32 character refresh memory. The controller can be programmed for either parallel or serial interface. An on board DC-DC converter develops the necessary panel voltages from a single 5V input.

FEATURES

- 16 (1 x 16) alphanumeric characters (5 x 7 dot matrix)
- Bezel and filter included
- Parallel and serial interfaces
- High brightness
- Wide viewing angle (150°)
- Low input voltage
- Compact size
- Enhanced replacement for Burroughs SSD1000-0061 (optionally-0041)

SPECIFICATIONS

OPTICAL

Viewing Area: .40″ [10.2] W x 6.69″ [169.1] L

Number of Characters: 16

Character Size: .28″ [7.1] W x .40″ [10.2] H

Dot Size: .036″ [.91] dia.

Dot Pitch: .061″ [1.55]

Character Spacing: 2 blank columns between successive characters — .147″ [3.73]

Brightness: 80 ft./lamberts

Color: neon orange

Viewing Angle: 150° cone

ENVIRONMENTAL

Operating Temperature: 0°C to +55°C

Storage Temperature: −55°C to +85°C

Relative Humidity: 10-90% non-condensing

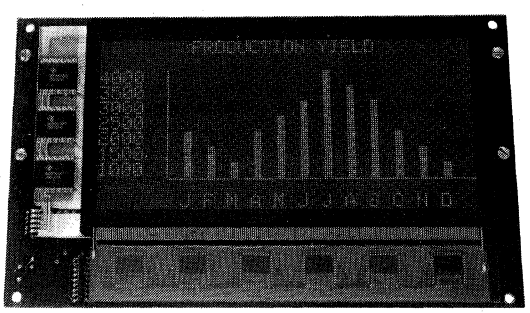
Mechanical Shock: 50G 1/2 Sine Wave, 11 ms duration, 5 shocks in each of 6 directions

Vibration: .018″ [.46] displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate. 30 min. duration along each side of the 3 major axes.

MODEL APD-192G088-1

192 by 88 graphics display with drive electronics and controller

The APD-192G088-1 is a full field dot matrix display with 192 columns and 88 rows. It includes drive electronics and a microprocessor based controller. The controller maintains all the refresh memory, character generation and control logic with parallel or serial interface and a DC to DC converter to generate the necessary panel voltage. Chip-on-glass construction eliminates hundreds of connections for increased reliability and reduced cost.



FEATURES

- 192 x 88 full field dot matrix
- Chip-on-glass drivers
- Parallel and serial interfaces
- High brightness
- Wide viewing angle
- Low input voltage
- Compact size
- Software dimming
- All functions software accessible
- Character graphics available

SPECIFICATIONS

OPTICAL

Viewing Area: 7.66″ [194.6] x 3.50″ [88.9]

Pixel Size: .020″ [.51]

Pixel Pitch: .040″ [1.02]

Brightness: 80 ft./lamberts

Color: neon orange

Viewing Angle: 120° cone

ENVIRONMENTAL

Operating Temperature: 0°C to +55°C

Storage Temperature: −55°C to +85°C

Relative Humidity: 10-90% R.H. non-condensing

Mechanical Shock: 50G 1/2 Sine Wave, 11 msec duration, 5 shocks in each of 6 directions

Vibration: .018″ [.46] displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate, along each side of the 3 major axes.

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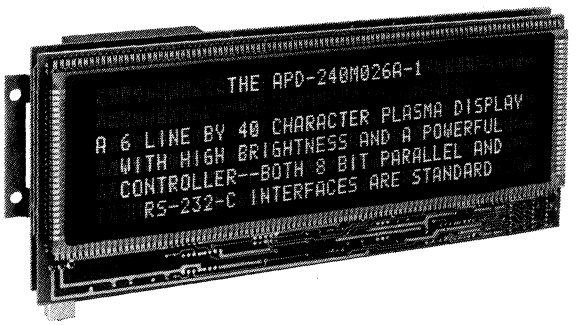
DALE® PLASMA PANEL DISPLAY MODULES

MODEL APD-240M026A-1

240 character display with drive electronics and controller



The APD-240M026A-1 display module displays up to 240 alphanumeric 5 x 7 dot matrix characters arranged in 6 lines of 40 characters each. The module includes drive electronics, a microprocessor-based controller consisting of refresh memory, character generator and control logic with parallel or serial interface and a DC to DC converter to develop the necessary panel voltage.

FEATURES

- 240 (6x40) alphanumeric characters (5x7 dot matrix)
- 128 USASCII character set + 128 user programmable character set
- Parallel and serial interfaces
- High brightness
- Wide viewing angle (150°)
- Low input voltage
- Compact size
- Software dimming

SPECIFICATIONS

OPTICAL

Viewing Area: 2.26″ [57.40] W x 8.33″ [211.66] L

Number of Characters: 240

Character size: .14″ [3.56] W x .26″ [6.60] H

Dot Size: .020″ [.51] dia.

Dot Pitch, Vertical: .040″ [1.016]

Dot Pitch, Horizontal: .030″ [.762]

Character Spacing: 2 blank columns of dots between successive characters

Brightness: 100 foot lamberts

Color: neon orange

Viewing Angle: 150° cone

ENVIRONMENTAL

Operating Temperature: 0°C to +55°C

Storage Temperature: −55°C to +85°C

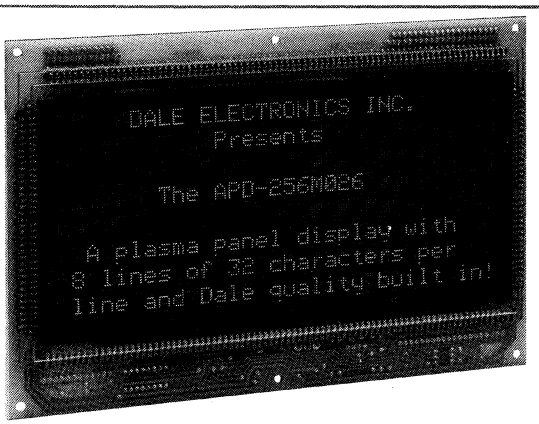
Relative Humidity: 10-90% non-condensing

Mechanical Shock: 50G 1/2 Sine Wave, 11 ms duration, 5 shocks in each of 6 directions

Vibration: .018″ displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate. 30 min. duration along each side of the 3 major axes.

MODEL APD-256M026-1

256 character display with drive electronics and controller



The APD-256M026-1 display module displays up to 256 alphanumeric 5 x 7 dot matrix characters arranged in 8 lines of 32 characters each. The module includes drive electronics, a microprocessor-based controller consisting of refresh memory, character generator and control logic with parallel or serial interface and a DC to DC converter to develop the necessary panel voltage.

FEATURES

- 256 (8x32) alphanumeric characters (5x7 dot matrix plus underbar)
- 128 USASCII character set + 128 user programmable character set
- Parallel and serial interfaces
- High brightness
- Wide viewing angle (150°)
- Low input voltage
- Compact size
- Software dimming

SPECIFICATIONS

OPTICAL

Viewing Area: 3.30″ [83.82] W x 7.62″ [193.55] L

Number of Characters: 256

Character Size: .18″ [4.57] W x .26″ [6.60] H

Dot Size: .020″ [.51] dia.

Dot Pitch: .040″ [1.016]

Character Spacing: .060″ [1.52]

Brightness: 100 ft./lamberts

Color: neon orange

Viewing Angle: 150° cone

ENVIRONMENTAL

Operating Temperature: 0°C to +55°C

Storage Temperature: −55°C to +85°C

Relative Humidity: 10-90% non-condensing

Mechanical Shock: 50G ½ Sine Wave, 11 ms duration, 5 shocks in each of 6 directions

Vibration: .018″ displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate. 30 min. duration along each side of the 3 major axes.

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DR50/DR55 SERIES HIGH RESOLUTION LARGE SCREEN COLOR MONITORS

CRT
Type: Shadow Mask
Size: 14"-20" (DR50 Series)
21"FS-29" (DR55 Series)
Electronic Gun: In-line (DR50 Series)
In-line, DAF System (DR55 Series)
Deflection Angle: 90 degrees
Dot Pitch: .31 mm (DR50 Series)
.26 mm (21"FS): .37 mm (29") (DR55 Series)
SIGNAL INPUT
Type: Analog RGB
Level: Composite: 1.0V p-p
Non-composite: .7V p-p
Signal Polarity: Positive
Impedance Termination: 75 Ohms
SYNC
Type: Composite
Level: 4V p-p @ 75 ohms
Signal Polarity: Negative or Positive
Connectors: BNC for RGB and Sync
ELECTRICAL PERFORMANCE
Resolution: Up to 1280 x 1024 (Non-Interlaced)
Scanning Frequency: Horizontal: 30-64 kHz
Vertical: 50-100 Hz
High Voltage Regulation: Better than .1%
POWER REQUIREMENTS
Voltage: 110/220 VAC
Frequency: 47-63 Hz
Consumption: Nominal: 115 watts
Max: 135 watts
VIDEO
Bandwidth: 130 MHz/-3dB
ENVIRONMENT
Operating: 0° TO 40°C
Storage: –30° TO 65°C
Humidity: 10-90% Non-condensing
Altitude: Operating: 10,000 ft.
AGENCY APPROVABILITY
Designed to comply with UL, CSA, TUV, FCC, DHHS
MECHANICAL
DR50 Series: Available in chassis
DR55 Series: Available in chassis or sheet metal cabinet
Specifications subject to change.

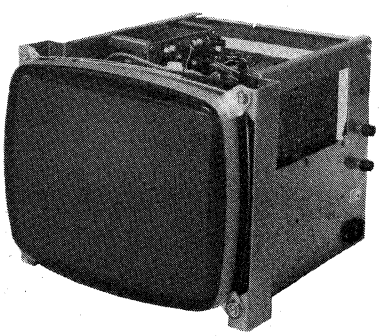
- **29" Diagonal Ideal for High-Res Large Screen Applications (Flight Simulation, GIS, CAD/CAM)**
- **Excellent Focus with DAF System CRT**
- **High Voltage Regulation Better than .1%**
- **Low Power Consumption**
- **High Reliability**

CALL US TODAY TO DISCUSS YOUR PARTICULAR OEM REQUIREMENTS!

DR53/DR54 SERIES HIGH PERFORMANCE SMALL SCREEN COLOR MONITORS

CRT
Type: Shadow Mask (DR53 Series)
Trinitron* (DR54 Series)
Size: 10",12",14" (DR53 Series)
10",14" (DR54 Series)
Electronic Gun: In-line
Deflection Angle: 90 degrees
Dot Pitch: .28 (DR53 Series)
.26 (DR54 Series)
SIGNAL INPUT
Type: Analog RGB
Level: Composite: 1.0V p-p
Non-composite: .7V p-p
Signal Polarity: Positive
Impedance Termination: 75 Ohms
SYNC
Type: Composite
Level: 4V p-p @ 75 ohms
Signal Polarity: Negative or Positive
Connectors: BNC for RGB and Sync
ELECTRICAL PERFORMANCE
Resolution: Up to 640 x 480 (Interlaced)
Scanning Frequency: Horizontal: 15.75 kHz (nominal)
Vertical: 50/60 Hz
High Voltage Regulation: 4% Standard (0.3% Available)
POWER REQUIREMENTS
Voltage: 110/220 VAC
Frequency: 47-63 Hz
Consumption: Nominal: 58 watts
VIDEO
Bandwidth: 15 MHz/-3dB
ENVIRONMENT
Operating: 0° TO 40°C
Storage: –30° TO 65°C
Humidity: 10-90% Non-condensing
Altitude: Operating: 10,000 ft.
AGENCY APPROVABILITY
Designed to comply with UL, CSA, TUV, FCC, DHHS
MECHANICAL
Available in chassis

*Trinitron is a trademark of Sony Corporation



- **Designed for high performance applications utilizing small color CRT's, the DR53/DR54 Series is ideal for medical and industrial imaging**
- **Shadow Mask or Sony Trinitron CRT**
- **Automatic White Balance System**
- **Automatic Switch 50/60 Hz Vertical Scan (50 to 80 Hz Automatic Vertical Scan Available)**
- **Compact Design**

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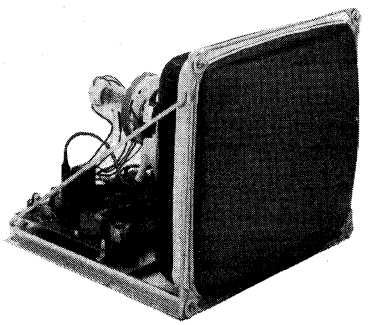
DR60/DR70 SERIES HIGH PERFORMANCE MONOCHROME MONITORS

CRT
Size: 7"-20"
Faceplate: Non-glare/Contrast Treatments Available
Phosphors: All EIA Phosphors
Neck Size: 20 mm/29 mm
DISPLAY
Resolution: Up to 1000 pixels
Up to 800 Active Lines
Linearity: 10% Standard (Tighter tolerances available)
Geometry: 1% of Display Size
Configuration: Portrait or Landscape
Dynamic Focus: Horizontal and Vertical
High Voltage Regulation: 3% Standard
VIDEO PERFORMANCE
Bandwidth: 30 MHz/-3dB
Input Signal: TTL, Composite, or Analog
Polarity: Positive = White
HORIZONTAL SYNC
Frequency: 15-30 kHz
Input: TTL
Polarity: Positive or Negative
VERTICAL SYNC
Frequency: 30-120 Hz
Input: TTL
Polarity: Positive or Negative
POWER REQUIREMENTS
Input Voltage: 12-24 VDC nominal
115/230 VAC Available
Power Consumption: 15 watts typical (DR60 Series w/9" CRT)
36 watts typical (DR70 Series w/15" CRT)
ENVIRONMENT
Operating: 0°C TO 50°C
Storage: –20°C TO 65°C
Humidity: 10-90% Non-condensing
Altitude: 10,000 ft. Operating
AGENCY APPROVABILITY
Designed to comply with UL, CSA, TUV, FCC, DHHS
MECHANICAL
Available in kit or chassis

*Specifications subject to change.



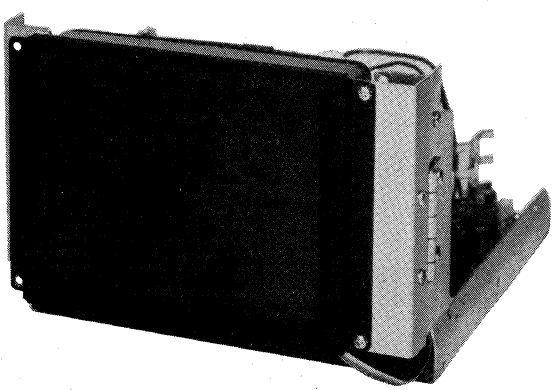
- **Engineered for high performance, the DR60/DR70 Series is especially suited to meet the demanding requirements of the medical imaging industry.**
- **Internal and External Blanking**
- **Dual Axis Dynamic Focus**
- **Backporch Clamping**
- **Excellent Linearity**

CALL US TODAY TO DISCUSS YOUR PARTICULAR OEM REQUIREMENTS!

DR61 SERIES LIQUID CRYSTAL SHUTTER DISPLAY*

CRT
Size: 5",7",9"
Faceplate: Non-glare Treatments Available
Phosphors: C181 Standard
Neck Size: 20 mm
DISPLAY
Resolution: Up to 640 Pixels
Up to 480 Active Lines
Linearity: 10% Standard (Tighter tolerances available)
Geometry: 1% of Display Size
Configuration: Landscape
Dynamic Focus: Horizontal and Vertical
High Voltage Regulation: Better than 1 mm misconvergence w/LCS
VIDEO PERFORMANCE
Bandwidth: 50 MHz/-3dB
Input Signal: Analog 1V p-p
Polarity: Positive = White
HORIZONTAL SYNC
Frequency: 62 kHz nominal
Input: TTL
Polarity: Positive or Negative
VERTICAL SYNC
Frequency: 120 Hz (nominal)
Input: TTL
Polarity: High for green field
Low for red field
POWER REQUIREMENTS
Input Voltage: 24 VDC nominal
115/230 VAC Available
Power Consumption: 30 watts typical w/7" CRT
ENVIRONMENT
Operating: 0°C TO 50°C
Storage: –20°C TO 65°C
Humidity: 10-90% Non-condensing
Altitude: 20,000 ft. Operating
AGENCY APPROVABILITY
Designed to comply with UL, CSA, TUV, FCC, DHHS
MECHANICAL
Available in kit or chassis

*Specifications subject to change.



- **Cost-effective "color" display (Colors: Red, Green, Yellow, Black)**
- **High Resolution**
- **Compact Design**
- **High Altitude Operation Capabilities (Up to 20,000 ft.)**

* LCS Technology by Tektronix, Inc.

CALL US TODAY TO DISCUSS YOUR PARTICULAR OEM REQUIREMENTS!

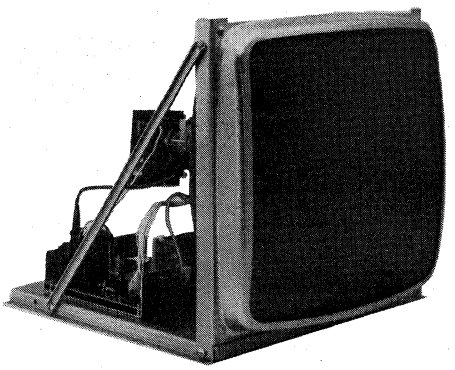
452 Burbank Street, Broomfield, CO 80020 TEL: (303) 469-5173 FAX (303) 466-9524

DATA RAY CORPORATION

HIGH PERFORMANCE COLOR & MONOCHROME MONITORS
There's More Than The Eye Can See...

DR31 SERIES HIGH RESOLUTION MONOCHROME MONITOR

CRT
Size: 15"-20"
Faceplate: Non-glare/Contrast Treatments Available
Phosphors: All EIA Phosphors
Neck Size: 29 mm
DISPLAY
Resolution: Up to 1500 Pixels
Up to 1024 Active Lines
Linearity: 10% Standard (Tighter tolerances available)
Geometry: 1% of Display Size
Configuration: Portrait or Landscape
Dynamic Focus: Horizontal and Vertical
High Voltage Regulation: Better than .5%
VIDEO PERFORMANCE
Bandwidth: 130 MHz/-3dB
Input Signal: ECL, TTL (1 or 2-bit) or Analog
Polarity: Positive or Negative (TTL, ECL)
Positive=White (Analog)
HORIZONTAL SYNC
Frequency: 30-75 kHz
Input: TTL
Polarity: Positive or Negative
VERTICAL SYNC
Frequency: 50-120 Hz
Input: TTL
Polarity: Positive or Negative
POWER REQUIREMENTS
Input Voltage: 24 VDC nominal
115/230 VAC Available
Power Consumption: 55 watts typical w/15" CRT
ENVIRONMENT
Operating: 0°C TO 50°C
Storage: −20°C TO 65°C
Humidity: 10-90% Non-condensing
Altitude: 10,000 ft. Operating
AGENT APPROVABILITY
Designed to comply with UL, CSA, TUV, FCC, DHHS
MECHANICAL
Available in kit or chassis
*Specifications subject to change

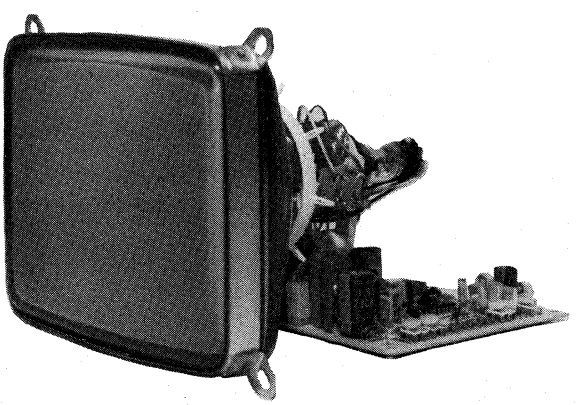


- **Ideal for High-End Computer and Desktop Publishing Applications**
- **Better than .5% High Voltage Regulation**
- **Wide Video Bandwidth for High-Res Graphics**
- **High Reliability**

CALL US TODAY TO DISCUSS YOUR PARTICULAR OEM REQUIREMENTS!

DR10 SERIES MONOCHROME DATA DISPLAY

CRT
Size: 7"-14"
Faceplate: Non-glare/Contrast Treatments Available
Phosphors: All EIA Phosphors
Neck Size: 20 mm
DISPLAY
Resolution: Up to 800 Pixels
Up to 600 Active Lines
Linearity: 10% Standard (Tighter tolerances available)
Geometry: 1% of Display Size
Configuration: Portrait or Landscape
Dynamic Focus: Horizontal
High Voltage Regulation: 5% Standard
VIDEO PERFORMANCE
Bandwidth: 18 MHz/−3dB
Input Signal: TTL, Analog, or Composite
Polarity: Positive=White
HORIZONTAL SYNC
Frequency: 15.75 kHz (nominal)
Input: TTL
Polarity: Positive or Negative
VERTICAL SYNC
Frequency: 50-60 Hz
Input: TTL
Polarity: Positive or Negative
POWER REQUIREMENTS
Input Voltage: 12 VDC nominal
115/230 VAC Available
Power Consumption: 12 watts typical w/9" CRT
ENVIRONMENT
Operating: 0°C TO 50°C
Storage: −20°C TO 65°C
Humidity: 10-90% Non-condensing
Altitude: 10,000 ft. Operating
AGENCY APPROVABILITY
Designed to comply with UL, CSA, TUV, FCC, DHHS
MECHANICAL
Available in kit or chassis
*Specifications subject to change



- **Ideal for Medium Resolution Data Display Applications**
- **Cost-effective**
- **High Reliability**
- **Compact Design**

CALL US TODAY TO DISCUSS YOUR PARTICULAR OEM REQUIREMENTS!

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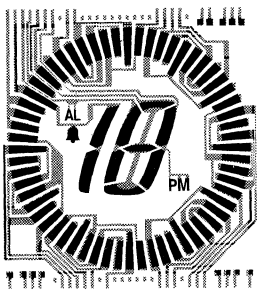
CUSTOM DISPLAYS

WITH CUSTOM DESIGN SUPPORT

Display graphics are limited only by your imagination.

Liquid crystal technology is ideal for creative visual displays of all kinds. Our engineers can help you design indicators which are alpha, numeric, pictorial or any combination of these. Discuss your ideas with our friendly engineers—we'll help you create the display you have in mind.

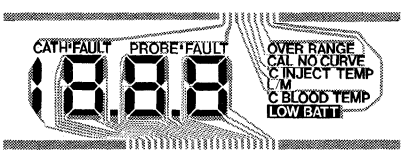


A clock display with digital hours and analog minutes.

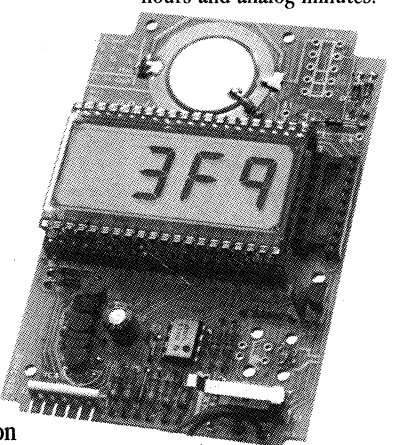
Advanced LCD technology

DCI uses the latest production methods and fabrication techniques to produce displays with:

- Wide Temperature Range
- Excellent visual Contrast
- Broad viewing angle
- Low power consumption
- High Reliability
- Tremendous design latitude



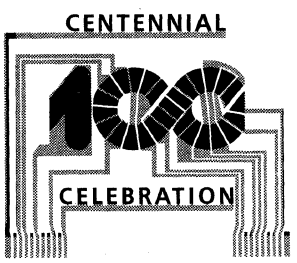
An alpha-numeric instrument display with switchable legends.



Ask us about our turnkey production capability: circuit design, prototype, assembly and packaging.

Specification experts

Whether you have defined requirements or only an idea you'll find our engineers ready and able to help. Regardless of how unique, different or unusual your need we can custom-make a display for your application. Call Larry Shelton or Bill Cook at (913) 782-5672 for the support you need.



Use graphic elements for emphasis.

The custom specialists

DCI INCORPORATED

14812 WEST 117TH STREET / OLATHE, KANSAS 66062
(913) 782-5672 • FAX (913) 782-5766

VISUAL DISPLAYS

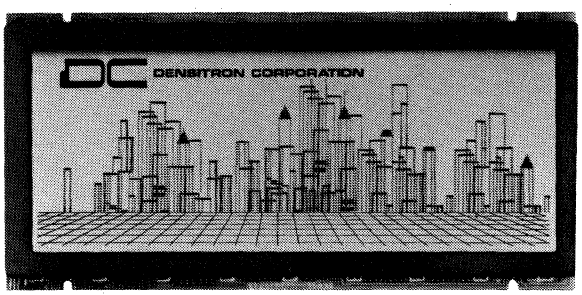
The Largest Variety of LCD Modules in the Industry

Character LCD Modules

- Industry standard 8-bit parallel controller
- **SUPERTWIST and FILM SUPERTWIST** modules for high contrast and wide viewing angle.
  Most **SUPERTWIST** models have 0°C to +50°C operating range.
- **LED backlight** modules offer long life and excellent readability in all lighting conditions.
- 1/2" and 1/3" character height modules
- **Extended temperature** modules operate from −20°C to +70°C
- Negative image modules (on all models) product **light-emitting displays** with light characters on a dark background
- **Electroluminescent backlighting avail.**
- New gray mode STN models

Graphic LCD Modules

- All modules available with **SUPERTWIST and NEW FILM SUPERTWIST** fluid for high contrast and wide viewing angle.
- **Extended temperature fluid** (−20°C to +70°C operating) available on smaller (≤ 128 lines) modules
- **Electroluminescent or fluorescent backlight** allows viewing in all lighting conditions.
- May be formatted as text only in formats from 4x20 to 50x80.



CHARACTER FORMATS

CHAR. ROWS \ CHAR. COL'S.	8	16	20	24	32	40	80
1	●	●	●	●	●	●	●
2	●	●	●	●	●	●	●
4		●	●	●		●	●

GRAPHIC FORMATS

DOT ROWS \ DOT COL'S.	120	128	240	256	480	640
32	●					
64	●		●		●	
128		●		●	●	
200						●
400						●
480						●

DENSITRON CORPORATION OF AMERICA
INFORMATION DEVICE DIVISION 2540 West 237th Street, Torrance, California 90505 U.S.A.
Phone: (213) 530-3530 Facsimile: (213) 534-8419 (G2/G3) Telex (II): 910-349-6200 DENSITRON TRNC

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Kyowa Nanabankan 5F No. 1-11-5 Omori-Kita, Ota-ku, Tokyo 143 Japan Cable: "DENTROROSE" Tokyo
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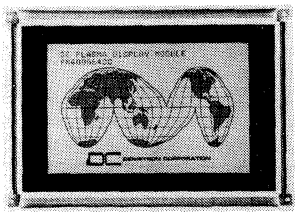
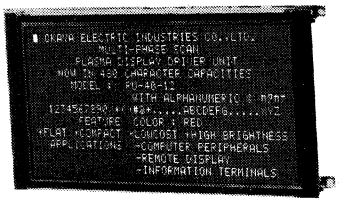
DENSITRON EUROPE LIMITED
Unit 4, Airport Trading Estate Biggin Hill, Westerham, Kent TN16 3BW, England
Phone: (0959) 76600 Facsimile: (0959) 71017 Telex: 957134

from DENSITRON!

Plasma, Custom Displays and Support Electronics





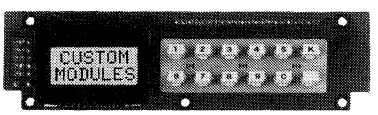
Plasma Modules

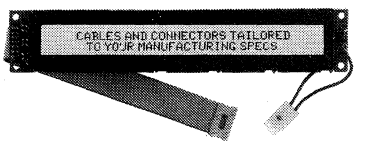
- Graphic modules in computer screen sizes
- Character modules with optional controllers
- High-brightness modules – 700cd/m^2

Formats

CHARACTER	
1 x 16	6 x 40
1 x 22	8 x 32
2 x 16	12 x 40
4 x 16	

GRAPHIC	
16 x 101	128 x 256
16 x 135	200 x 640
96 x 192	350 x 720
96 x 240	480 x 640





Custom Modules

- Integrate a display with other front panel components. Densitron can build to your specifications.

Value-added Capability

- Steamline production with a display tailored to your assembly. Densitron can add cables, connectors and other accessories to your displays in a cost-effective manner.

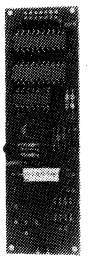
Controllers for Graphic Modules

- Small graphic LCD modules (≤128 lines) have an optional 8-bit parallel controller.
- Large graphic LCD modules (≥200 lines) can be controlled by IBM PC* compatible interface cards.
- Large graphic Plasma and LCDs have terminal emulation controllers available.
- Consult Densitron for more information.

**IBM PC is a registered trademark of International Business Machines.*

RS232 Interface Card for LCDs

- Operates with all character modules and small graphic modules (≤128 lines) operated in the alphanumeric mode
- Permits **remote operation**
- Facilitates hook-up – **no other hardware required**
- Software controllable backlight
- **Options include:**
  On-board EL lamp inverter
  Contrast adjustment
  –5VDC supply



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SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States (ANSI) American National Standards Institute

United States (NEMA) National Electrical Manufacturers Association

Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

Yugoslavia Federal Institute of Standardization

DIALIGHT LED READOUT DISPLAYS

PASSIVE COMPONENTS, ACTIVELY ENGINEERED

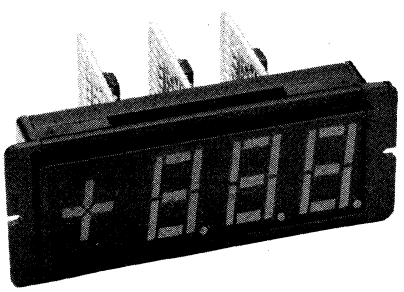
Dialight offers three basic types of LED readout displays: complete assemblies, modules and bezel kits, and discrete readouts. All are excellent choices where power is a limiting factor and IC compatibility, ultra reliability and packaging density are prime requirements.

Readouts come in a variety of sizes, ranging from .270″ to .600″ in character height. Available styles include: 7 segment, hexadecimal, alphanumeric and custom symbols.

Typical viewing distance, in normal ambient, ranges from 10 to 25 feet, with brightness a current variable. Special Dialight filters provide excellent character enhancement, permitting use in higher illumination environments (excluding direct sunlight).

Because Dialight readout displays are virtually immune to shock and vibration, they're particularly valuable in rugged applications. Their solid-state construction offers life measured in years.

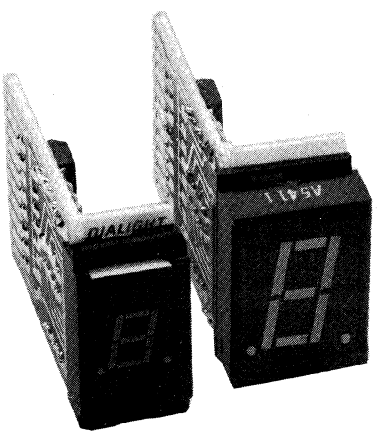
COMPLETE LED ASSEMBLIES



Complete assemblies significantly reduce the design time and cost normally associated with mounting and driving displays. They come complete with readouts and drivers mounted to PC boards in a bezel, making panel mounting easy. They also require only a 5 or 12 VDC power supply and BCD inputs. And they can be wired directly or by using edge-card connectors.

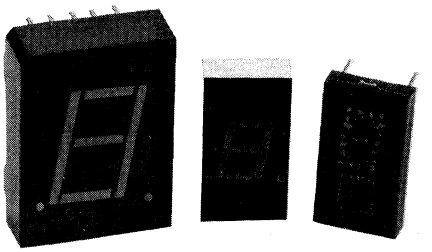
Attractive and bright, these LED readouts have non-glare windows to further enhance visibility. Each assembly is available with anywhere from one to 20 digits or status indicators. Character size ranges from .270″ to .600″ in height. To further increase design flexibility, drive circuitry is available with optional latch or counter. Also available with hexadecimal decoder with latch and CMOS decoder with latch. In addition, polarity indicators are an option. And optional spacers or specialty status symbols can be accommodated for custom assemblies.

LED MODULES



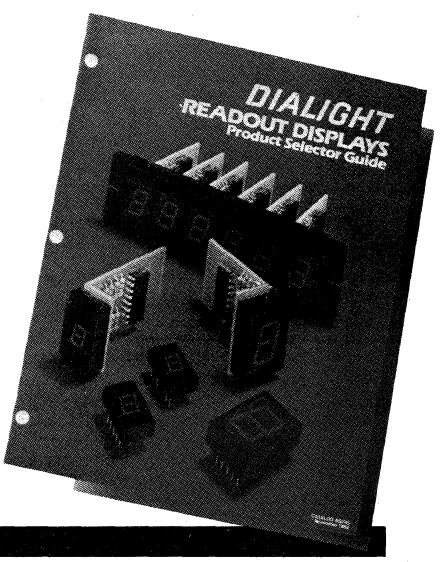
The same modules used in Dialight complete assemblies can be ordered separately, along with easily assembled bezel kits. This allows users to make their own custom displays with a minimum of parts, money and effort. Modules are also available in panel mount types for use without a bezel.

DISCRETE LED READOUTS



Discrete readouts are available in .270″, .300″ and .600″ character heights. Choose from seven segment, hexadecimal with integral drive circuitry and alphanumeric styles. Each readout offers high brightness with a wide viewing angle. Standoffs also allow for easy flux removal from PC boards after wave soldering.

For complete specifications, mounting diagrams, ordering information, etc., send for our free product catalog. **Dialight Corp., 1913 Atlantic Avenue, Manasquan, NJ 08736. Or call *(201) 223-9400***



DIALIGHT CORPORATION
A Cambridge Electronic Industries Company

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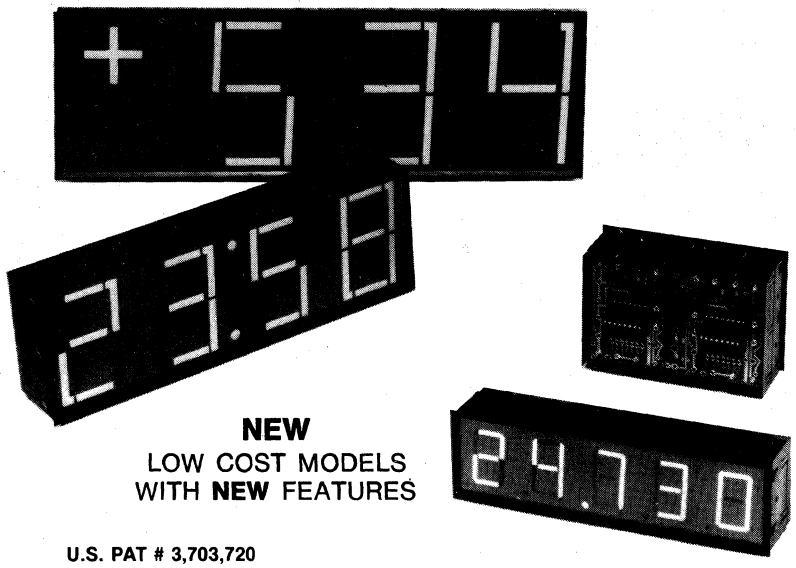
DIO-REY

THE LIGHTED DISPLAY DIVISION OF INFO-LITE CORPORATION

LARGE CHARACTER DIGITAL DISPLAYS



NEW
LOW COST MODELS
WITH **NEW** FEATURES

U.S. PAT # 3,703,720

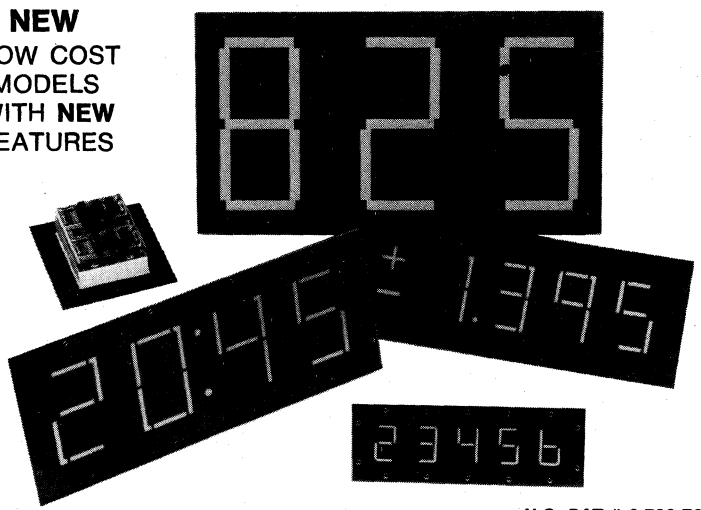
DESIGNER SERIES

SERIES	DIGIT HT.	VIEW'G DIST.
68631	1.0 IN.	30 FT.
68632	2.0 IN.	60 FT.
68633	2.8 IN.	85 FT.

FEATURES

- Supplied in attractive, multi-digit assemblies
- Ready to install into rectangular panel cutout
- Assembly includes bezel & anti-glare front panel
- High-Efficiency Red Std; white, amber, yellow, green & blue optional
- Low power: .6 watt/1″ digit; 1.5 watt/2″ digit for LED displays
- TTL or CMOS logic boards are part of assembly—Memory opt'l
- ± sign, colons, fixed or floating decimal are standard options
- Serviced from front without tools
- Logic Socketed; socketed lamps used in incandescent models
- Solderless, plug-in I/O

NEW
LOW COST MODELS
WITH **NEW** FEATURES



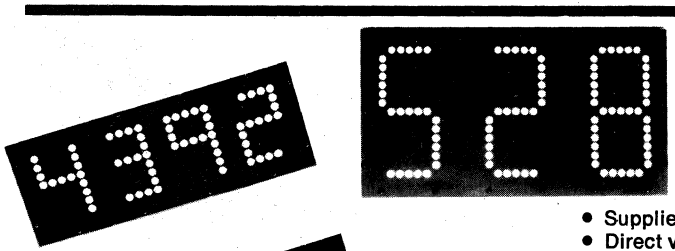
U.S. PAT # 3,703,720

INDUSTRIAL SERIES

SERIES	DIGIT HT.	VIEW'G DIST.
68731	1.0 IN.	30 FT.
68732	2.0 IN.	60 FT.
68733	2.8 IN.	85 FT.
68736	5.6 IN.	170 FT.

FEATURES

- Supplied in multi-digit assemblies w/anti-glare front panel
- Flange mounting w/gasket for NEMA environments
- TTL or CMOS drive logic boards are part of assembly—Memory opt'l
- High-Efficiency Red Std; white, amber, yellow, green & blue opt'l
- ± sign, colons, fixed or floating decimal are standard options
- Logic Socketed; socketed lamps used on incandescent models
- Solderless, plug-in I/O



U.S. PAT # 3,703,720

OUTDOOR SERIES

SERIES	DIGIT HT.	VIEW'G DIST.
68832	2.0 IN.	60 FT.
68833	2.7 IN.	80 FT.
68836	5.5 IN.	150 FT.

FEATURES

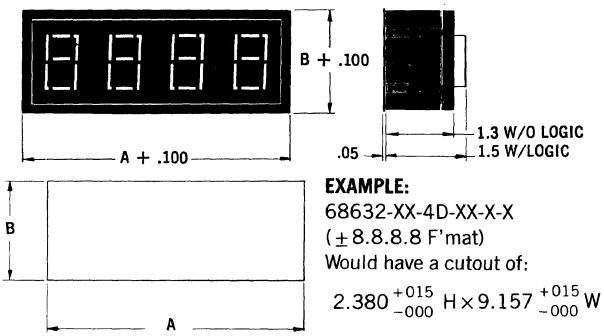
- Supplied in 1 to 8 digit assemblies w/anti-glare front panel
- Direct viewed filaments for sunlight or stage light applications
- Flange mounting w/gasket for NEMA environments
- High-Efficiency Red Std for outdoors; amber Std for color camera applications
- TTL or CMOS drive logic boards are part of assembly—Memory opt'l
- ± sign, colons, fixed or floating decimal are options
- All wear parts (lamps and logic) socket mounted
- Solderless, Plug-in I/O

DIO-REY • Div. of INFO-LITE, CORP. • 422 Cliff Street • Fairview, NJ 07022 • (201) 941-4455 • FAX (201) 941-4919
"LINKS BETWEEN MAN AND MACHINE"

DIO-REY
THE LIGHTED DISPLAY DIVISION OF
INFO-LITE CORPORATION

MOUNTING INFORMATION

6863X DESIGNER SERIES



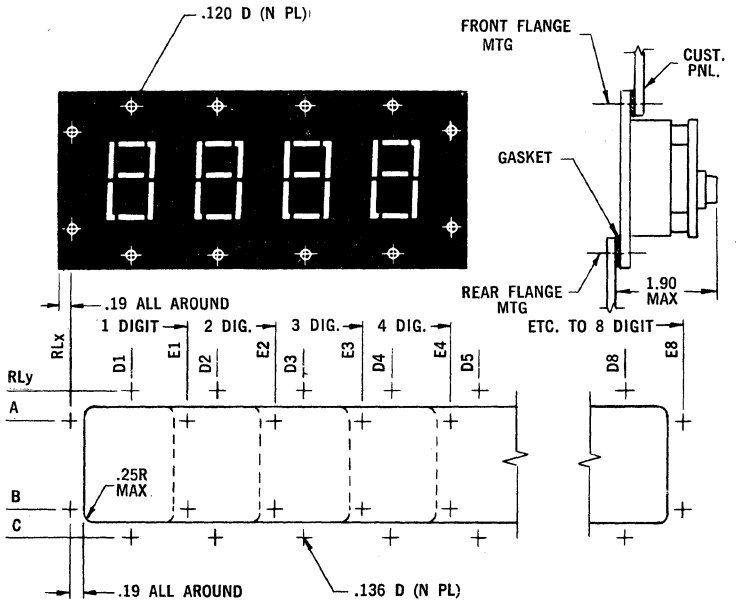
EXAMPLE:
68632-XX-4D-XX-X-X
(±8.8.8.8 F'mat)
Would have a cutout of:
$2.380^{+.015}_{-.000}$ H × $9.157^{+.015}_{-.000}$ W

CUTOUT DIMENSIONS
ALL TOLERANCES +.015, −.000

No. of Digits In Assy*	Series 68631 B = 1.630 A	Series 68632 B = 2.380 A	Series 68633 B = 3.130 A
1	1.253	1.629	2.010
2	2.381	3.511	4.650
3	3.509	5.393	7.290
4	4.637	7.275	9.930
5	5.765	9.157	12.570
6	6.893	11.039	15.210
7	8.021	12.921	17.850
8	9.149	14.803	20.490

* ± sign equals one digit

6873X INDUSTRIAL SERIES & 6883X OUTDOOR SERIES



NOTES:
(1) Segments on all OUTDOOR Series are dot type. See photos.
(2) Two dimensions for a given Dim. Code indicate 2 mounting hole locations.
(3) ± sign equals one digit.

EXAMPLE:
68733-XX-2A-XX-X-X
(88 F'mat)
Would have 8 holes .136D;
Mtg. hole centers would be defined by: A = .750,
B = 3.375, C = 4.125,
D1 = 1.500, D2 = 4.125,
E2 = 5.625; The cutout size will be: 3.75 H × 5.25 W

CUTOUT DIMENSIONS *ALL DIMENSIONS OFF RLX & RLY*

DIM. CODE (2)	SERIES 68731	68732 & 68832	68733 & 68833	68736 & 68836
A	.375	.750	.750	1.125
B	1.500	2.625	3.375	3.375
C	1.875	3.375	4.125	5.625
D1	.750	1.500	1.500	6.750
D2	1.875	3.375	4.125	.750
D3	3.000	5.250	6.750	3.000
D4	4.125	7.125	9.375	5.250
D5	5.250	9.000	12.000	7.500
D6	6.375	10.875	14.625	9.750
D7	7.500	12.750	17.250	12.000
D8	8.625	14.625	19.875	14.250
E1	1.500	2.625	3.000	16.500
E2	2.625	4.500	5.625	18.750
E3	3.750	6.375	8.250	21.000
E4	4.875	8.250	10.875	23.250
E5	6.000	10.125	13.500	25.500
E6	7.125	12.000	16.125	27.750
E7	8.250	13.875	18.750	30.000
E8	9.375	15.750	21.375	32.250
				34.500

NO. OF DIGITS	N (Qty. of Mtg. Holes)			
1	6	6	6	10
2	8	8	8	14
3	10	10	10	18
4	12	12	12	22
5	14	14	14	26
6	16	16	16	30
7	18	18	18	34
8	20	20	20	38

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DIO-REY
THE LIGHTED DISPLAY DIVISION OF
INFO-LITE CORPORATION

SPECIFYING INFORMATION

GENERATING PART NUMBERS

68X 3X – XX – X X – X – X – X

SERIES
- DESIGNER 6
- INDUSTRIAL 7
- OUTDOOR 8

DIGIT HT.
- 1″ 1
- 2″ 2
- 3″ 3
- 5½″ 6

LOGIC CODE (SEE TABLE 1)

NO. OF DIGITS

DISPLAY FORMAT
- 88 ..... 8 A
- 8.8. ..... .8 B
- ±88 ..... 8 C
- ±8.8. ..... .8 D
- 88:88:88 or 88:88 E
- 88 ..... 80 F
- OTHER F'MATS (4) X

LAMP CODE (SEE TABLE 2)

COLOR FILTER (6)
- 1 WHITE (3)
- 2 RED (4)
- 3 AMBER (7)
- 4 YELLOW (3) (5)
- 5 GREEN (3) (5)
- 6 BLUE (3)

GASKET (1)
- O NONE
- F FRONT FLANGE MT'G (2)
- R REAR FLANGE MT'G

NOTES:
(1) Gasket not available on Designer Series.
(2) Not available on 68X31 (1″) Series.
(3) Not available on Outdoor Series.
(4) Std LED Color; Std outdoor color (Incandes't).
(5) Opt'l LED color.
(6) All colors available w/opt'l incandescent lamps.
(7) Std stage lighting and color camera color.

EXAMPLE: A Designer Series with 2″ digits; TTL, BCD to 7-Bar decoder-drivers without leading zero blanking; 3 digits, ± sign and floating decimal point (± 8.8.8 format); 12 volt, red LEDs and red color filter would have part #68632-D1-3D-P12-2-0. If the unit had a single decimal to the left of the least significant digit, it would be called out as: "#68632-D1-3X-P12-2-0; ±88.8 format."

LAMP & DRIVE LOGIC OPTIONS

TABLE 1

LOGIC TYPE	TTL		CMOS W/LATCH MEMORY								CMOS				NONE
LOGIC CODE DASH NO.	-D1	-D2	-M1	-M2	-M3	-M4	-M5	-M6	-M7	-M8	-C1	-C2	-C3	-C4	-00
W/O Lead'g Zero Blank'g	•														W/O LOGIC
W/Lead'g Zero Blank'g		•													
1 Latch Per Digit			•	•	•	•									
1 Latch Per Display							•	•	•	•					
Latch Inactive											•	•	•	•	
Blanking User Driven					•	•			•	•			•	•	
Blanking Inactive			•	•			•	•			•	•			
Test User Driven				•		•		•		•		•		•	
Test Inactive			•		•		•		•		•		•		
Requires External Connections		•					•	•	•	•					
Bridge "T" Condition	R	R	C	R	C	R	C	R	C	R	C	R	C	R	
Bridge "B" Condition	R	(9)	C	C	R	R	C	C	R	R	C	C	R	R	
Bridge "S" Condition	R	(9)	R	R	R	R	R	R	R	R	C	C	C	C	
DIP Plug Cable Type	XPOO		XPMX				XPOO				XPOO				

DISPLAY	0	1	2	3	4	5	6	7	8	9	*	*	*	*	*	
BINARY INPUTS 8	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
1 = High 4	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
0 = Low 2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1

DRIVE LOGIC NOTES

The 68X31 Series use SN7447A (TTL) or 4511B (CMOS), BCD to 7 Bar decoder drivers. The 68X32, 68X33 & 68X36 Series use SN74LS48 (TTL) or 4511B (CMOS), decoders which drive ULN2003A, 7 channel darlington drivers.

As with all CMOS devices, options with user driven inputs must be switched high or low during operation.

The logic supply current for TTL options is 30ma, typ., per digit except for the 68X31 Series where 55ma per digit is required.

TABLE CODES

* *With CMOS logic options, the display will blank if BCD input is greater than 9.*
• *Has the function.*
Blank *Does not have the function.*
C *Closed.*
R *Open.*

TABLE 2

LAMP TYPE	LAMP CODE	VOLTS (2)	Ma PER LAMP	MAX. AMPS/DIGIT (3) 68631 68731	68632 68732	68832	68733	68833	68736 68836	AVG. LIFE (K HRS.)
RED LED	P5/P12(7)	5.0/12.0(6)	25	.18	.18(10)		.18(10)		.35	100+
INCAN-DESCENT	J1	5.0	60	.42	.84		.84		1.26	10(5)
	K1(4)	12.0	39	.27	.54	.70	.54	.97	.82	10(5)

NOTES:
(1) Use with High Efficiency Red only.
(2) Input DC volts to lamp drivers.
(3) With figure 8 displayed.
(4) Use with all 6883X Outdoor Series.
(5) Reducing voltage by 6% doubles life.
(6) 5 V req'd for 1″ model; 12 V req'd for 2″, 3″ & 5½″ models.
(7) For 1″ models w/ CMOS Decoders, lamp code is ZP5.
(8) Std LED orientation for 2″, 3″ & 5½″ is common anode. Common cathode opt'l. CC & CA are std for 1″.
(9) See DISPLAY/DIP PLUG CABLE SCHEMATIC.
(10) A 5V regulator for logic power is optional on units with 12V lamps.

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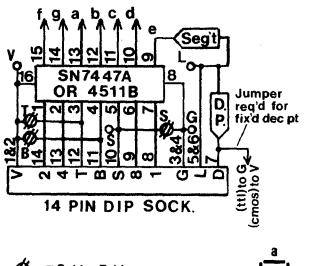
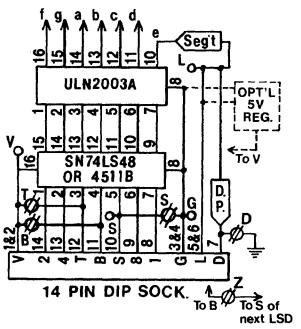
NUMERIC SCHEMATICS
ALPHA NUMERICS

1"
68631 & 68731 SERIES



= Solder Bridge (Shown open)

2", 3", and 5½"
68632, 68732, 68633
68733 & 68736 SERIES



DRIVE LOGIC TERMINAL DESIGNATIONS
— FUNCTION —

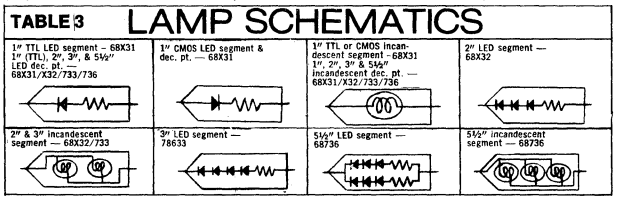
TERMINAL CODE	TTL (1) (68X3X-DX Series)	CMOS (3) (8) (68X3X-CX & -MX Series)
1, 2, 4 & 8	BCD INPUTS	BCD INPUTS
B	BLANKING INPUT (2)(6)	BLANKING INPUT (4) (6)
D	DECIMAL POINT (10)	DECIMAL POINT (10)
G	GROUND	GROUND
L	LAMP POS. COMM.	LAMP COMM. (5)
S	NONE	LATCH (11)
T	LAMP TEST (6)	LAMP TEST (4) (6)
V	LOGIC POS.	LOGIC POS.

DRIVE LOGIC SCHEMATICS

The 1" LED display is supplied w/comm. anode for TTL decoders or comm. cathode for CMOS decoders. Common anode LED's are used in 2", 3", and 5½" units with either type of logic because the ULN2003A, 7 channel, Darlington driver is employed. — TTL or 5V CMOS logic is Std. for 1" displays; 12V CMOS is opt'l. TTL or 5-15V CMOS logic is standard for the 2", 3", 5½". Latch memory is Std. on all CMOS displays. The schematics for the various lamps used in all the indoor series are shown in Table 3. Consult factory for outdoor lamp schematics. The Std termination for each digit is a 14 pin DIP socket. This I/Os the BCD, logic & lamp power, and, when specified, strobe, blanking, lamp test & decimal point. Additional connection points for logic & lamp power, strobe & decimal point are provided on the drive logic board for applications requiring larger power lines or separate strobe &/or decimal point inputs (-M1 thru -M4). The L, V & G lines are bussed for all digits on ea. P.C. Bd.

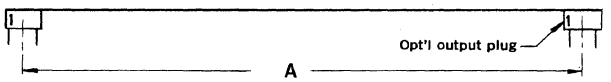
NOTES: (1) See specifications of SN7447A or SN74LS48 for details.
(2) Not available if leading zero suppression is specified.
(3) See specifications of 4511B for details.
(4) The T and/or B inputs are strapped high for CMOS logic options calling for inactive test or blanking.
(5) Positive EXCEPT for 68X31-CX & 68X31-MX where L is Gnd.
(6) Test & Blanking are active low functions if specified "User Driven."
(7) Regulated power supplies recommended for lamps & logic.
(8) Handle CMOS logic at a conductive work station until wired into system.
(9) For ± sign: BCD 7 = +, BCD 6 = — (Control w/1 bit; Strap 2 & 4 bits high & 8 bit low.)
(10) Dec. pts. & colons are user driven thru term'l D. Connect D to G on all series except 1" w/CMOS where D goes to V.
(11) S input is strapped low for CMOS logic without memory.
(12) For additional information, see notes in "DIP PLUG CABLES," below.

TABLE 3 LAMP SCHEMATICS

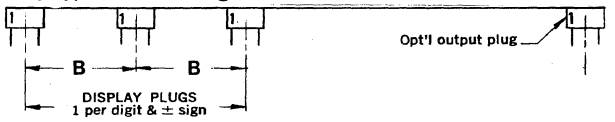


DIP PLUG CABLES

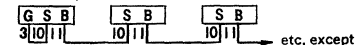
TYPE XP00 — #14-1P00-1-36 shown (If A = 36).



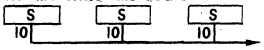
TYPE XPMX — #14-2PM1-3-24 shown (For 1" & 2" Displays; A = 24"; B = 2"). Strobe &/or Dec. Pt. connections will be made by Type XP00 DIP Plug Cable.



EXTERNAL CONNECTIONS REQ'D FOR -D2 LOGIC



EXTERNAL CONNECTIONS REQ'D for -M5 THRU -M8 LOGIC



STANDARD INTERFACE CABLES

Interface Type	Cable Type
820 Serial Receiver	14-2PMX-X-XX-CS001
821 A/D Converter	14-2P00-X-XX-CS003
822 Decade Counter	14-2P00-X-XX-CS004
823 Clocks & Timers	14-2P00-X-XX-CS004

WIRE LIST/COLOR CODE

COLOR/LINE #	PIN #	FUNCT'N
Brown 1	Pin 14	BCD 2
Red 2	Pin 1	V
Orange 3	Pin 13	BCD 4
Yellow 4	Pin 2	V
Green 5	Pin 12	T
Blue 6	Pin 3	G
Violet 7	Pin 11	B
Gray 8	Pin 4	G
White 9	Pin 10	S
Black 10	Pin 5	L
Brown 11	Pin 9	BCD 8
Red 12	Pin 6	L
Orange 13	Pin 8	BCD 1
Yellow 14	Pin 7	D.P.

Using type XP00 & XPMX DIP Plug Cables will simplify the installation of the 68X3X Series Displays. This leads to lower installed cost & ease of servicing. They include 14 pin DIP plugs to mate with the drive logic board & optional output plugs, assembled to color coded flat cable (See Table).

EXTERNAL CONNECTIONS IN XP00 & XPMX DIP PLUG CABLES

-D2 Logic Code (XP00 Plug Cable) For -D2 Logic Code (Leading zero blanking): Strap S term'l of MSD(1) to G (If -D2 Logic Code is specified for display this has been done by closing Bridge S). The B line of the MSD(1) is connected to the S line of the next LSD(1). This B to S connection is repeated on the following digits except the LSD(1) of the display assembly (If -D2 Logic Code is specified for 2" or 3" displays, Solder Bridges Z are closed between all digits except the last two LSDs).— See schematic "External Connections Req'd for -D2 Logic," to the left.)

-M5 thru -M8 Logic Codes (XP00 Plug Cable) Buss the S Lines from ea. digit (2).

-M1 thru -M4 Logic Codes (XPMX Plug Cable) As supplied, pins 10 (S) & 7 (D) are removed from all the plugs in these cable assy's. Strobe &/or dec. pts. may be brought out by #14-1P00-XX.

(1) MSD = Most significant digit (L.H. digit); LSD = Least significant digit (R.H. digit).

(2) Naturally, all V lines, G lines & L lines should be bussed to facilitate powering the display. If the T &/or B functions are user driven, they should be bussed also.

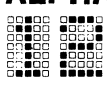
GENERATING PART NUMBERS

14-XPXX-X-XX

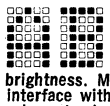
Single Ended	1	
Double Ended	2	
Multidrop, 1" & 2" (1)(3)	M1	A Dimension (Inches) (3)
Multidrop, 3" & 5½" (1)(3)	M3	
Single Drop (2)	00	Number of Display Plugs (4)

Notes: (1) For -M1 thru -M4 logic codes. (2) For -D1, -D2, M5 thru M8 & C1 thru C4 logic codes. (3) B = 2" for 1" & 2" displays; B = 4⅝" for 3" & 5½"displays. (4) ± Sign counts as one digit.

ALPHANUMERICS — 0.7", 2.0" & 4.0" 5 x 7 DOT MATRIX



84040 SERIES, 0.7" LED
Features an on-board, 7 bit, TTL latch, character generator & LED drive circuitry, as well as a four level brightness control & lamp test. It will display a 96 character ASCII repetoire. Power is 5 volt at 200ma max. Available in orange & green with 500ucd brightness. Micro-processor buss compatible & can interface with Dio-Rey's 820 Series ASCII Serial Receivers (up to 16 characters can be driven by one 820 receiver)*. The characters may be stacked horizontally on .7" centers. Loading data: The desired data and chip enable should be present & stable during a write pulse. No sync is necessary & character will continue to be displayed until replaced with another. Multi-character units supplied (16 character Std.).
*See SYSTEM INTERFACES on following page.



84042 SERIES, 2.0" LED &
84044 SERIES, 4.0" LED
Complete multi-character units (18 character units are Std.) can be supplied to meet a wide variety of applications. They can be supplied in NEMA or Designer enclosures. Alternately, the hardware can be supplied bare, ready for user mounting. Included in the unit: Serial ASCII current loop receiver (300 to 1200 baud); Character generator and display driver; Optional display controller which allows various modes of display including direct copy, horizontal scroll, vertical scroll, etc.; All required DC power supplies. Multiple units may be driven off a single data loop with each unit being addressable. Up to 1756 characters can be stored in the memory.— For further information or applications engineering assistance, please contact us or your area representative.

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DIO-REY

THE LIGHTED DISPLAY DIVISION OF
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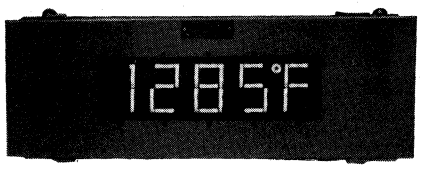
DIGITAL INSTRUMENTS AND SYSTEMS

SERIAL INTERFACE DISPLAYS, DIGITAL METERS, COUNTERS, CLOCKS & TIMERS



GENERAL:

Dio-Rey standard instruments integrate a wide range of display interfaces and power supplies. Whether it be a 6 digit, 5½" high display w/serial interface in a NEMA 12 box or a 2" 4 digit clock in a designer enclosure, Dio-Rey has the unit.

FEATURES

- Large, easy to read LED displays for high reliability (1", 2", 3" and 5½")
- Available in rugged Industrial or attractive Designer packages
- Designed for long, trouble-free service
- Suitable for a wide variety of applications
- Serial interface EIA RS422, RS232 or current loop compatible
- Analog to digital interfaces are voltage, current, temperature, load-cell and tachometer compatible
- Counters, clocks and timers in most popular configurations are available
- Powered from 110/220V, 50/60 Hz
- All wear and calibration components easily accessible

SPECIFICATIONS

- For Displays, see "Large Character Digital Display" spec. sht.
- For Interfaces, see this & next page.
- For Enclosures, see below
- Termination: barrier terminal block std.

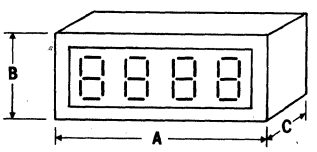
APPLICATIONS

- Analog to digital converters
- Clocks
- Bidirectional counters
- Coil winding counters
- Decade counters
- Event counters
- Pulse counters
- AC/DC ammeters
- AMP-HR meters
- Decibel indicating meters
- Fluid flow meters
- Volt meters
- Ohm meters
- Temperature meters
- Watt meters
- Timers
- Special indicators

STD ENCLOSURES, NEMA 12 & DES 'N'R

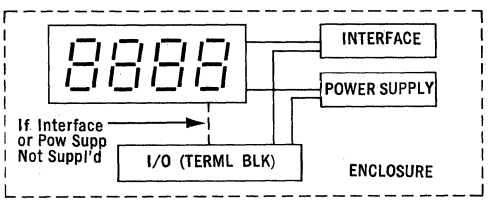
Digit Ht.	No. of Digits*	Enclosure Size (in)		
		A	B	C
1"	up to 6	8.6	3.8	6.2
2"	up to 4	8.6	3.8	6.2
2"	5 to 7	13.8	4.5	4.7
3"	up to 5	13.8	4.5	4.7
3"	6 to 9	26.6	7.1	5.2
5½"	up to 6	26.6	7.1	5.2

* ± sign equals one digit.



Std finish is grey enamel

BLOCK DIAGRAM



823 SERIES CLOCK & TIMERS

Standard Clock Interfaces are supplied in 4 or 6 digit, 12 or 24 hour formats. Calendar and decimal formats are available. Fast and Slow set inputs are standard; hold is optional.(1) As with the timers, All have BCD outputs compatible with Dio-Rey's Numeric Readouts. Timer interfaces that are available include count up, count down, both with preset options. Switch operation at a specified time optional.

(1) 50/60 Hz and crystal oscillation time bases are optional as are master/slave systems.

Part Number	Interface Code	Description
823-1	—61	4/6 Digit, 12 Hr Clock
823-2	—62	4/6 Digit, 24 Hr Clock
823-3	—63	Up Timer
823-4	—64	Down Timer

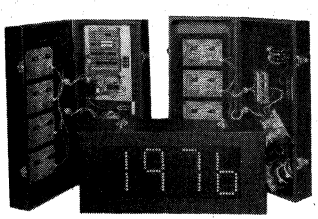
GENERATING PART NUMBERS

88X 3X — XX — XX — X

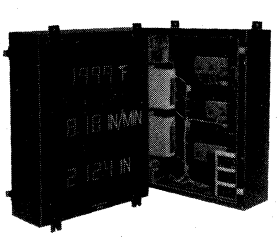
- **ENCLOSURE TYPE**: DESIGNER 6, INDUSTRIAL 7
- **DIGIT HT.**: 1" 1, 2" 2, 3" 3, 5½" 6
- **POWER**: 1 110V, 60 Hz; 2 220V, 60 Hz; 3 220V, 50 Hz
- **INTERFACE CODE**: SEE TABLES ON THIS & NEXT PAGE
- **NO. OF DIGITS & FORMAT**: SEE "GENERATING PART NUMBERS" IN "LARGE CHARACTER DIGITAL DISPLAY" SPEC. SHTS.

EXAMPLE: A 4 digit, 3"; designer unit w/serial RS232 receiver having 110V, 60 Hz power would have pt. no. 88633-4A-11-1.

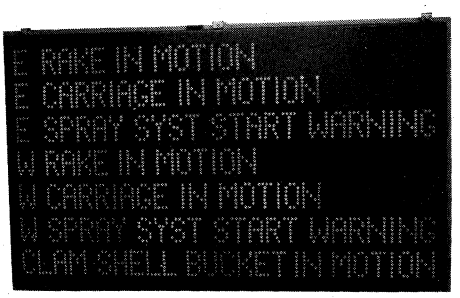
SPECIAL NUMERIC & ALPHA NUMERIC DISPLAY SYSTEMS



Laddle Wt meter (5½")



Laddle temp/cast feed/cast length digital instrument unit for metal slab casting plant (3")



If you have a special requirement for lighted displays, please call us for applications engineering assistance. — We will be happy to help you.

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"LINKS BETWEEN MAN AND MACHINE"

DIO-REY

THE LIGHTED DISPLAY DIVISION OF
INFO-LITE CORPORATION

SYSTEM INTERFACES
POWER SUPPLIES

GENERAL

DIO-REY has developed a wide variety of standard system interfaces for its numeric/alphanumeric redouts and lighted indicator/annunciators. These are the result of over 20 years experience in serving a broad spectrum of industries including instrumentation process control, communications, metals, chemicals, data processing, agriculture, security, office equipment, petroleum, auto, aerospace, textile, packaging, paper, transportation, governmental agencies and military.

These products may also be used in systems which do not require displays. In addition, custom interface electronics, designed to perform outside the specifications or capabilities of our standard units are available. Contact our sales department for technical application assistance.

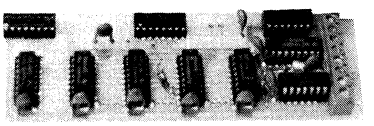
821 SERIES ANALOG TO DIGITAL CONVERTERS

The DIO-REY 821 Series are bipolar A/D's with up to 4½ digit output capacity • BCD output ranges are: ±1999, ±3999, ±19999 and ±39999.

All feature state-of-the-art technology at competitive cost • Input impedance >100 mΩ • Common mode rejection is 110 dB for DC; 90 dB for AC • Accuracy is ±0.05%, ±1 count • Auto zero and zero offset available • Ranging and zero adjustments conveniently located • 5 VDC and 110/220, 47-500 Hz input, depending on model • −10°C to +65°C; 0-90% RH non-condensing operating environment • ½" LED display available • 100 K hr MTBF.

Part Number	Interface Code	Range	Input Power	
			5 VDC	110/220 VAC
821-1	—21	±1.999V	●	
821-2	—22	±199.9V	●	
821-3	—23	±20.0 mA	●	●
821-4	—24	±20.00 mA	●	●
821-5	—25	4.0-20.0 mA	●	●
821-6	—26	4.00-20.00 mA	●	●
821-7	—27	10.0-50.0 mA	●	●
821-8	—28	10.00-50.00 mA	●	●
821-9	—29	±1.999 mV		●
821-10	—30	±1999 mV		●
821-11	—31	±3.999 mV		●
821-12	—32	±3999 mV		●

822 SERIES DECADE COUNTERS

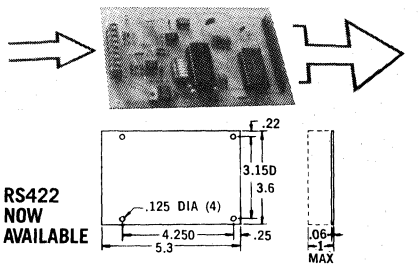


Stds available up to 5 decades, opt'l units available up to 10 decades. This series of counters includes Up, Down, Bi-Directional and Presetable (or combinations of these) units. All have TTL BCD outputs, compatible with DIO-REY displays. — Reset, count and power (5 VDC) are brought in via a terminal block. Outputs terminate through a header.

CONTACT DEBOUNCER IS STD OPTION.

Part Number	Interface Code	X = No. of decades Description
822-X-1	—41	X Decade, Up Counter
822-X-2	—42	X Decade, Down Counter
822-X-3	—43	X Decade, Up-Down Counter
822-X-4	—44	X Decade, Present Up Counter
822-X-5	—45	X Decade, Preset Down Counter
822-X-6	—46	X Decade, Preset Up-Down Counter

820C SERIES SERIAL ASCII INTERFACES



RS422 NOW AVAILABLE

The DIO-REY 820 Series Serial to Parallel and Parallel to Serial Converters are microprocessor based and are primarily intended for driving remote display decoders.

The input to the 820 Receiver is a Serial ASCII coded data stream at either RS232 or current loop levels. The 820 Receiver automatically adapts itself to incoming data rates over the range of 110 to 1200 baud. In addition it features a six position DIP switch which allows selective addressing of up to 64 separate receivers on one data link. The output of the receiver is six bits of data and sixteen strobe lines. The receiver, therefore, can drive either sixteen numeric or alphanumeric displays per receiver or up to 96 points in an annunciator system.

An array of sixteen, 6-bit registers may be sequentially inputed to the 820 Transmitter and converted to a serial output, for annunciator systems.

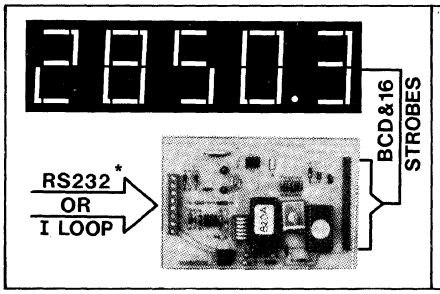
Part Number	Interface Code	Description	Transmission Mode
820-1**	—11	Serial ASCII Data Receiver	EIA RS232 110-1200 Baud
820-2	—12	Serial ASCII Data Receiver	Current Loop 110-1200 Baud
820-5/6**	—13	Serial ASCII Data Receiver	RS232 or Current Loop 1200-4800 Baud
820-9	—14	Serial ASCII Data Receiver	RS422

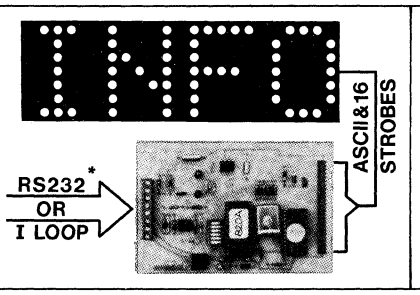
**Available w/ serial repeater circuit and voltage inverter.

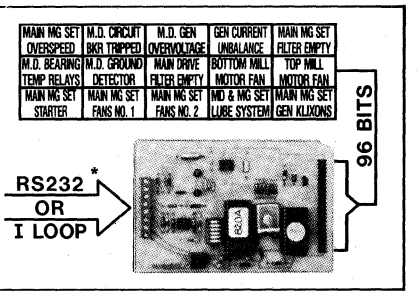
SERIAL ASCII RECEIVERS & TRANSMITTERS

FOR REMOTE DISPLAYS. CONTROLS & TELEMETRY

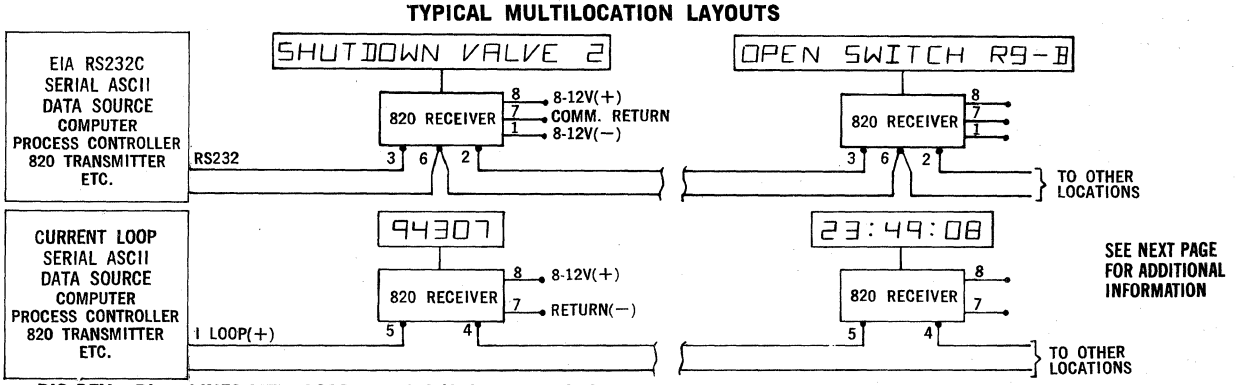
*RS422 NOW AVAILABLE







TYPICAL MULTILOCATION LAYOUTS



SEE NEXT PAGE FOR ADDITIONAL INFORMATION

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"LINKS BETWEEN MAN AND MACHINE"

DIO-REY
THE LIGHTED DISPLAY DIVISION OF INFO-LITE CORPORATION

USER DATA FOR SERIAL RECEIVERS & XMITTERS

GENERATING PART NUMBERS

820C-XX-X-X-X

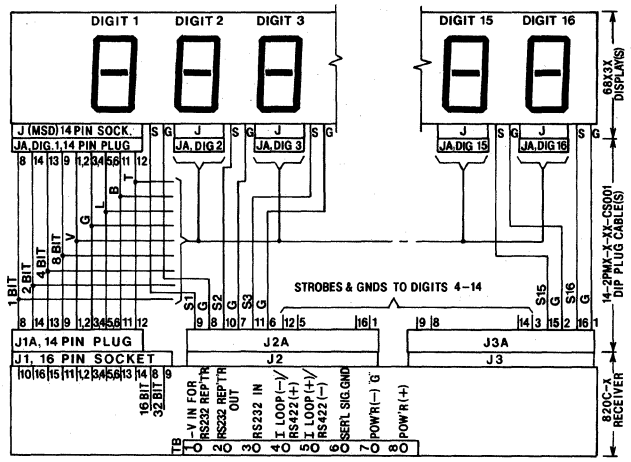
TYPE
SEE PAR 2.0, "PART NO'S & DESCRIPTION" FOR DASH NO. (PAR 2.1 FOR TRANSMITTER)

POWER REQ'D
5V REGULATED 5
8-12V UNREG'D & FILT'D 8

STROBE I/O
1 W/8 STROBES
2 W/16 STROBES

DIGIT HT. DRIVEN
1 1"
2 2", 3" & 5½"

820C-X SERIAL ASCII RECEIVER TO NUMERIC READOUT SCHEMATIC (UP TO 16 DIGITS)



USER DATA FOR 820C-X SERIAL DATA TRANSMITTER

1.00 GENERAL

The Info-Lite 820C Transmitter is a microprocessor based parallel to serial converter primarily intended for driving remote display receivers. The output of the 820C is a serial ASCII coded data stream at RS232, RS422 or current loop levels. It may be user set to data rates over the range of 110 to 4800 baud. The input to the transmitter is six bits of data and sixteen strobe lines. The transmitter, therefore, can drive sixteen numeric or A/N characters or, for annunciators, ninty-six (6 x 16) indicators. For annunciator applications: the 32 bits are inverted (32).

2.0 SPECIFICATIONS

2.1 PART NUMBERS AND DESCRIPTION

820C-3	RS232 (±8-12V power)
820C-3B	RS232 (±8-12V power)
820C-4	Current loop
820C-11	RS422

2.2 OUTPUT LEVELS, SERIAL DATA

Current loop output: 15 to 60 ma. depending on external supplied voltage and impedance. 20 ma. recommended
EIA outputs: RS232 levels i.e.: ±6 volts nominal
RS422 levels i.e.: ±5 volts nominal

2.2.1 OUTPUT LEVELS OF INPUT STROBES

Sixteen active low signals, 4 ma. sink at 0.4 volts max., 0.4 ma. source at 2.7 volts min. Strobe timing: 60 microseconds width and spacing, nominal. Data setup time: 5 microseconds minimum.

2.3 INPUT LEVELS

Data: Six ASCII coded signals, 0.5 ma. sink at 1.0 volts max., 0.1 ma. source at 4 volts min.

2.4 DATA FORMAT, OUTPUT

Serial output data ASCII coded; seven bit ASCII, one stop, even parity.

2.4.1 MESSAGE FORMAT

First character = SOH (HEX 01); Second character = <A> most significant address digit, fixed at 0; Third character = <A> least significant address digit, fixed at 0; Fourth character = <D> first numeric or alpha displayed character; Fifth to nineteenth character = second thru sixteenth inputted characters; Last character = CR (HEX OD).

2.4.2 TRANSMISSION LIMITS

Current loop systems: 20 ma. nominal current loop systems can be designed with cable lengths up to several thousand feet and exhibit excellent noise immunity at low to medium data rates. Normal twisted pair cable of 24 AWG suffices for most applications. Ultimate distances attainable are a function or cable capacitance, data rate, and ambient electrical noise.

EIA RS422 offers high noise immunity and data rates with the use of long lines, as well as multi-dropping of data (32 receivers, max.).

EIA RS232 systems: RS232 is generally limited to distances of 25 feet. Distances beyond this are possible using special lo-cap data cable. RS232 is not recommended where high electrical noise is a factor. RS232 systems do not provide any electrical isolation between devices and problems with differential voltage between devices adds to the poor noise immunity.

2.4.3 MESSAGE LENGTHS

Fixed message consists of 16 inputted characters in message.

2.5 DATA FORMAT, INPUT

Six bits, multiplexed. These correspond to 64 displayable characters from HEX 20 to HEX 5F inclusive, and represent one alpha case, numerics and certain symbols. They correspond to 96 discreet (max) indicators.

2.6 ADDRESS

The address is fixed at 00. All receivers must be set to respond to this address.

2.7 BAUD RATE SELECTION

Determined by the Dip switch on the board.

3.0 POWER

8 to 12 VDC at 100 ma (and −8 to −12 VDC at 10 ma for RS232 without voltage inverter option), filtered, unregulated.

3.1 CONNECTIONS: POWER AND SERIAL DATA

All signals appear on a screw type terminal strip (see schematic).

3.2 DATA/STROBE

All inputs appear on three, 16 Pin-Dip sockets; J1 I/O the 6 bit binary; J2 and J3 I/O the 16 strobes (see schematic).

4.0 THEORY OF OPERATION

The 820C transmitter consists of a single chip microprocessor and three support chips. One of these chips provides electrical isolation from the current loop or RS422 output, another chip expands the microprocessor's outputs to provide address strobes, and the third chip provides buffering and enhanced noise immunity on the six bit input. This input buffer will allow the use of diodes on switch inputs for those applications where the input is an array of up to 96 physical switches (16 x 6 matrix). An optional fourth chip provides an inversion of the input voltage for RS232 transmission (powered by +8 to +12V only).

Incoming data is received as 16, 6 bit characters, via the aformentioned buffer. The processor does a software contact debounce and reads and stores the incoming data stream. The processor sends the debounced data in a serial manner starting with the most significant digit, i.e., left justified.

Data is inputted when the individual strobe lines are brought low to allow transfer to data from the external switches or gates.

The transmitter determines the baud rate of the outgoing data stream by reading the first 3 switches of the dipswitch on the board. At all data rates, a minimum intermessage gap of 4 milleseconds exists.

USER DATA FOR 820C-X SERIAL DATA RECEIVER

1.0 GENERAL

The Info-Lite 820C-R Receiver is a microprocessor based serial to parallel converter primarily intended for driving remote display decoders. The input to the 820C-X is a serial ASCII coded data stream at RS232, RS422 or current loop levels. The 820C-1X, -2 and -9 automatically adapt to incoming data rates over the range of 100 to 1200 baud. Optionally the 820C-5X, -6-10 are supplied with a DIP switch which will allow operation between 1200 and 4800 baud. In addition, a six position DIP switch allows selective addressing of up to sixty-four separate receivers on one data link. The output of the receiver is six bits of data and sixteen strobe lines. Each receiver, therefore, can drive either sixteen numeric or alphanumeric displays or up to 96 annunciator points.

2.0 PART NUMBERS AND DESCRIPTION

820C-1	RS232 at 110-1200 baud.
820C-1A	RS232 at 110-1200 baud with RS232 repeater circuit.
820C-1B	RS232 at 110-1200 baud with RS232 repeater circuit and voltage inverter for repeater.
820C-2	Current loop at 110-1200 baud.
820C-5	RS232 at 1200-4800 baud.
820C-5A	RS232 at 1200-4800 baud with RS232 repeater circuit.
820C-5B	RS232 at 1200-4800 baud with RS232 repeater circuit and voltage inverter for repeater.
820C-6	Current loop at 1200-4800 baud.
820C-9	RS422 at 110-1200 baud.
820C-10	RS422 at 1200-4800 baud.

3.0 SPECIFICATIONS

3.1 INPUT LEVELS

Current loop output: 15 to 100 ma, without adjustment; 2.0V drop, typical; 20 ma recommended. EIA Input: RS232 levels I.E. ±12 volts nominal.

3.2 OUTPUT LEVELS

DATA: Six ASCII coded signals; 10 ma. sink at 1.0 volts max; 0.4 ma. source at 2.4 volts min.
STROBES: Sixteen active low signals, 4 ma. sink at 0.4 volts max., 0.4 ma. source at 2.7 volts min.
STROBE TIMING: 60 microseconds width and spacing, nominal.
DATA SETUP TIME: 5 microseconds minimum.

3.3 DATA FORMAT: INPUT

Serial input data 7 bit ASCII coded, one or two stop bits (2 stop bits reg'd for 4800 baud), even parity. Intermessage Gap: 4 milleseconds, min. If this is not possible HEX FF followed by HEX 00 as a Gap may be transmitted.

3.3.1 MESSAGE FORMAT

First character = SOH (Hex 01); Second character = <A> Most significant address digit; Third character = <A> Least significant address digit; Fourth character = <D> Most significant numeric on alpha displayed character; Fifth to Ninteenth character = Second thru sixteenth displayed characters; Fourth thru twentieth character = CR (HEX OD)

3.3.2 MESSAGE LENGTHS

Minimum message consists of; (SOH), (A), (CR) and will cause the display to blank.
Maximum message consists of 16 display characters in message.
Nominal messages are left justified and leading zero suppressed. This may be overridden by transmitting false zeros (HEX 20, 40 or 50) or by not using STROBE DIGIT 1 and transmitting a filler word, other than ASCII zero for the most significant digit.

3.4 DATA FORMAT, OUTPUT

Six bits, multiplexed. These correspond to 64 displayable characters from Hex 20 to Hex 5F inclusive, and represent one alpha case, numerics and certain symbols.

3.5 ADDRESS SELECTION

Each receiver may be set to one of 64 different addresses from 00 to 63. This selection may be made by setting the DIP switch on each board to the six bit binary value desired. This feature is intended for use where multiple receivers are to be used on one communications link and it is desired to send different messages to each one.

4.0 PHYSICAL

(Size, Power Requirements, Input and Output Connections) See Outline Drawing No. A820C-1X and Schematic No. B820C-X.

INPUT CONNECTIONS:

See Schematic No. B820C-X.

5.0 THEORY OF OPERATION

The 820C-X Receiver consists of a single chip microprocessor and one or two support chips. For the -2 and -6 receivers, one of these chips (IC5) provides electrical isolation from the current loop input. For the -9X and -10, one chip (IC6) provides buffering for the RS422 signal. The other chip expands the microprocessor's output to provide the address strobes.

Incoming data is received either as current loop, via the aforementioned isolator, thru the RS422 buffer, or via the RS232 input network. The processor reads and stores the incoming data stream. If the transmitted address code agrees with the address set into the DIP switch, the stored message is sent to the displays in a sequential manner starting with the most significant digit, i.e., left justified. If the incoming message contains more than 16 display characters, exhibits any parity errors, or contains any "illegal" words, the stored message is not outputted. The next error free message, properly addressed will be displayed.

For the units with 110-1200 baud (-1X, -2 and -9X), the receiver determines the baud rate of the incoming data stream by measuring the width of the start bit on the first character in the message, which must be "Start of Header" (HEX 01). The higher baud units, (5X, -6 and -10), utilize hardware for baud selection.

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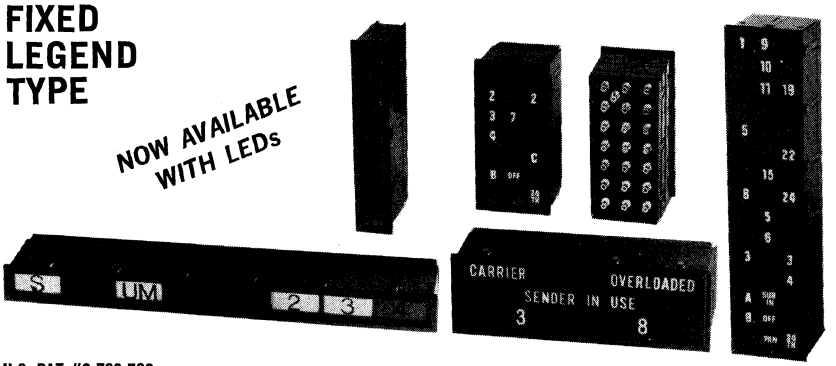
DIO-REY

THE LIGHTED DISPLAY DIVISION OF INFO-LITE CORPORATION

LIGHTED INDICATORS AND ANNUNCIATORS

FIXED LEGEND TYPE

NOW AVAILABLE WITH LEDs



U.S. PAT #3,703,720

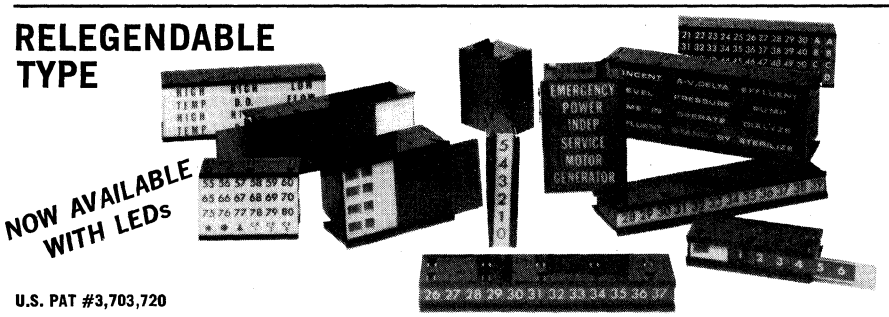
Series	Indicator Module Size	Series	Indicator Module Size
68811	3/8" x 3/8"	68822	3/4" x 3/4"
68812	3/8" x 3/4"	68823	3/4" x 1 1/8"
68813	3/8" x 1 1/8"	68824	3/4" x 1 1/2"
68814	3/8" x 1 1/2"	Special	Any size on 3/8" Grid

Any group of messages/symbols can be displayed in any combination of colors

- Construction is modular
- Front panel graphics are back lighted using LEDS — STD MFB T1¾ lamps also available
- Units are supplied in an attractive package with bezel and "Black-Out" front panel, ready to snap into rectangular panel cutout
- Lamp common reduces installation time
- Serviced from the front
- Lamp drivers and special logic available

RELEGENDABLE TYPE

NOW AVAILABLE WITH LEDs



U.S. PAT #3,703,720

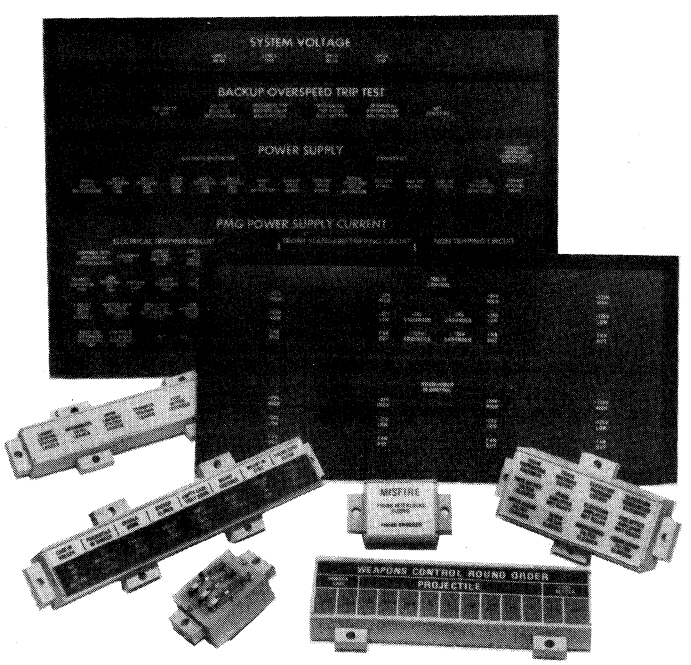
Series	68911	68912	68914
Indicator Module Size	3/8" x 3/8"	3/8" x 3/4"	3/8" x 1 1/2"

For applications where the legend or graphics must be able to be changed

- Same features as the FIXED LEGEND TYPE
- Can be supplied with photographic film legend
- Relegendable from front
- Six standard color filters
- Twenty-three standard units with from 2 to 48 indicator modules
- Special assemblies available

74000 SERIES CUSTOM UNITS

ANNUNCIATORS • STATUS DISPLAYS • BACK LIGHTED INDICATORS PANELS • MAP/FLOW DISPLAYS • DEAD FRONT PANELS



Units shown include status displays for power generating station & military fire control system. Many other configurations have been supplied for applications such as: Industrial process control, security systems, automated machine control, chemical/petroleum/textile flow indicators, steel/aluminum plant condition displays, banking system displays, medical instrument displays, communication network indicators and data processing/computer system communication.

Dio-Rey's back lighted displays are now available with either LEDs and/or incandescent light sources. They provide design flexibility and attractive appearance usually associated with expensive custom units. Dio-Rey allows you to choose the size, shape, color, legend and intensity combination that will meet your requirements. Color filters, special legends and masks are supplied to meet customer specifications. As well as having a standard line, we have supplied a wide range of hardware designed to meet special requirements. Contact us to discuss your specific needs.

FEATURES

- Available with standard LED and/or incandescent light source
- Sizes range from several square inches to square yards
- Fixed legends may be screened in one or more colors
- Can be supplied to endure severe environments (NEM4 or MIL-E-5400 and MIL-STD-202)
- Special units with any group of messages/symbols may be displayed in any combination of colors
- Units are supplied in an attractive package with bezel
- Front panel options include: "black out," clear, high efficiency red, amber or green. Lampdrivers/flashers and annunciator logic is available
- All incandescent lamps are socket mounted to ease servicing
- Termination options include: terminal block, header, connector-harness, taper pin and solder terminal

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MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 89/90 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1404, **B**•1090, **C**•1119 **D**•1156
AC Power Supplies, Product Selection Guide ..... **D**•2156
ASCII Code ..... **D**•1080
Batteries, Product Selection Guide ..... **D**•1447
Batteries & Fuel Cells, Characteristics ..... **D**•1450
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide ..... **A**•1002
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1197
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **A**•2272, **C**•1316
Connectors, Miniglossary ..... **C**•1271
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1339
DC Power Supplies, Product Selection Guide ..... **D**•1537
Delay Lines, Product Selection Guide ..... **A**•1503
Dielectrics, Thermal Conductivity ..... **B**•1916
Discrete Semiconductors, Product Selection Guide ..... **A**•2154
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1041
EBCDIC Code ..... **D**•1086
Encapsulation, Miniglossary ..... **C**•1124
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide ..... **C**•1631
Fiber Optics, Miniglossary ..... **B**•1185
Fiber Optics, Product Selection Guide ..... B•1204
Filters, Power, Product Selection Guide ..... **A**•1642
Filters, Signal, Product Selection Guide ..... **A**•1683
IC Master ..... **A**•1740
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1210
Interconnection Systems, Product Selection Guide ..... **C**•1702
Keyboards & Keypads, Product Selection Guide ..... **B**•1854
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Military Qualified Products List ..... **B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1221
Opto Semiconductors, Miniglossary ..... **A**•2169
Oscilloscopes, Product Selection Guide ..... **D**•1426
Panel Hardware, Product Selection Guide ..... **C**•1583
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Power Supplies, Miniglossary ..... A•2276, **D**•1541
Power Supplies, AC, Product Selection Guide ..... **D**•2156
Power Supplies, DC, Product Selection Guide ..... **D**•1537
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1351
Relay Contact Forms ..... **B**•1450
Relays, Electromechanical, Miniglossary ..... **B**•1414
Relays, Product Selection Guide ..... **B**•1411
Resistor Color Codes ..... **A**•1952
Resistors, Product Selection Guide ..... **A**•1867
Servo Components, Miniglossary ..... **B**•1266
SI Units, Basic Guide To, ... **A**•1434, **B**•1472, **C**•1692, **D**•1386
Solenoids, Product Selection Guide ..... **B**•1655
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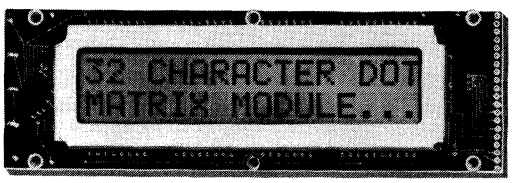
REFAC ELECTRONICS DISPLAYS

Intelligent LCD Modules

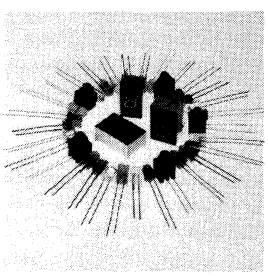


Many dot matrix arrays with all IC's on board. EL and LED backlight options and wide temperature range available. U.S.-based engineering, economic pricing, and distributor stocking.

0438 LCD Modules

Custom fonts up to 32 segments available in standard 0438 LCD modules. Complete with serial driver, display, PCB, connector, and bezel. Self-contained, compact LCD assemblies with backlighting and wide temperature operation including bar graphs, pictorial annunciators, and indicators.

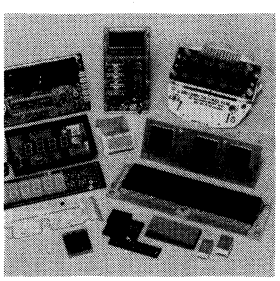
OPCOA® LED Lamps & Displays



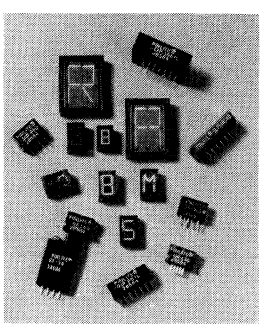
Single and bi-color lamps are 100% electrical tested and designed for more than 100,000 hours' service. Used in automotive, industrial, appliance, and military applications. Plus a broad line of single and multi, seven segment and alphanumeric displays for automotive, industrial, appliance, and military markets.

Custom Display Assemblies

One stop shopping for custom display assemblies of all types, including incandescent, LED, or LCD digits, Display Modules, and associated electronics. For consumer, industrial, and military applications.



Pinlite® Incandescent Displays



Digital and alpha-numeric incandescent displays frequently specified for civil and military aircraft instrumentation. They offer long life, fast response, low voltage, vibration resistance, 9,000 ft./lambert minimum brightness, 120° viewing angle, patented filament arrangement, and direct compatibility with standard TTL driving networks and multiplex circuits.

State-Of-The-Art Tooling And Assembly

You can depend on ERA/REFAC for the latest in subassemblies and turnkey products. Our manufacturing facilities in Connecticut and Taiwan are both equipped with automated assembly lines that include chip-on-board wire bonders, surface mount pick-and-place machines, wave soldering machines, and automated test equipment. Our capabilities are complemented by the ERA/REFAC Design Engineering Group, specialists in design and customer interfacing. Computer controlled tool room capabilities assure precision tooling and fast turnarounds.

There may be an ERA/REFAC display or module in your future. Write, call, or fax your specifications to us today.

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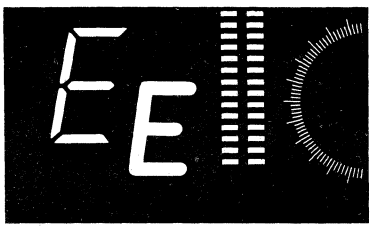
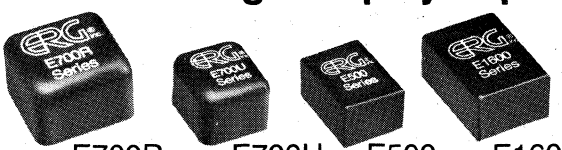
Power your displays —

DC-DC converters for Gas Discharge Displays up to 25W

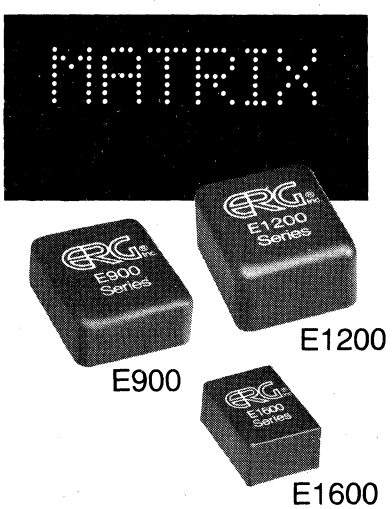




E700R E700U E500 E1600

Made in U.S.A.

Convert low DC line voltage to the higher voltage levels required to activate multi-segment plasma gas discharge displays (including bar graphs). ERG Converters eliminate need for 200–250V DC line.



E1200

E900

E1600

General Specifications

ERG Converter Series	Input	Output	Size	Weight	Package
E700U	5,9,12,15 V DC standard (to 48 available)	Up to 3W unregulated (e.g. 200 V DC @ 15 ma)	1.1" (27.94 mm) × 1.2" (30.48 mm) × .91" (23.11 mm) max. high	30 gms.	Plastic
E700R (Regulated)	5,9,12,15 V DC standard (to 48 available)	Up to 3W regulated (e.g. 200 V DC @ 15 ma)	1.43" (36.32 mm) × 1.5" (38.10 mm) × 1.03" (26.16 mm) max. high	40 gms.	Plastic
E500*	5,9,12,15 V DC standard (to 48 available)	Up to 3W unregulated (e.g. 200 V DC @ 15 ma)	1.00" (25.40 mm) × 1.38" (35.05 mm) × 0.70" (17.78 mm) high	20 gms.	Plastic
E1600	5,9,12,15 V DC standard (to 48 available)	Up to 6W unregulated (e.g. 250 V DC @ 24 ma)	1.30" (33.02 mm) × 1.88" (47.75 mm) × 0.82" (20.83 mm) high	44 gms.	Plastic
E900	5,12,15 V DC standard (to 48 available)	Up to 12W total, with single or dual outputs, unregulated; (e.g. Single: 250V DC @ 30 ma Dual: 250V DC @ 30 ma and −16V DC @ up to 200 ma to power the drive electronics in many applications using the Burroughs SELF-SCAN* or IEE* ARGUS displays)	2" (50.80 mm) × 2.5" (63.50 mm) × .98" (24.9 mm) high	122 gms.	Aluminum
E1200	12,15 V DC standard (others to your spec)	Up to 25W unregulated (e.g. 250V DC @ 100 ma)	2" (50.80 mm) × 2.5" (63.50 mm) × 1.19" (30.23 mm) high	185 gms.	Aluminum

*For high-volume requirements, E500 delivers same performance as E700 at significantly lower unit cost!

Mounting: P.C. board standard
Encapsulation: All ERG converters are fully encapsulated
Isolation (in/out): 600V RMS (60 Hz. breakdown for 1 min.) standard
Temperature: 0–70° C. standard. Wider ranges available. 85° C. case max. 25° C. temp. rise typical for E1200

Match our converter to your display

Use this handy chart to find the right ERG converter for your gas discharge display application. Remember, this is just a guideline. Consult the factory if your application requires a series or part number other than shown below! Ask about our expanded Cross Reference Index for gas discharge displays.

All converters below are 12V DC input; other input voltages available.

Mfr.	Mfr.'s Part #	ERG Part #	Mfr.	Mfr.'s Part #	ERG Part #
BABCOCK	SP-101	E712-215U	CHERRY	W-750-2052	E1612-1.835S
BABCOCK	HB-332	E712-215U	CHERRY	WO7-1007	E1612-1.835S
BABCOCK	DP-0216-C1	E1612-1.8540S	DALE	PD-06D040	E512-215U
BABCOCK	DP-16G101-C1	E912-1.8545S	DALE	PD-16A040	E512-215U
BABCOCK	DP-0840-C1	E1212-1.85130	DALE	PD-32A025	E512-215U
BURROUGHS	SSD1000-0030/39	E912-2.530S	DALE	APD-32A025	E1612-2.520S
BURROUGHS	SII0120A0030/39	E1212-2.5100	FUJITSU	FPN060DRUD	E1212-1.510S
BURROUGHS	SII0140A-0030/39	E1612-2.520S	FUJITSU	FPC4012NRPL	E912-1.5560S
BURROUGHS	SII-1240PD	E1212-2.5100	FUJITSU	FPN020DRUD	E1612-1.535S
BURROUGHS	BG16101-2	E712-2.512U	IEE	MAXI 32(16X2) (O)	E1612-1.535S
BURROUGHS	BAF06770	E712-215U	IEE	MAXI 128(32X4) (O)	E912-1.566S
CHERRY	W416-1051	E1612-1.835S	IEE	MINI 480(40X12)(O)	E1212-1.3185
CHERRY	W420-1052	E1612-1.835S	PCPC	RU-32-8RD10(32X8)	E1212-2.5100
CHERRY	W424-1053	E1612-1.835S	PCPC	PC1705-25664DC	E1212-1.85130
CHERRY	W416-1054	E1612-1.835S	THOMSON	TH 7606	E1212-1.00160
CHERRY	W420-1055	E1612-1.835S		NEEDS BOTH	E1212-1.00160
CHERRY	W424-1058	E1612-1.835S	THORN EMI	P157/03-MI	E912-2.732S

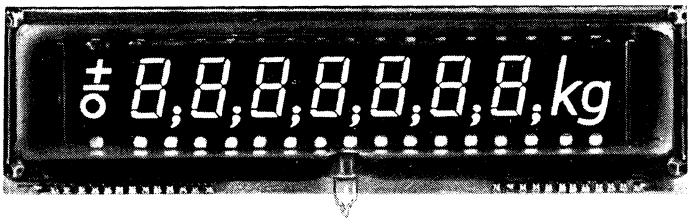
All specifications subject to change without notice.

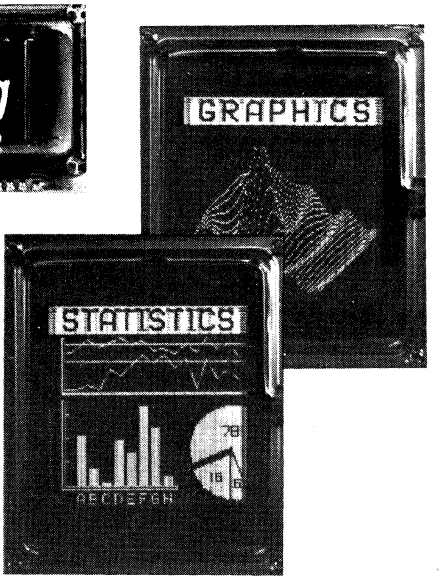
Tell us about your display power needs

- **Custom Designs**
- **Variations for multi-segment, bar graph and dot matrix gas discharge and vacuum fluorescent displays**
- **Inputs from 5V DC to 48V DC (your choice)**
- **Outputs from 5V DC to 1,500V DC (your choice)**
- **Single and dual outputs (up to 25W total)**
- **Regulated and unregulated**
- **Center tap (± voltages)**

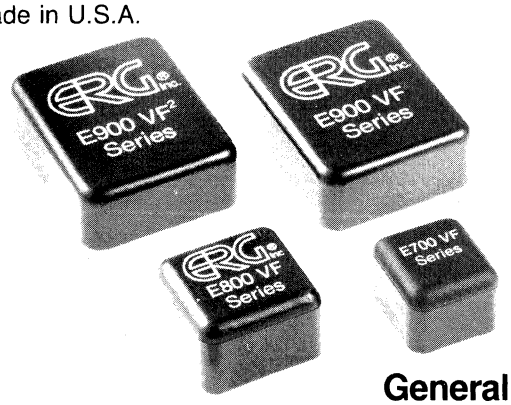
from low DC voltage

DC-DC converters for Vacuum Fluorescent Displays up to 12W





Made in U.S.A.



No need for "special" multiple output power supplies. ERG converters produce both anode and filament voltages for VF displays up to 12W. Compatible with all major VF display makes. Mount on your PC board as needed, where needed.

General Specifications

ERG Converter Series	Input	Output	Size	Weight	Package
E700 VF up to 3W	5, 12V DC (other inputs available.)	DC Anode voltage and Center tap (AC) filament voltage.	1.1" (27.94 mm) × 1.2" (30.48 mm) × .91" (23.11 mm) high	30 gms.	Plastic
E800 VF up to 6W	5, 12V DC (other inputs available.)	Up to 6W max.	1.43" (36.32 mm) × 1.50" (38.10 mm) × 1.03" (26.16 mm) high	40 gms.	Plastic
E900 VF up to 12W	5, 12V DC (other inputs available.)	Up to 12W max. (to 7.5W max. with 5V DC input)	2" (50.80 mm) × 2.5" (63.50 mm) × .98" (24.9 mm) high	122 gms.	Aluminum

Mounting: P.C. board standard
Encapsulation: All ERG converters are fully encapsulated
Isolation (in/out): 300V RMS (60 Hz. breakdown for 1 min.) standard
Temperature: 0-70° C. standard. Wider ranges available. 85° C. case max.

Match our converter to your VF display

Use this handy chart to find the right ERG converter for your VF display application. Remember, this is just a guideline. Consult the factory if your application requires a series or part number other than shown! Ask about our expanded Cross Reference Index for vacuum fluorescent displays.

All converters below are 12V DC input; other input voltages available.

Mfr.	Mfr.'s Part #	ERG Part #	Mfr.	Mfr.'s Part #	ERG Part #
FUTABA	16-SY-O3Z	E712-.24V5.8	NORITAKE	DC40125A	E912-.60100V7.6
FUTABA	5-LY-O1ZL	E712-.26V3.0	NORITAKE	DM256X64A	E912-.8060V7.2
FUTABA	16-MY-O1ZL	E712-.31V6.2	NORITAKE	DM128X128D	E912-.8060V4.0
FUTABA	32-SD-43Z	E712-.30V7.3	NORITAKE	DM64X64B	E912-.7448V4.3
FUTABA	14-LD-O1Z	E712-.31V6.5	NORITAKE	DC440066A	E912-.60V8.8
FUTABA	28-BD-O1Z	E712-.30V5.4	NORITAKE	DC440046A	E912-.60V9.2
FUTABA	16-MD-O2Z	E712-.32V6.1	NORITAKE	DC40026B2	E812-.55V9.0
FUTABA	16-LD-O1Z	E712-.47V7.5	NORITAKE	DC409A2	E712-.55V9.7
NEC	FIP32B5X	E712-.45V6.8	NORITAKE	DC209A2	E712-.35V6.5
NEC	FIP32A9X	E712-.45V6.5	NORITAKE	DC205A2	E712-.42V5.7
NEC	FIP40A5X	E712-.45V8.9	NORITAKE	DC169A2A	E712-.42V4.8
NEC	FIP80A5X	E712-.45V9.0	NORITAKE	FG206A2	E712-.35V6
NEC	FIP14A8T	E712-.135V1.7	NORITAKE	FG166A2	E712-.35V5.3
NEC	FIP16B11X	E712-.35V8.3	NORITAKE	FG326A2	E712-.45V6.8
NEC	FIP16B13R	E712-.47V7.2	NORITAKE	FG108B1	E712-.26V4.8

All specifications subject to change without notice.

Ask about our quadruple output DC-DC converters, capable of powering two dissimilar vacuum fluorescent displays!

Also see our pages in EEM, Sec. 4000, Power Supplies DC.

To expedite smaller orders (up to $250) we welcome credit card purchases.

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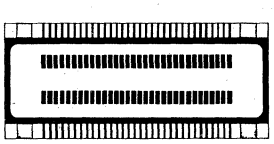
EXCELIX LCD
Technology International Corp.

Numeric Displays

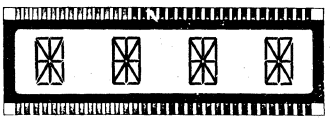
Excelix LCD Model #	Digit Height (inches)	Display Format	Connector	Glass Size (inches)
3150	0.181	3½ digits, duplex	S.I.L. Elastomer	0.808 x 0.520
3252	0.200	3½ digits, duplex	S.I.L. Elastomer	0.808 x 0.520
6200		6 digits, duplex	D.I.L.	1.500 x 0.600
8200	0.236	8 digits, M/E, triplex	S.I.L. Elastomer	2.090 x 0.690
3250	0.255	3½ digits, direct	D.I.L.	0.808 x 0.509
3313	0.300	3 digits, 5 triangles, triplex	D.I.L.	1.200 x 1.000
8300		8 digits, triplex	D.I.L.	2.750 x 1.100
4300	0.315	4 digits, S, bell, direct	D.I.L.	1.457 x 0.709
4320	0.350	4 digits, direct	D.I.L.	2.000 x 0.900
3401	0.400	3½ digits, direct	S.I.L.	2.500 x 1.100
3450		3½ digits, duplex	S.I.L.	1.960 x 0.950
4400		4 digits, AM, PM, S, bell, direct	D.I.L.	1.960 x 0.950
4451		4½ digits, over-range, direct	D.I.L.	2.005 x 1.200
4455		4½ digits, Lobat, direct	D.I.L.	2.000 x 1.200
5400		5 digits, direct	D.I.L.	2.000 x 1.200
3451	0.433	3½ digits, direct	D.I.L.	1.960 x 0.950
3501	0.500	3½ digits, direct	S.I.L.	2.000 x 1.200
3551		3½ digits, over-range, direct	D.I.L.	2.000 x 1.200
3555		3½ digits, Lobat, direct	D.I.L.	2.000 x 1.200
3557		3½ digits, AM, PM, bell, direct	D.I.L.	2.000 x 1.200
4500		4 digits, direct	D.I.L.	2.000 x 1.200
4500 (M3)		4 digits, triplex	D.I.L.	2.000 x 1.200
6500		6 digits, direct	D.I.L.	2.750 x 1.200
8500		8 digits, direct	D.I.L.	3.695 x 1.200
3452	0.531	3½ digits, AM, PM, AL, bell, direct	D.I.L.	1.960 x 1.079
3751	0.700	3½ digits, over-range, direct	D.I.L.	2.750 x 1.500
4700		4 digits, direct	D.I.L.	2.750 x 1.500
4707		4 digits, PM, direct	S.I.L. Elastomer	3.250 x 1.250
5700		5 digits, direct	D.I.L.	3.200 x 1.500
6700		6 digits, direct	D.I.L.	3.695 x 1.500
31030	1.000	3 digits, direct	D.I.L.	3.695 x 1.800
31051		3½ digits, over-range, direct	D.I.L.	3.695 x 1.800
41000		4 digits, direct	D.I.L.	3.695 x 1.800
41051		4½ digits, over-range, direct	D.I.L.	4.000 x 1.800

Bar Graph Displays



Excelix LCD Model #	Bar Height (inches)	Display Format	Connector	Glass Size (inches)
0520	0.156	32 bars x 2 lines, direct	Elastomer	2.750 x 1.200
0620	0.230	9 bars x 2 lines, direct	D.I.L.	1.900 x 1.100
0320	0.300	9 bars x 2 lines, direct	D.I.L.	3.100 x 1.300
01420	1.400	20 bars x 1 line, direct	S.I.L.	5.300 x 1.900

Alphanumeric Displays



Excelix LCD Model #	Character Height (in.)	Display Format	Connector	Glass Size (inches)
4540	0.500	4 characters, direct	D.I.L.	3.500 x 1.150
8540		8 characters, triplex	D.I.L.	3.700 x 1.200
12540		12 characters, triplex	D.I.L.	5.750 x 1.200
16540		16 characters, triplex	D.I.L.	7.250 x 1.200
11040	1.000	1 character, direct	S.I.L. Elastomer	1.000 x 1.750

Light Valves

Excelix LCD Model #	Window Size (in.)	Display Format	Connector	Glass Size (inches)
LV001	0.375 x 0.375	1 square, direct	D.I.L.	0.500 x 0.700
LV002	1.800 x 0.700	2 triangles, direct	D.I.L.	2.000 x 1.100
LV003	1.800 x 0.700	1 rectangle, direct	D.I.L.	2.000 x 1.100

Dot Matrix Display Module

Item No.	No. of Display ch. × line	External Dimension W × H × T (mm) (max)	Effective Viewing Area W × H (mm)	Character Dimension W × H (mm)	Driving Method (duty)
1610	16 × 1	80 × 36 × 10	64.3 × 13.8	3.07 × 5.73	1/16
1610L	16 × 1	80 × 36 × 15	64.3 × 13.8	3.07 × 5.73	1/16
1610C	16 × 1	80 × 36 × 10	64.3 × 13.8	3.07 × 5.73	1/16
1610CL	16 × 1	80 × 36 × 15	64.3 × 13.8	3.07 × 5.73	1/16
1610CR	16 × 1	80 × 36 × 10	64.3 × 13.8	3.07 × 5.73	1/16
1620-30	16 × 2	85 × 30 × 10	62.4 × 16	2.78 × 4.27	1/16
1620-35	16 × 2	85 × 35 × 10	62 × 17.6	2.96 × 4.86	1/16
1620-44	16 × 2	85 × 44 × 10	62 × 17.4	2.96 × 4.86	1/16
1620-30L	16 × 2	85 × 30 × 15	62.4 × 15.9	2.78 × 3.27	1/16
1620-35L	16 × 2	85 × 35 × 15	62 × 17.6	2.96 × 4.86	1/16
1620-44L	16 × 2	85 × 44 × 15	62 × 17.4	2.96 × 4.86	1/16
1640	16 × 4	87 × 60 × 10	61.8 × 25.2	2.95 × 4.15	1/16
2020	20 × 2	116 × 36 × 10	82 × 18.3	3.2 × 4.85	1/16
2020L	20 × 2	116 × 36 × 15	82 × 18.3	3.2 × 4.85	1/16
2020C	20 × 2	116 × 36 × 10	82 × 18.3	3.2 × 4.85	1/16
2020CL	20 × 2	116 × 36 × 15	82 × 18.3	3.2 × 4.85	1/16
2420	24 × 2	116 × 36 × 10	82 × 18.3	2.7 × 4.85	1/16
4020	40 × 2	182 × 36 × 10	154 × 15.3	3.2 × 4.85	1/16

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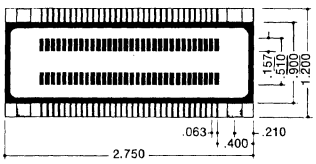
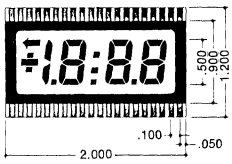
EXCEL Technology International Corp.

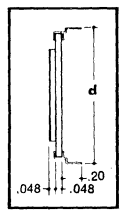
EXCELIX LCD

0520 d = N/A



3551 d = 1.25





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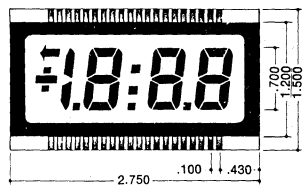

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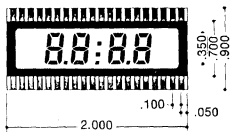

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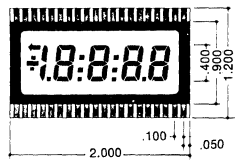

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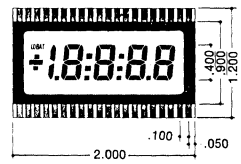

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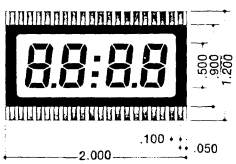

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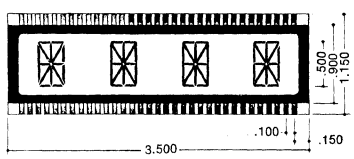

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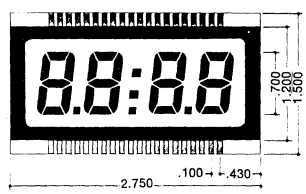

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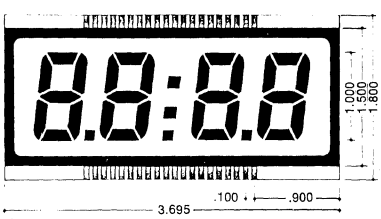

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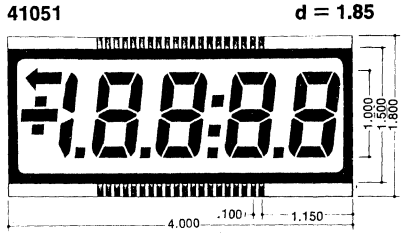

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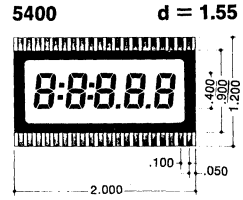

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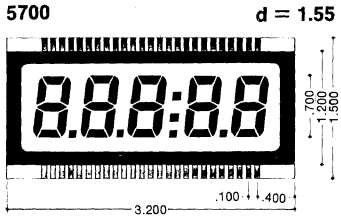
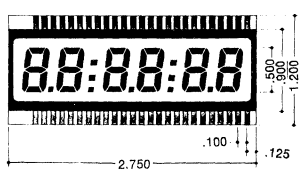


6500 d = 1.25



6700 d = 1.55

PERFORMANCE SPECIFICATIONS

PARAMETER	UNITS	MIN.	TYP.	MAX.
Operating Voltage	V	3	5	10
Operating Frequency	Hz	30	60	120
Current*	μA		3	10
Capacitance*	pf		3,000	
DC Resistance*	MΩ	20		
Allowable DC Offset	mV			50
Response Times (25°C)				
Rise to 90% ON	ms		30	50
Decay to 10% OFF	ms		50	100
Contrast Ratio			20:1	
Viewing Angle (at 5V)			±75°	
Operating Temp. Range	°C	−30		85
Storage Temp. Range	°C	−30		85
Estimated Life	hrs.		50,000	

* All Segments ON. Specifications are for 3½ digit 0.5″DH LCDs.

ORDERING INFORMATION

□□□□-□□□-□

Excelix Part Number

OPTICAL MODES:
R Reflective
T Transmissive
S Transflective
O No Polarizer

PRINTING MODES:
P Positive Printing (dark segments on light background)
N Negative Printing (light segments on dark background)
O No Polarizer

DEVIATION:
0 Standard, Epoxied Pins 0.100″ center-to-center
1 Snap on Terminal 0.100″ center-to-center
2 No Pins Conductive Pads Up
3 No Pins Conductive Pads Down

POLARIZERS:
H Standard
Q High Humidity*
O No Polarizer

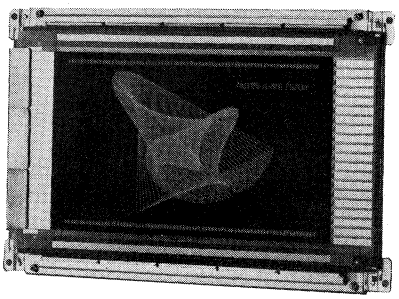
* Q-type polarizer is less bright than H-type.

5–4, Stryker Lane • Hillsborough Industrial Park • Belle Mead, NJ 08502 • Tel. (201) 874-4747 • FAX. (201) 874-3278 • TWX. 9103339588

FUJITSU

PLASMA DISPLAY UNIT FPF8050HFUGA

(640 x 400 DOT GRAPHIC DISPLAY)



The Fujitsu FPF8050HFUGA plasma display unit consists of an AC gas discharge plasma display panel with memory function (bi-stable characteristic) and its driver circuits.

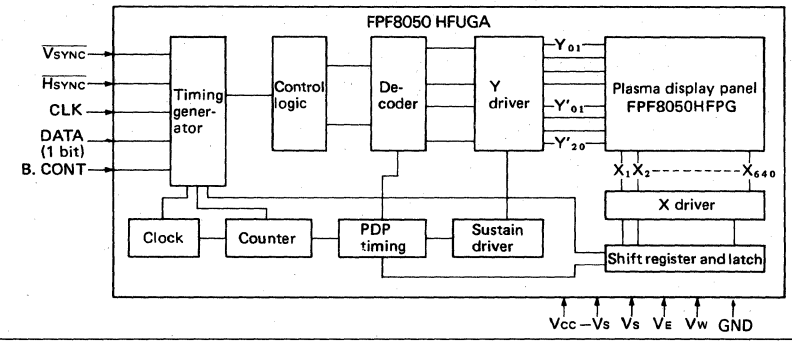
FEATURES

- **Bright, clear display**
  The black-face panel with high brightness gives a clear display even in bright places.
- **Easy-to-use CRT interface**
  This unit can be connected to all types of systems equipped with common CRT interface.
- **Compact panel**
  The higher integration of drive and logic circuits makes the display compact and thin, resulting in a total system that is more compact.
- **No flicker and warp**
  The AC memory panel gives an easy to view display, without flicker and warp.
- **High reliability**
  The unit is reliable because the panel structure employs Fujitsu's unique protective film and the drive and logic circuits are highly integrated.

UNIT SPECIFICATIONS

Display panel — FPF8050HFUGA
Number of display dots — 640×400 dots (256,000 dots)
Dot pitch — 0.33mm (0.013in.)×0.33mm(0.013 in.)
Dot size — 0.2mm (0.008 in.) dia.
Effective display area — 132(V) mm (5.197 in.) ×
Dimensions — 211(H) mm (8.307 in.)
Display color — Neon orange
Brightness — 150 cd/m²
Contrast ratio — 20:1 min.
Visual angle — 120° min.
Weight—Approx. 1.7kg (with metal fittings)
Exterior dimensions — See diagram of exterior dimensions

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Value	Unit
Sustain voltage 1	V_S	125	V
Sustain voltage 2	$-V_S$	−125	V
Write voltage	V_W	180	V
Erase voltage	V_E	40	V
Logic voltage	V_{CC}	7	V

ENVIRONMENTAL CONDITIONS

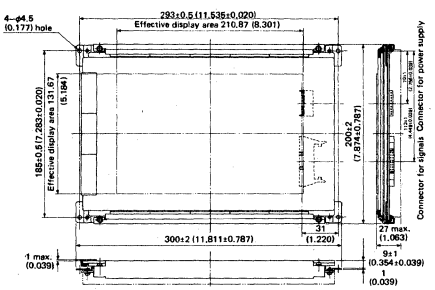
Item	Symbol	Value	Unit
Operating temperature	T_{op}	0 ~ 50	°C
Operating humidity	RH_{op}	20 ~ 85	%
Storage temperature	T_{stg}	−20 ~ 70	°C
Storage humidity	RH_{stg}	20 ~ 85	%
Vibration	V	2	G
Shock	S	40	G
Pressure (non-operating)		340 ~ 1114	mb

INTERFACE

Interface signals (TTL-compatible)

Signal	Symbol	Function
Display data signal	DATA	The serial dot data which is input synchronized with the leading edge of the clock signal. Dots are lit at logical High and are not lit at logical Low. The diagram below shows the relation between display data and display dots.
Clock signal	CLK	The input signal which controls the input timing of the display data. Dot data is read into the shift register at the leading edge of the signal. The number of clock signals during the period H_{SYNC} is 640.
Line synchronous signal	$\overline{H_{SYNC}}$	The input signal which controls the scanning timing of the line-electrode. Address increment to select the next line-electrode is done at the trailing edge of each signal.
Frame synchronous signal	$\overline{V_{SYNC}}$	The input signal which controls the refresh speed of the screen. The scanning position returns to the first line-electrode (home position) at the trailing edge of the V_{SYNC}
Brightness control signal	B. CONT	The input signal which controls the screen brightness. Brightness is at its maximum at logical H, and is 50% of the maximum at logical L.

EXTERIOR DIMENSIONS



CONNECTOR PIN ASSIGMENT

Connector for signal connections (FCN-605Q016-G/S)

Pin No.	Signal	Pin No.	Signal
1	N.C.	2	N.C.
3	N.C.	4	S. GND
5	DATA	6	S. GND
7	N.C.	8	S. GND
9	$\overline{H_{SYNC}}$	10	S. GND
11	$\overline{V_{SYNC}}$	12	S. GND
13	B. CONT	14	S. GND
15	CLK	16	S. GND

Connector for power supply connections (FCN-815P009-TA)

Pin No.	Signal
1	V_{CC}
2	GND (L)
3	$-V_S$
4	GND (H)
5	$+V_S$
6	V_W
7	N.C.
8	V_E
9	N.C.

Recommended connectors: FCN-813J009-A housing (attached); FCN-813J-T/Q contact for manual use (attached); FNC-813J-T/R contact for automatic use

OPERATION RATINGS (may be changed to improve characteristics)

Item	Symbol	Min.	Typ.		Max.	Unit
Supply voltage 1 for sustain	V_S	85	95	Note 1	105	V
Supply current 1 for sustain (V_S=95V)	I_S	—	75		160	mA
Supply voltage 2 for sustain	$-V_S$	−85	−95	Note 2	−105	V
Supply current 2 for sustain ($-V_S$=−95V)	$-I_S$	—	−75		−160	mA
Supply voltage for writing	V_W	150	165	Note 3	175	V
Supply current for writing (V_W=165V)	I_W	—	10		20	mA
Supply voltage for erase	V_E	38	40		42	V
Supply current for erase (V_E=40V)	I_E	—	100		150	mA
Supply voltage for logic	V_{CC}	—	5.0		5.25	V
Supply current for logic (V_{CC}=5V)	I_{CC}	—	0.35		0.5	A
Signal input voltage (H-level)	V_{IH}	2.4	—		5.25	V
Signal input current (H-level) (V_{IH}=2.75V)	I_{IH}	—	—		20	μA
Signal input voltage (L-level)	V_{IL}	—	—		0.4	V
Signal input current (L-level) (V_{IL}=0.4V)	I_{IL}	—	—		−16	mA

Note 1: The power source is required to be variable from 80 to 110V DC.
Note 2: The power source is required to be variable from −80 to −110V DC.
Note 3: The power source is required to be variable from 150 to 175V DC.

INTERFACE SIGNAL CHART

		Item	Min.	Typ.	Max.	Unit
1	T_{VSYNC}	A cycle of frame synchronous signal	16.8	25		ms
2	t_{WV}	Pulse width of frame synchronous signal	2			μs
3	t_{VH}	Delay time, $\overline{V_{SYNC}}$-$\overline{H_{SYNC}}$	1			μs
4	t_{HV}	Delay time, $\overline{H_{SYNC}}$-$\overline{V_{SYNC}}$	2			μs
5	T_{HSYNC}	A cycle of line synchronous signal	40	60	80	μs
6	t_{WH}	Pulse width of line synchronous signal	2			μs
7	t_{HC}	Delay time, $\overline{H_{SYNC}}$-CLK	1			μs
8	t_{CH}	Delay time, CLK-$\overline{H_{SYNC}}$	0.5			μs
9	T_{CLK}	A cycle of clock signal	45	80	110	ns
10	$t_{WCLK1,2}$	Pulse width of clock signal*	22	40		ns
11	t_{SUD}	Data set up time	20	40		ns
12	t_{HD}	Data hold time	22	40		ns

*Recommended ratio between t_{WCLK_1} and t_{WCLK_2}:1:1

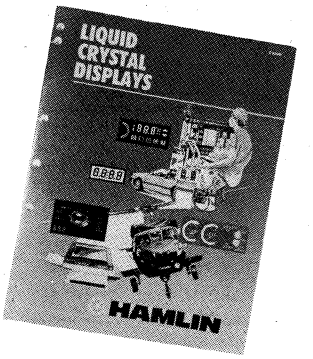
LIQUID CRYSTAL DISPLAYS

HAMLIN LCD

Division of Standish Industries Inc.
W7514 Hwy. V • Lake Mills, WI 53551
Phone 414/648-2315 • Fax 414/648-8696

Hamlin LCD built their first display in 1972 — and since that time has maintained the leading edge position in LCD technology and manufacturing methods. That expertise and experience provides Hamlin the unique ability to supply custom designed LCDs, in quantities from 100 to 100,000, that meet exact customer requirements.

For detailed product information send for the Hamlin LCD Catalog. The 24-page catalog provides complete information about our standard LCDs plus application and design recommendations for custom LCDs. Also included are examples of color and backlighted techniques, theory of operation, and quality assurance and test standards.



DIRECT DRIVE LCDs

MODEL 3900-365-X20

MODEL 3901-365-X20

MODEL 3902-365-X20

MODEL 3906-365-X20

MODEL 3918-365-X20

MODEL 3919-365-X20

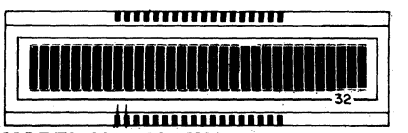
MODEL 3920-365-X20

MODEL 3922-365-X20

	Min.	Typ.	Max.
Operating Voltage	4	7	15
DC Drive Component Allowable		50	
Operating Frequency Range	30	60	100
Current (all segments on)*		5	20
Capacitance (all segments on)*		3000	
DC Resistance (all segments on)*		50	
Visual Threshold			
10% ON @ 25°C		2.2	
10% ON @ 0°C		2.4	
90% ON @ 25°C		3.0	
90% ON @ 0°C		3.2	
Typical Response Time*			
(T on and T off) at 25°C		Less than 45 ms total	
Segment ON (TA = 25°C)		15	20
Segment OFF (TA = 25°C)		30	60
Segment ON (TA = 0°C)		50	180
Segment OFF (TA = 0°C)		150	320
Contrast Ratio		20:1	
Operating Temperature Range	—20[1]		+85
Storage Temperature Range	—55		+85
Expected Life		100,000	
Viewing Angle — From Normal		±75° @ 7V ±60° @ 6V ±45° @ 5V	

* for a 4 digit (½ ") instrument LCD (3906)
1 Typical combined ON and OFF times of: 0.8 sec @ −20°C

MODEL 3935-365-X20



MODEL 3975-365-X20

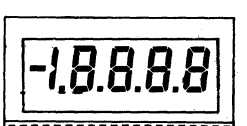
ORDERING INFORMATION

PART NUMBER	DESCRIPTION	GLASS SIZE	LIST PRICE
3900-365-X20	4.0 digit (.35") 40 contacts	2.00" x 0.90", 0.70"	16.28
3901-365-X20	3.5 digit (.5") 40 contacts	2.00" x 1.20", 0.90"	17.13
3902-365-X20	3.5 digit (.5") 40 contacts	2.00" x 1.20", 0.90"	17.13
3906-365-X20	4.0 digit (.5") 40 contacts	2.00" x 1.20", 0.90"	17.13
3918-365-X20	6.0 digit (.5") 50 contacts	2.75" x 1.20", 0.90"	21.48
3919-365-X20	6.0 digit (.7") 50 contacts	3.70" x 1.50", 1.20"	23.40
3920-365-X20	6.0 digit (1.0") 70 contacts	5.40" x 1.80", 1.50"	48.23
3922-365-X20	8.0 digit (.5") 68 contacts	3.70" x 1.20", 0.90"	24.15
3935-365-X20	2.0 digit (.5") 18 contacts	1.20" x 1.20", 0.90"	15.50
3975-365-X20	Single 32-Bar Graph 35 contacts	4.00" x 1.20", 0.90"	31.59

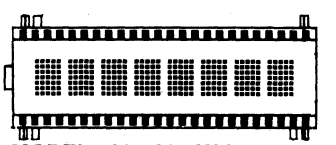
MULTIPLEX LCDs

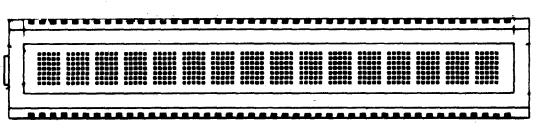
	Min.	Typ.	Max.
DC Drive Component Allowable			100
Operating Frequency Range		30	250
Current Consumption*		3	5
Capacitance		1200	
Visual Threshold			
10% ON		2.2	
dv/dt		−9	
Typical Response Time*			
T on @ 25°C		15	
T off @ 25°C		30	
T on @ 20°C		50	
T off @ 0°C		150	
Operating Temperature Range**	−20		80
Storage Temperature Range	−55		80

*Test Voltage = 6 Vrms @ 60 Hz



MODEL 4201-365-X20


MODEL 4284-365-X20


MODEL 4285-365-X20

ORDERING INFORMATION

PART NUMBER	DESCRIPTION	GLASS SIZE	LIST PRICE
4201-365-X20	4.5 digit (.4") 44 contacts	2.0" x 1.050", 0.9"	16.28
4284-365-X20	8 Char., 5 x 7 dot matrix (.3") 48 contacts	2.5" x 0.8", 0.6"	18.95
4285-365-X20	16 Char., 5 x 7 dot matrix (.3") 88 contacts	4.7" x 0.9", 20.7"	22.91

**Minimum operating temperature is chosen as temperature at which one update per second is possible. Temperature compensation may be required to realize satisfactory operation over entire operating temperature range.

HITACHI®

Hitachi America, Ltd.
Monochrome Liquid Crystal Displays

Leadership in Technology

Hitachi has been a pioneer in LCD research and development ever since the infancy of commercial LCD technology. Hitachi involvement in LCD technology began in 1968, with basic research on the electro-optical properties of liquid crystal materials.

Since then, Hitachi expertise has led to a number of important firsts in the LCD industry:

- The first production TN-FE mode numerical LCDs for wristwatch applications.
- The first LSIs for driving matrix LCDs.
- The first LCDs for television applications.
- The first production Super Twist LCD.
- The first LCDs for use in an automotive instrument panel.
- The first production of large-size full color active matrix LCDs.

LCDs Provide a Number of Key Benefits For Your Design

LCDs have a unique combination of features and benefits unmatched by other display technologies.

Low power requirements

Unlike CRT and gas plasma displays, LCDs are inherently low power devices. Typically, they exhibit power consumption of less than 10uw/cm^2, and operate with power supply voltages of 8VDC or less.

As a result, LCDs are ideal for portable or battery-powered applications where power consumption must be as low as possible. For those applications powered from the AC line, a liquid crystal display can mean a smaller, less expensive power supply.

High readability

Clearly, one of the most important qualities of any display is that it be easy to read. In this regard, LCDs excel.

Their flickerless display means improved readability with less eye strain and fatigue. And, because of their optically passive nature, bright ambient light makes them even easier to read.

Compact packaging

LCDs are thin, compact, and lightweight. While obviously ideal for portable applications, these qualities can help make possible the new generation of "small footprint" electronics.

Easy integration into your design

Because of their simple interfacing and power supply requirements, LCDs get your design to market faster, with less design cost.

Highly rugged construction

LCDs don't rely on fragile glass envelopes or complicated structures as do other display technologies. This gives them better durability, making your design more reliable.

Cost-effective design

Hitachi's LCDs are cost-effective design solutions because Hitachi's highly automated manufacturing process results in lower prices per unit. Standard interfaces and low power requirements also contribute to more cost-effective designs, and help reduce your overall system costs.

Hitachi Delivers the Right LCD Solution for Every Application

Being the leader in LCD technology, Hitachi offers all types of liquid crystal displays.

Twisted Nematic (TN)

TN was the first successful LCD technology to be used on a far-reaching basis. Its combination of low power consumption, low voltage requirements, good visibility under bright ambient light, and its compact size and low weight gave it many advantages over previous display technologies. Even today, the TN LCD continues to enjoy widespread use in cost-constrained consumer and commercial applications.

Super Twisted Nematic (STN)

STN represents a refinement of basic TN technology. A single layer of glass is used, but the twist angle of the liquid crystal molecules is greater, allowing improved contrast and viewing angle. STN LCDs can often be recognized by their characteristic blue coloration.

Double Super Twisted Nematic (DSTN)

With their move into high-end applications such as laptop computers, LCDs continue to remain the preferred display technology. DSTN adds an extra color compensating liquid crystal glass substrate to provide an almost pure black-and-white display with little color tinge. It has twice the contrast of STN, and an improved viewing angle.

DSTN typically requires fluorescent backlighting. This option adds weight, thickness, power consumption, and cost to the module itself, but delivers high brightness and high contrast.

Super Twisted Nematic with Film (Film STN)

Film STN offers excellent black-and-white image quality without the trade-offs associated with DSTN. This LCD technology replaces the extra glass layer of DSTN with an ultra-thin polymer compensating film. The result is improved light transmission which allows the use of a less powerful backlight. Compared with the DSTN, the new Film STN weighs 50% less, reduces thickness by 75%, consumes 60% less power, and features a viewing angle which is 25% wider.

The following two pages give you key specifications for our graphic, character, and segment LCD modules.

HITACHI® Hitachi America, Ltd.

Graphic LCD Modules

Hitachi graphic LCD modules provide clear, detailed displays of graphics, symbols, and all types of alphanumerics. They have resolutions ranging from 240 x 64 to 1120 x 780, giving you the right display for virtually any application. All have built-in drivers, and some models even include built-in controllers. Hitachi also has available graphic LCD modules with electroluminescent (EL) panel backlight, or cold cathode fluorescent (CCFL) lamp backlight. Contact Hitachi for packaging, backlighting, and transmission options which let you custom-configure LCD modules for your specific application.

*Excluding the backlight
† Twisted Nematic (TN)
■Double Super Twisted Nematic (DSTN)
■■Film Super Twisted Nematic (Film STN)
1 Transflective Display
2 Consult factory for final specifications

Graphic LCD Modules (without backlight)

Part No.	No. of dot W x H (dot)	External dimensions W x H x T (mm)	Effective viewing area W x H (mm)	Dot size W x H (mm)	Driving method (Duty)	Recommended power supply VDD-VSS (V)	Recommended power supply VEE-VSS (V)	Power consumption (typ.) (mW)
LM200†	240 x 64	180 x 75 x 13.8 max.	132 x 39	0.48 x 0.48	1/32	+ 5	– 5	25
LM258X	240 x 64	149 x 57 x 13 max.	117 x 41	0.44 x 0.44	1/64	+ 5	– 12	66
LM300XM	240 x 64	180 x 75 x 10.9 max.	132 x 39	0.48 x 0.48	1/32	+ 5	– 9	33
LM221XB	240 x 128	180 x 120 x 13.8 max.	148 x 75	0.50 x 0.50	1/64	+ 5	– 13.5	130
LM238XB	240 x 128	180 x 120 x 13.8 max.	131.95 x 75	0.50 x 0.50	1/64	+ 5	– 13.5	210
LM213XB	256 x 64	184 x 75 x 12 max.	149.6 x 43	0.51 x 0.51	1/64	+ 5	– 10.5	250
LM246X	320 x 256	168 x 150 x 13.5 max.	142 x 115	0.38 x 0.38	1/128	+ 5	– 20	76
LM211XB	480 x 64	270 x 82 x 13 max.	240 x 38	0.44 x 0.44	1/64	+ 5	– 10.5	130
LM215XB	480 x 128	270 x 110 x 11.5 max.	242 x 69	0.43 x 0.43	1/64	+ 5	– 13.5	100
LM236XB	640 x 200	270 x 149 x 13.5 max.	239 x 104	0.32 x 0.46	1/100	+ 5	– 14.5	170
LM280XM	640 x 200	270 x 104 x 13 max.	236.4 x 78	0.33 x 0.33	1/200	+ 5	– 20.5	180
LM254XP	640 x 200	270 x 150 x 16 max.	234 x 104	0.32 x 0.46	1/200	+ 5	– 21.5	190
LM755CXGP	640 x 400	270 x 198 x 13.5 max.	236 x 153.6	0.33 x 0.33	1/200	+ 5	– 21.5	250
LMG6010XUFR■■	640 x 480	285 x 217 x 7 max.	216 x 163	0.30 x 0.30	(2)	(2)	(2)	1,330*
LMG6011XUFT(1)■■	640 x 480	285 x 217 x 7 max.	216 x 163	0.30 x 0.30	(2)	(2)	(2)	1,330*
LM268CXP	740 x 540	290 x 214 x 15.5 max.	241 x 174	0.28 x 0.28	1/270	+ 5	+ 32	650

EL Backlighted Versions

Part No.	No. of dot W x H (dot)	External dimensions W x H x T (mm)	Effective viewing area W x H (mm)	Dot size W x H (mm)	Driving method (Duty)	Recommended power supply VDD-VSS (V)	Recommended power supply VEE-VSS (V)	Power consumption (typ.) (mW)
LM300XN	240 x 64	180 x 75 x 10.9 max.	132 x 39	0.48 x 0.48	1/32	+ 5	– 9	33*
LM313XBN	256 x 64	184 x 75 x 12 max.	149.6 x 43	0.51 x 0.51	1/64	+ 5	– 10.5	250*
LM315XBN	480 x 128	270 x 110 x 11.5 max.	239.5 x 65.5	0.43 x 0.43	1/16	+ 5	– 13.5	100*
LM674XGNR	640 x 200	270 x 154 x 11.3 max.	243 x 114	0.34 x 0.34	1/100	+ 5	– 15.0	250*
LM254XNP	640 x 200	270 x 150 x 16 max.	234 x 104	0.32 x 0.46	1/200	+ 5	– 21.5	450*
LM272CXGNR	640 x 400	270 x 198 x 14 max.	236 x 153.6	0.33 x 0.33	1/200	+ 5	– 21.5	640*
LMG6011XUFE■■	640 x 480	285 x 217 x 7 max.	216 x 163	0.30 x 0.30	(2)	(2)	(2)	1,330*

CCFL Backlighted Versions

Part No.	No. of dot W x H (dot)	External dimensions W x H x T (mm)	Effective viewing area W x H (mm)	Dot size W x H (mm)	Driving method (Duty)	Recommended power supply VDD-VSS (V)	Recommended power supply VEE-VSS (V)	Power consumption (typ.) (mW)
LM384XF	640 x 200	289 x 150 x 30 max.	234 x 104	0.32 x 0.46	1/200	+ 5	– 21.5	500*
LM383XF	640 x 400	292 x 201 x 30 max.	236 x 153.6	0.33 x 0.33	1/200	+ 5	– 21.5	1,330*
LM383CXFR	640 x 400	292 x 201 x 30 max.	236 x 153.6	0.33 x 0.33	1/200	+ 5	– 21.5	730*
LM296DXF■	640 x 400	292 x 198 x 21.0 max.	234 x 150	0.32 x 0.32	1/200	+ 5	– 24.0	454*
LM298DXF■	640 x 480	285 x 217 x 22.0 max.	216 x 163	0.30 x 0.30	1/240	+ 5	+ 32	1,330*
LMG9000ZZZ■	1120 x 780	316 x 230 x 31 max.	236 x 166	0.185 x 0.185	1/390	+ 5	+ 38.0	2,500*

Note: All part numbers listed above, unless otherwise noted, are Super Twisted Nematic (STN).

Monochrome Liquid Crystal Displays

Character and Segment LCD Modules

Hitachi character LCD modules are ideal for general-purpose character display applications where numbers, letters, and symbols are presented. These products display 160 types of 5 x 7 dot character fonts, and 32 types of 5 x 10 dot character fonts.

Hitachi's broad line includes character LCD modules ranging from 1 to 4 lines in length, up to a maximum of 40 characters. A choice of EL or LED backlighted versions provides clear, highly legible displays. All models include built-in drivers and controllers.

Segment display LCD modules are well-suited for cost-effective 7-segment display applications. These products feature a built-in controller and driver, and operate from a single 5 volt power supply.

Character LCD Modules (without backlight)

Part No.	No. of char. (Char. x line)	External dimensions W x H x T (mm)	Effective viewing area W x H (mm)	Character dimensions W x H (mm)	Driving method (Duty)	Recommended power supply V_{DD}-V_{SS} (V)
LM054	8 x 1	84 x 44 x 12 max.	61 x 15.8	6.45 x 9.4	1/8	+ 5
LM015	16 x 1	80 x 36 x 12 max.	64.5 x 13.8	3.15 x 5.5	1/8	+ 5
LM568F	16 x 1	122 x 33 x 12 max.	99.0 x 13.0	4.84 x 8.06	1/8	+ 5
H2570	16 x 1	80 x 36 x 12 max.	64.5 x 13.8	3.15 x 7.9	1/11	+ 5
LM020L[2]	16 x 1	80 x 36 x 12 max.	64.5 x 13.8	3.07 x 5.73	1/16	+ 5
LM070L	20 x 1	105 x 39.0 x 11 max.	84.0 x 13.0	3.2 x 5.2	1/8	+ 5
LM038	20 x 1	182 x 35.5 x 13 max.	154.0 x 15.3	6.7 x 9.4	1/8	+ 5
LM027	24 x 1	126 x 36 x 12 max.	100 x 13.8	3.15 x 7.9	1/11	+ 5
H2571	32 x 1	174.5 x 33 x 13.4 max.	132.5 x 14	3.15 x 7.9	1/11	+ 5
H2572	40 x 1	182 x 35.5 x 13 max.	154.0 x 15.3	3.15 x 7.9	1/11	+ 5
LM058	40 x 1	290 x 60 x 13 max.	245 x 19	4.82 x 9.36	1/8	+ 5
LM052L[2]	16 x 2	80 x 36 x 11 max.	64.5 x 13.8	2.95 x 3.8	1/16	+ 5
LM016L[2]	16 x 2	84 x 44 x 12 max.	61 x 15.8	2.96 x 4.86	1/16	+ 5
LM016XML[1]	16 x 2	84 x 44 x 12 max.	61 x 15.8	2.96 x 4.86	1/16	+ 5
LM032L[2]	20 x 2	116 x 39 x 13 max.	83 x 18.6	3.2 x 4.85	1/16	+ 5
LM032XML[1]	20 x 2	116 x 37 x 10.5 max.	83 x 18.6	3.2 x 4.85	1/16	+ 5
LM060L	24 x 2	116 x 39 x 13 max.	83 x 18.6	2.7 x 4.85	1/16	+ 5
LM017L	32 x 2	174.5 x 33 x 13.4 max.	141.19 x 16.75	3.45 x 4.85	1/16	+ 5
LM107XML[1]	40 x 2	170 x 30 x 11 max.	150.1 x 15.1	3.2 x 4.85	1/16	+ 5
LM018L[2]	40 x 2	182 x 35.5 x 13 max.	154 x 15.3	3.2 x 4.85	1/16	+ 5
LM041L	16 x 4	87 x 60 x 12 max.	61.8 x 25.2	2.95 x 4.15	1/16	+ 5
LM044L	20 x 4	98 x 60 x 12 max.	76 x 25.2	2.95 x 4.15	1/16	+ 5

1 Yellow mode, Super Twisted Nematic (STN).
2 EL backlight versions available.

LED Backlighted Versions

Part No.	No. of char. (Char. x line)	External dimensions W x H x T (mm)	Effective viewing area W x H (mm)	Character dimensions W x H (mm)	Driving method (Duty)	Recommended power supply V_{DD}-V_{SS} (V)*
LM087LN	16 x 1	90 x 36 x 14 max.	64.5 x 13.8	3.07 x 6.56	1/16	+ 5, (+ 5)
LM086ALN	16 x 2	90 x 36 x 14 max.	64.5 x 13.8	2.95 x 3.8	1/16	+ 5, (−)
LM093LN	16 x 2	90 x 44 x 13.8 max.	61.0 x 15.3	2.96 x 4.86	1/16	+ 5, (+ 5)
LM091LN	20 x 2	126 x 39 x 14 max.	83 x 18.6	3.2 x 4.85	1/16	+ 5, (+ 5)
LM092LN	40 x 2	192 x 35.5 x 14 max.	154 x 15.3	3.2 x 4.85	1/16	+ 5, (+ 5)

*(V_{LED})

Segment Display LCD Modules

Part No.	No. of char. (Char. x line)	External dimensions W x H x T (mm)	Effective viewing area W x H (mm)	Character dimensions W x H (mm)	Driving method (Duty)	Recommended power supply V_{DD}-V_{SS} (V)
LM039	16 x 1	87 x 27.5 x 11 max.	64.7 x 13.3	2.2 x 6.4	1/4	+ 5

Note: All part numbers listed above, unless otherwise noted, are Twisted Nematic (TN).

HOMALITE DISPLAY FILTERS AND SPECIFICATIONS

LOW REFLECTANCE CONTRAST ENHANCEMENT FILTERS

Product Description

In designing instruments with LED, LCD, CRT, gas discharge, plasma or vacuum fluorescent displays, an important design consideration is the human engineering factor.

For optimum contrast and readability, Homalite™ display filters are available in colors designed to meet requirements of a wide variety of displays. Glare is reduced with a low reflectance surface cast into the material —it can't chip or peel. By increasing contrast and reducing glare, the display can be read easily and accurately under varied lighting conditions.

Because Homalite materials are thermosetting plastics, the display filters are more rigid and resistant to impact, heat, abrasion and chemical attack than other plastic filters.

All our filters can be cleaned with soap and water, acetone, chlorinated and other commercial solvents or common glass cleaning preparations.

Homalite representatives can provide technical assistance to meet your design requirements. Sample chips in various colors are available upon request.

Grades of Material

All grades shown below are available with LR (low-reflectance) surface.

	Description	Properties	UL Flammability Classification
H-100	Thermosetting polyester. Available in all colors.	General purpose applications. Excellent resistance to chemical attack. Scratch-resistant.	UL94HB
H-101	Thermosetting polyester. Available in all colors.	For high temperature applications. This self- extinguishing, fire retardant grade offers good heat distortion resistance.	UL94V-0 (thicknesses ⅛″ and over) UL94HB (thicknesses up to ⅛″)
H-911	Allyl diglycol carbonate. Available in clear and selected colors.	Highest optical qualities. Abrasion resistant—30 to 40 times more scratch-resistant than acrylics.	UL94HB

INSTRUMENT DISPLAY FILTERS

Sizes and Forms

Homalite can fabricate display filters to meet your requirements. This includes cutting to size, drilling holes, milling slots, steps and beveled edges, etc. Parts can be silkscreened, mirrored or coated for RFI/EMI shielding. See standard CRT filter sizes.

Homalite materials are available in standard thicknesses of 1/16″, 3/32″, and ⅛″. Other thicknesses from 1/32″ to over 2″ are available upon request.

A protective, removable masking is available on one or both sides of fabricated parts. If masking is required, please specify when ordering.

If you choose to fabricate your own display filters, you can order Homalite materials in sheet form in two sizes: 21″ x 31″ and 33″ x 45″. Sheets will be supplied with masking on both sides. Instructions for fabrication are available upon request.

Filter Colors

Homalite filters are available in a wide range of standard colors which are designed for use with commonly available displays. Homalite can also color match and prepare filter material for specific application requirements or to duplicate the color of existing filters. Choosing the proper color will give sharp, clear characters with enhanced contrast between the information displayed and the background.

Light Emitting Displays and CRT'S

An important consideration in choosing the filter shade is the environment where the instrument will be used. For instance, if the display will be viewed in bright sunlight, you would select a darker shade than if the display were used in a room with fluorescent lighting.

Standard colors and spectral curves are as displayed. However, we would be pleased to match a specific color or work with you on a shade that meets your special application requirements.

Liquid Crystal Displays

Although LCD's do not emit light, reduction of glare from ambient light greatly improves readability. Homalite materials with the LR finish in clear or light gray (1295) are recommended for this type of display.

Spectral Transmission Data

Color	Shade	% of Transmission	Wavelength Nanometers
Gray	1245	45	N/A
	1250	22	N/A
	1265	30	N/A
	1295	60	N/A
Green	1425	25	565
	1436	36	500
	1440	40	565
	1452	50	505
Red	1600	44	655
	1670	71	655
Amber	1709	24	575
	1720	34	565
	1726	46	565
	1795	25	565
Blue	1500	55	450
	1558	80	440

Low Reflectance Surface

Homalite filters reduce specular reflection associated with conventional face plates and filters. Unlike other filters, the low glare surface of Homalite filters is cast into the material. This surface is not a lamination or coating, so it cannot separate, chip, peel or rub off.

The Homalite low-reflectance surface, referred to as "LR", minimizes glare and improves readability.

Two low-reflectance surfaces are available.

LR-72—The most light diffusing surface. For mounting as close as possible to the light source, up to ½″ distance.

LR-92—For mounting from ½″ to 2″ from the light source.

CRT FILTERS

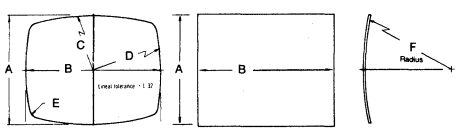
Typical filter configurations for CRT sizes 5″ to 19″ are shown below in contoured and rectangular shapes. For 5″ to 15″ filters, the standard thickness is 1/16″. For 19″ filters, we recommend 3/32″ thickness material. Other thicknesses available upon request.

When ordering filters, the letter C or R after the (Diagonal) Filter Size denotes contoured or rectangular shape. The spherical radius shown for each size applies to both contoured and rectangular shapes.

Homalite will fabricate filters to the exact size and shape requirement of specific monitors. For best results, please include measurements (width, length and spherical radius) to ensure proper fit. A mechanical assembly drawing of the monitor showing dimensions and mounting arrangements can be useful in establishing the proper configuration for your filter.

Filters can be supplied with or without adhesive tape for mounting.

Contoured Rectangular Curvature



Standard Dimensions*	Filter Size (Diagonal) 5″	9″	12″	15″	19″
A	3.62	5.87	7.88	9.50	12.87
B	4.62	7.97	10.32	11.83	15.97
C	14.19	22.00	39.00	60.00	15.00
D	13.38	22.00	18.00	49.00	32.60
E	0.44	0.68	0.75	0.81	1.50
F	14	27	25 or 24	25 or 24	47/21**

* All linear tolerances ±.030″
Curvature radius tolerance (F) ±1″

** Compound Radius

How to Order

When placing an order for Homalite filters, please include the following information:	Example
1. Material grade	H 100
2. Type of LR surface	LR 72
3. Color number (or clear)	1265
4. Masking required (one side or both sides)	2 Sides
5. Size: For fabricated filters, indicate width x length, thickness and tolerances. Please include drawing if available (Preferred)	10″ x 8″ ±.030″ x .062″ ±.015″
For sheet material, indicate either 21″ x 31″ or 33″ x 45″ and thickness	21″ x 31″
For standard CRT applications, include diagonal size and whether filter shape is contoured (C) or rectangular (R)	12″ R

HOMALITE™

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(302) 652-3686 TELEX 510-600-0874
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Send For Engineering Bulletin 126-128 for Spectral Transmission Curves and Engineering Bulletin 135 for Material Properties Chart

idea

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QUALITY PRODUCTS are based on QUALITY IDEA PARTS

'IDEA' = LED

IDEA is a specialty company dealing exclusively in LEDs and LED-based components. If you need an LED, we either have it or will work with you to supply you with a product that will satisfy your need. The listing below is intended to show you some of the "IDEAs" we can provide!

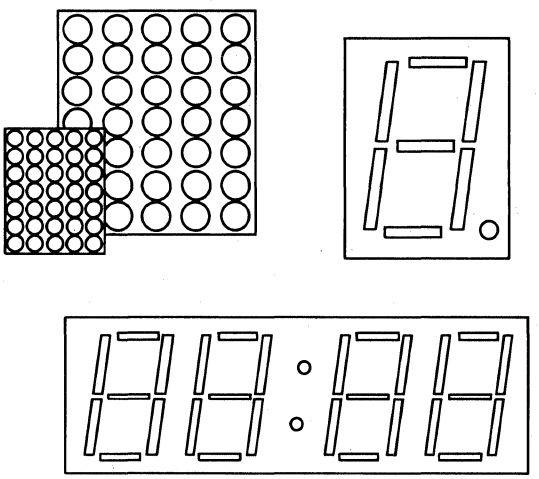
SEVEN SEGMENT DISPLAYS:

Single Digit:
- 0.3-in digit – 130, 530, 830, 930, 9301, 9530 Series
- 0.36-in digit – 136, 936, 9536 Series
- 0.4-in digit – 940, 9540 Series
- 0.43-in digit – 143, 543, 843, 943, 9543 Series
- 0.5-in digit – 150, 950, 952, 9521, 9550 Series
- 0.56-in digit – 156, 556, 956 Series
- 0.6-in digit – 160, 960 Series
- 0.63-in digit – 963 Series
- 0.8-in digit – 880, 980 Series
- 0.8-in Alpha-numeric – 180, 980 Series
- 1.0-in digit – 110, 9100 Series
- 1.8-in digit – 9180 Series
- 2.0-in digit – 9200 Series
- 2.3-in digit – 123, 9230 Series
- 4.0-in digit – 1400, 9400 Series

Double-digit:
- 0.3-in digit – 230, 2930, 2931, 2932 Series
- 0.4-in digit – 240, 2940, 2941 Series
- 0.5-in digit – 250, 2950, 2951, 2952 Series
- 0.54-in Alpha-numeric – 254, 2954 Series
- 0.56-in digit – 256, 2956, 29562, 656, 29656 Series
- 0.8-in digit – 2980 Series

Triple-digit (0.56-in) – 356, 3956, 39561 Series

Quad-digit (0.56-in) – 4956, 49561 Series



DOT-MATRIX DISPLAYS:
- 0.7-in Matrix – 907, 9071 Series
- 1.2-in Matrix – 112, 912, 9121, 9812 Series
- 1.4-in Matrix – 114, 914 Series
- 2.0-in Matrix – 120, 920 Series
- 2.3-in Matrix – 123, 923, 9231, 9623, 9823, 98231 Series
- 3.0-in Matrix – 930, 9301 Series
- 4.0-in Matrix – 1400, 1401, 9401, 9402, 9403, 944 Series
- 4.6-in Matrix – 9461, 9462, 9463 Series

CLOCK MODULES:

We offer 11 sizes of clock modules ranging from 0.27-in to 4.0-in height, in direct, duplex and multiplex drive mode, either common cathode or anode, usually in red or green.

AN IDEA DISPLAY FOR EVERYONE!

Industrial Products Division

Intelligent Displays, and Much More
IEE's Industrial Products Division offers as standard products a broad range of intelligent display modules, incorporating a variety of display technologies. Nearly all include on-board intelligent controllers to handle display control, refresh, and character generation. Most modules have on-board power converters. These features greatly simplify the customer's design tasks.

We also offer a wide assortment of accessories, including power supplies, contrast-enhancement filters, cables/connectors, and serial data converters. This comprehensive range of products, combined with the total customer support offered by our technical staff, helps make IEE the "one-stop" source for all your display needs.

Vacuum Fluorescent Family
The unbeatable combination of outstanding appearance, ease of use, and a broad choice of formats, have helped our FLIP™ intelligent VF display modules find wide use in applications such as industrial, medical and test equipment.

Display fields range from 10 to 240 bright, easy-to-read characters. The display color is a pleasant blue-green which may be filtered to any of a range of colors.

The FLIP product family includes 14-segment and "No-Frills" budget lines, the "Industrial Strength" FLIP line, several ruggedized models, and a group of extended operating-temperature range models. Our newest models take advantage of surface-mount technology, for the ultimate in compact packaging.

Liquid Crystal Family
IEE's newest display technology is embodied in the DAYSTAR NOVA™ line of high-performance, ASCII-input LCD modules. Engineered for high reliability, they feature extra-large characters and an extra-wide operating-temperature range (−30 to +85°C).

These low-power, compact modules are ideal for battery-operated portable equipment, especially when sunlight readability is a must. Optional electroluminescent back-lighting makes night-time viewing easy.

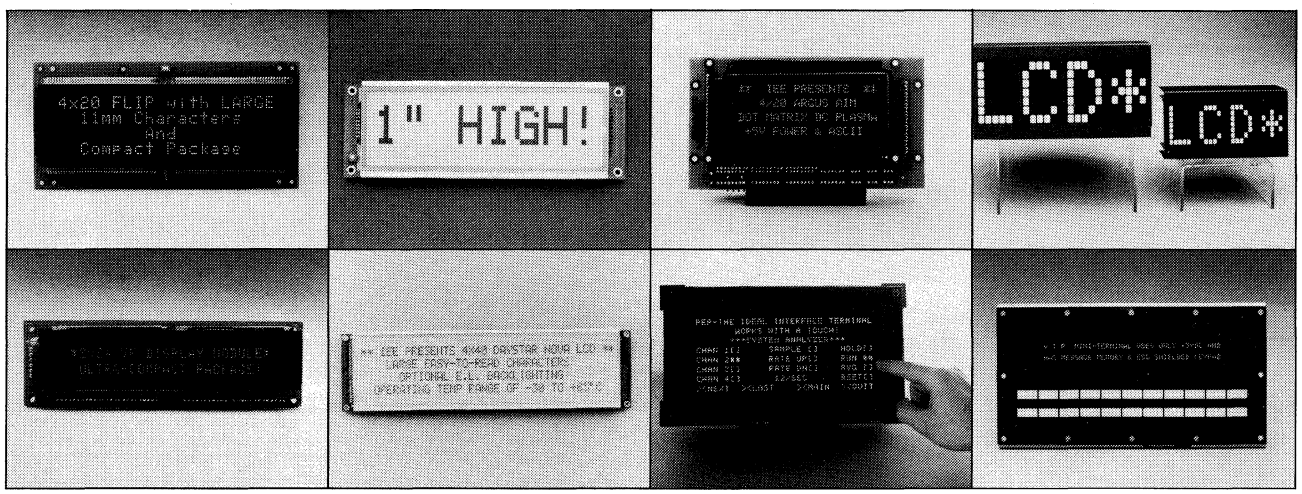
The SUPERNOVA™ family uses advanced LCD technology in the transmissive mode to create extra-large (4 to 6") characters for signs, message centers, and factory-floor annunciators. Many eye-catching colorful effects are possible using fluorescent backlighting.

DC Plasma Family
Especially well-suited to high-information-content applications, ARGUS™ DC plasma display modules use neon-orange or green 5×7 dot matrix panels to produce bright, easy-to-read, alphanumeric characters. Careful attention to package design has resulted in very compact modules.

ARGUS AIM™ modules require only low-voltage (+5 and +11 to 29VDC) power supplies. High-voltage IC drivers ensure maximum reliability and power efficiency.

Interactive Display Modules
The PEP™ family of interactive touch-entry display modules includes models based on ARGUS and FLIP displays. These innovative operator interface modules helped establish the current trend towards touch-interactive displays. On the drawing boards now are several "full-dot" graphic-type PEP modules using advanced DC plasma technologies.

V.I.P.™ is an interactive display system which integrates a VF display with a metal-dome key pad. It is ideal for a variety of applications including small machine tools, process control, and test equipment. Several standard display/keypad formats are available.



Large Character 4×20 VF Display	**Large Character 1×8 LCD Display**	**Low Power DC Plasma Display**	**4" to 6" LCD Modules**
Low Cost 2×24 VF Display	**4×40 LCD Module**	**Interactive Touch DC Plasma Display**	**2×40 VF Interactive Mini-Terminal**

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DISPLAY SYSTEMS TECHNOLOGIES

Precision, functional design, reliability – the qualities that keep electronics firms coming back for Infodex's raster scan and X-Y CRT and EL Flat Panel display models.

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They want ruggedly designed displays that can take punishment, yet perform flawlessly after shock levels up to 100G's. And they want compact designs for very tight envelope constraints.

They get all those qualities – plus our built-in reliability and serviceability. In short, they get their money's worth from Infodex – and so can you.

- All applicable EIA, ARINC and UL requirements are satisfied in the design and manufacture of Infodex products.
- All specifications and unique regulatory requirements relating to medical applications are considered and satisfied by Infodex products.
- Infodex display technologies may be found working in Space Shuttle Robotic Arm Training Systems, Offshore acoustic position indicators, oil field seismographic monitors, wave form monitors, automotive engine analyzers, computer graphics, and factory automation monitoring systems.
- Among our medical applications, Infodex displays may be found in CRT displays for ultrasonic diagnostic systems, CAT scanners, EKG monitors, blood analysis systems, nonfade cardioscopes, and X-ray image intensifiers.

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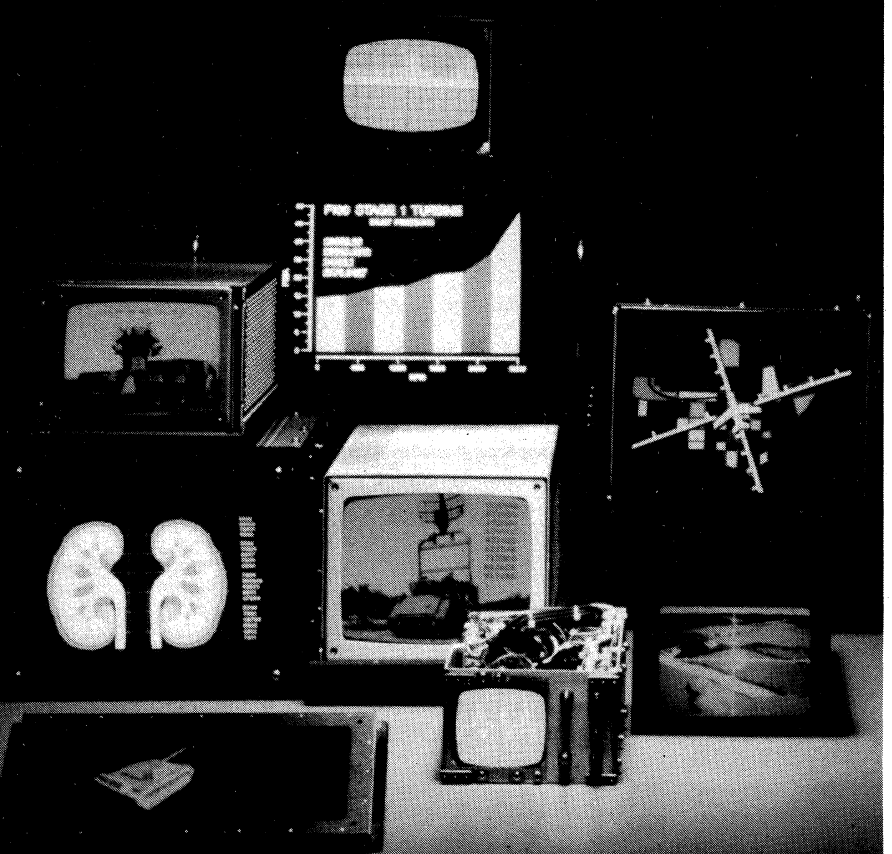
to our Family of High Performance CRT AND EL DISPLAY MONITORS



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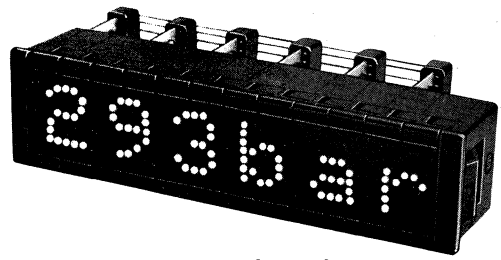
LED DISPLAYS

7 Segment Displays
Red or green LED



Alphanumeric Displays
LED 5 x 7 dot matrix, ASCII decoded

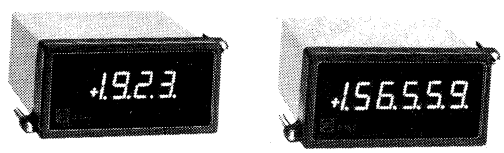
IVO LED Displays are individual display modules which are designed to be easily panel mounted. Simply assemble the displays into the desired arrangement, attach the mounting clips, and snap the entire assembly into your panel cutout.

IVO has done all of the design work for you! The decoders, drivers, housings and mounting hardware are all included.

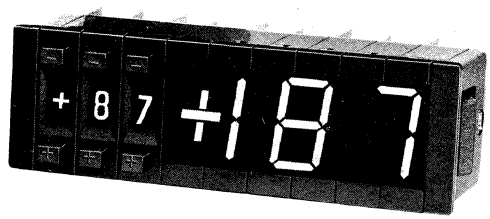
With our wide selection of display sizes and codes, we will certainly be able to meet your next requirement for panel mounted **LED Displays.**

Model	Character Height	Module Width
D005	9 mm	10 mm
D006	9 mm	8 mm
DC016	11 mm	16 mm
DC020	20.4 mm	20 mm
DA 020	17.3 mm	20 mm
D135	14.5 mm	96 mm (3 1/2 Digits)
D155	14.5 mm	96 mm (5 1/2 Digits)

Design	
Direct Drive CA	5-15VDC
Direct drive CC	5-15VDC
+/- Overflow	5-15VDC, 24VDC
TTL 0-9, A-F	5VDC
CMOS 0-9, A-F	5-15VDC, 24VDC
CMOS 0-9	24VDC

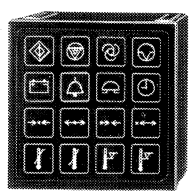


3 1/2 & 5 1/2 Digit Displays
Fully Multiplexed CMOS Positive Logic



Codeswitch/Display Combinations
Snap together any desired combination!
(See **IVO** ad in Switch section Page **B•1775**)

Annunciator Display



With standard or custom symbols for remote indication of system status. Panel mounted, custom sized. Bright red LED backlighting for high visibility.

IVO Industries Inc.201 Industrial Way West, Eatontown, NJ 07724 **Tel.1-800-932-0489** Fax(201)542-2938
Call for immediate engineering assistance, exact price, delivery. Many other models available.

eem

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

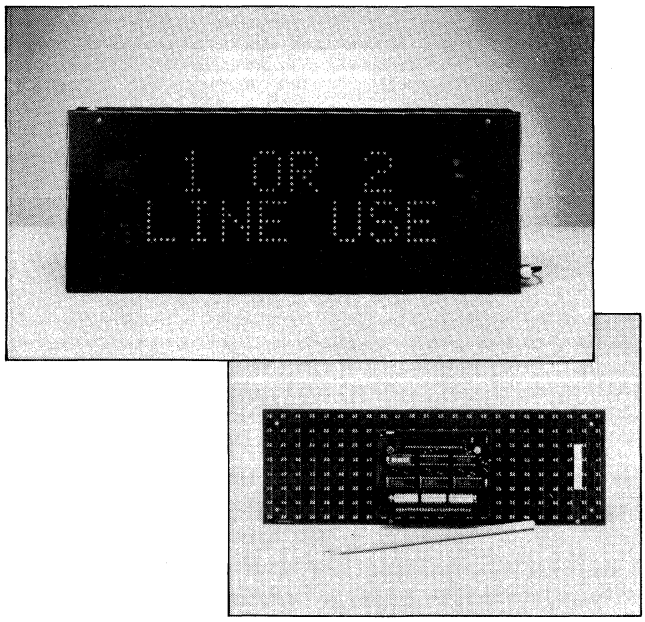
Z
ZIF zero insertion force

MicroDimensions, Inc.

7345 Production Drive, Mentor, Ohio 44060-4858
216/974-8070 • 800/423-7252 • Telefax: 216/974-1648

Micro-824

Industrial Scoreboard Display



Display Characteristics

- High visibility provided by a single line of 8" high characters viewable to 400 feet, (minimum).

  or

- A double line display of 4" high characters viewable to 200 feet, (minimum).
- Message scrolling up to 128 characters.
- 2 line 8 character display/scrolling window.

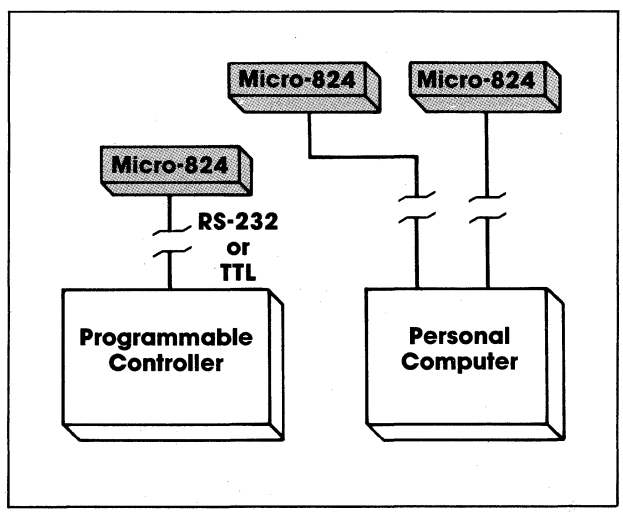
Message Capability

- Three internal message buffers.
- Simple communication commands using standard ASCII characters.
- Display can provide:

  Bold characters
  Flashing mode
  "Bit image" graphics
  Vertical scrolling

Applications

- Display of machine or cell status.
- Display of parts per minute, throughput, weight, etc.
- Maintenance dispatch display to call a skilled trade to a machine or cell.
- Display of process variables such as temperature or RPM.
- Use as an employee information system.



Specifications

Display area:	8" (20.3 cm) high 24" (60.9 cm) wide
Enclosure size:	14" (35.5 cm) high 36" (91.4 cm) wide 4" (10.1 cm) deep
Mounting:	Dual wall bracket Chain hooks
Environmental:	0-50 C (32-122 F) 10-90% Relative humidity Dust/splash proof enclosure (NEMA-12) Indoor Use Only
Electrical:	120/240 VAC 2.0/1.0 amp 50-60 Hz
Interface:	RS-232 Input 20 mA Current Loop 150, 300, 600, 1200, 2400, 4800 Baud Optional TTL interface
Miscellaneous:	68A09 Microprocessor 2k RAM expandable to 32k 8k EPROM expandable to 16k Switching power supply

Interfaces

Standard Interfaces

- RS 232
- 20 mA current loop

Optional Interfaces

- Parallel (TTL)
- RS 422/485

Options

- Multi-drop network configuration
- Pre-programmed "canned" messages

MicroDimensions, Inc.

NEC Electronics Inc.
401 Ellis St., Mountain View, CA 94039 • 415/960-6000

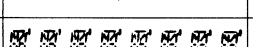
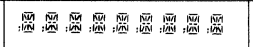
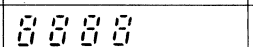
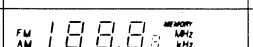
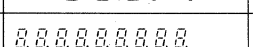
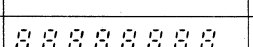
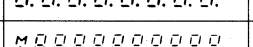
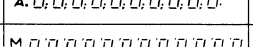
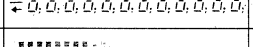
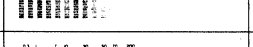
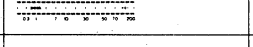
OPTOELECTRONIC PRODUCTS—FLUORESCENT INDICATOR PANEL DISPLAYS

Vacuum Fluorescent Indicator Panels are more effective and reliable than other display systems. An exceptionally wide variety of sizes, styles and configurations are available from NEC. The table below provides a brief glimpse at a few selected standard types. Hundreds of others are available.

The principal advantages of FIPs is their inherent brilliance and sharpness. They can be driven directly from MOS ICs and operate at voltages as low as 10V.

The normal color of an FIP is blue-green. This is filterable to red, orange or yellow with very little visual loss. The basic blue-green color is far less fatiguing to the human eye than colors in the red-orange end of the spectrum.

For complete details on NEC FIPs, ask for the FIP Selector Guide.

Type No.	No. of Digits	Character Format, Symbol	Character Dimensions		Outline Dimensions				
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	P.T. (mm)	L.P. (mm)	L.L. (mm)
FIP16X1EA	16	5×7	3.95	2.3	$26.0^{+0.8}_{-0.3}$	$82.0^{+0.8}_{-0.3}$	7.4 MAX.	2.54	14.0
FIP16XM1DA/FIP16D11X	16	5×7, DP, COMMA, CURSOR (▽)	11.3	7.25	43.2 MAX.	$208.0^{+0.8}_{-0.3}$	9.9 MAX.	2.54	14.0
FIP20X1KA	20	5×12	15.85	6.4	42.4±1.0	208.0±1.0	9.5±0.7	2.54	14.0
FIP16XM2AA/FIP32A11X	32 16×2 line	5×7, DP, COMMA, 2 line	11.3	7.25	60.0±1.0	208.0±1.0	13.0 MAX.	2.54	14.0
FIP20X2CA	40 20 × 2 line	5×7, DP, COMMA, 2 line	11.3	7.25	60.0±1.0	252.0±1.0	12.0 MAX.	2.54	16.0
FIP40X1DA/FIP40E5X	40	5×7	5.05	3.55	$34.0^{+1.0}_{-0.5}$	220.0±0.7	10.0 MAX.	2.54	8.76
FIP20X3AA/FIP60A5X	60 20 × 3 line	5×7, 3 line	5.05	3.55	49.0±1.0	138.0±1.0	11.0 MAX.	2.0	10.2
FIP20X4AA	80 20×4 line	5×7, 4 line	11.3	7.25	90.0±1.0	240.0±1.0	13.3±0.7	2.54	10.0
FIP80X2AA/FIP160A4X	160 80×2 line	5×7, CURSOR, 2 line	3.55	2.05	$44.0^{+0.8}_{-0.3}$	$298.0^{+0.8}_{-0.3}$	10.0±0.7	2.54	7.0
FIP40X6AA	240 40×6 line	5×7, CURSOR, 6 line	5.0	3.5	90.0 MAX.	250.0±1.0	14.0 MAX.	2.0	20.0
FIP48GX7AA/FIP48A8XT	—	48×7, GRAPHIC	7.9	57.1	34.0±1.0	93.0±1.0	9.5 MAX.	2.54	7.4
FIP180GX48BA	—	180×48, GRAPHIC	29.54	111.38	60.0±1.0	156.0±1.0	11.0 MAX.	1.27	20.0
FIP280GX60AA/ FIP240A4XT	—	280×60, GRAPHIC	38.75	181.75	70.0±1.0	265.0±1.0	12.0 MAX.	1.27	20.0
FIP8A5R FIP8A5AR	8		5.0	3.0	$24.5^{+0.5}_{-0.3}$	65.5 MAX.	7.3 MAX.	2.54	14.0 7.0
FIP9A5AR	9		5.0	3.0	$23.0^{+0.5}_{-0.3}$	71.5 MAX.	7.5 MAX.	2.54	7.0
FIP80B5R	80 40×2 line	14 segment CURSOR, COMMA, 2 line	5.0	3.0	39.0±1.0	250±1.0	9.7±0.7	2.54	10.0
FIP2A13	2		12.5	6.6	$28.0^{+1.5}_{-0.5}$	50.0±1.0	7.5±1.0	2.54	10.0
FIP4H5	4		5.0	2.5	14.5±1.0	41.0±1.0	6.5±0.7	2.54	8.0
FIP7P8 Series	7		8.0	4.6	24.5±1.0	76.0±1.0	6.1±0.7	2.54	15.0 ~ 3.2
LD8225/FIP8A5	8		4.5	2.3	17.0±1.0	58.0±1.0	6.5 MAX.	2.54	6.2
FIP9B6 FIP9B6A	9		5.5	2.65	20±1.0	70±1.0	6.5±0.5	2.54	3.5 9.0
FIP11B8A	11		8.0	3.6	$25.5^{+1.5}_{-1.0}$	$93.0^{+1.5}_{-0.5}$	9.5 MAX	2.54	14.0
FIP13F7	13		6.5	2.9	$25.0^{+0.5}_{-0.3}$	94.5 MAX.	9.5 MAX.	2.54	34.0
FIP10CW19Y	10		18.5	70.0	33.0±1.0	98.0±1.0	8.0±0.7	2.54	9.5
FIP24A15YS	24		15.0	71.7	33.0±1.0	98.0±1.0	8.5 MAX.	2.54	7.0
FIP101B8AY	101		7.6	127.5	24.5±1.0	158.8±1.5	10.0 MAX.	5.08	12.5

NEC Electronics Inc.
401 Ellis St., Mountain View, CA 94039 • 415/960-6000

OPTOELECTRONIC PRODUCTS,—FLUORESCENT INDICATOR PANEL DISPLAYS

World's first Chip-In-Glass FIP Modules give you beauty that lasts.

NEC has removed something that used to stand between you and truly reliable fluorescent displays. We took the anode and grid driver ICs out of their packages. Then mounted the bare chips directly on the display substrate. Result: a trimmed-down, cost-efficient display that solves a host of reliability problems.

Now, for the first time, the display drivers are on-board —in a vacuum-sealed glass envelope that provides the ideal protective environment. On-board ICs permit a drastic reduction in the number of lead terminals. By reducing leads, we further increase dependability. Create a more compact design. And lower costs to you.

MINI-MODULES: UP TO 50% SMALLER AND 33% LIGHTER.

We use surface-mount technology to trim our modules even more. Board height is up to 50% less than conventional modules and weight is reduced by up to 33%.

Chip-In-Glass FIPs come in four models: 20 characters x 1 line; 20 x 2; 40 x 1; or 40 x 2. All models offer a 5 x 7 dot character format. The display is brilliant and easy to read from virtually any angle.

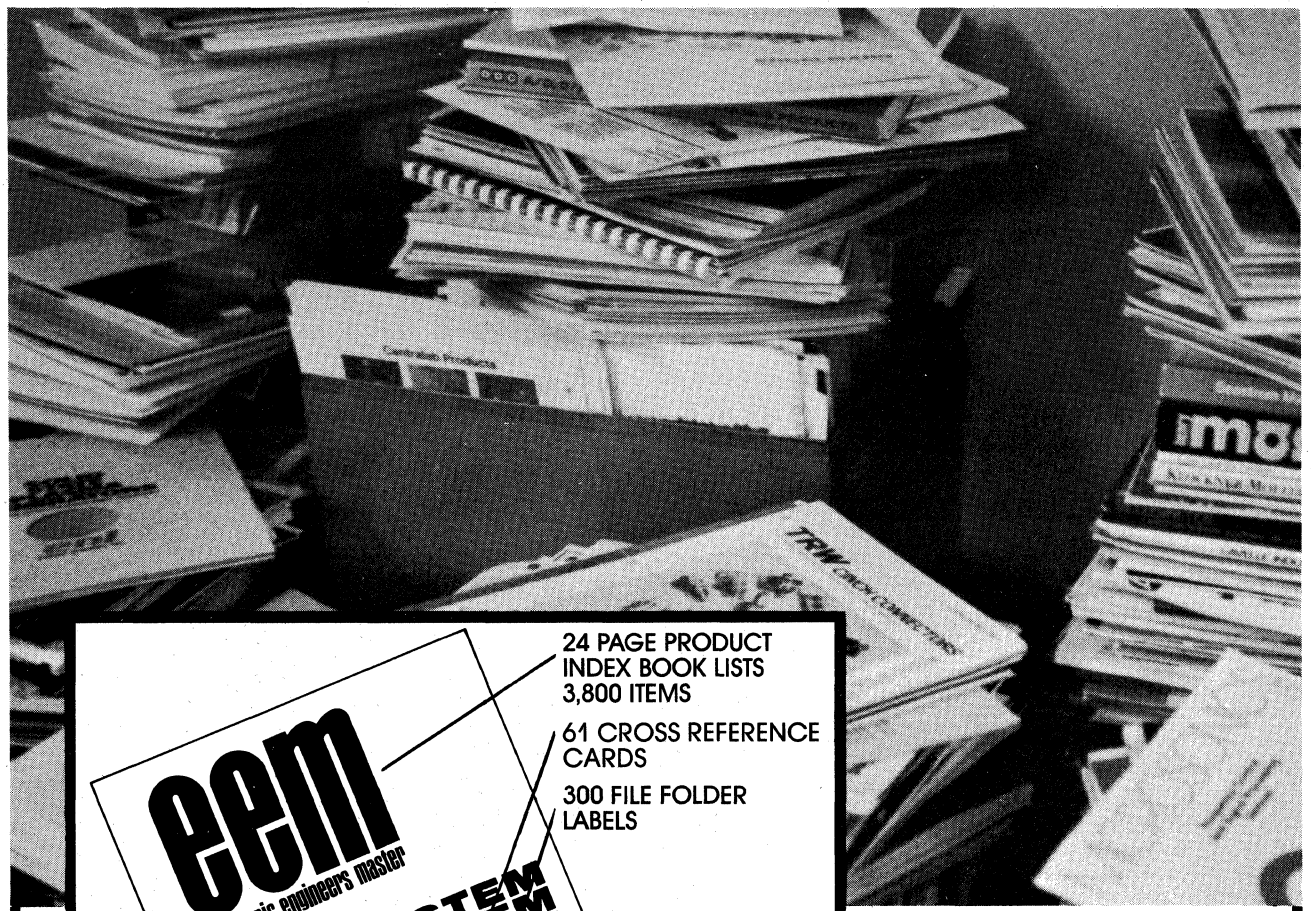
FIPs run on a 5V power source. Interface readily with your system bus. Execute numerous commands. Fonts include: ASCII-7, ECMA-7 (General European, German, Scandinavian, Spanish) and JIS.

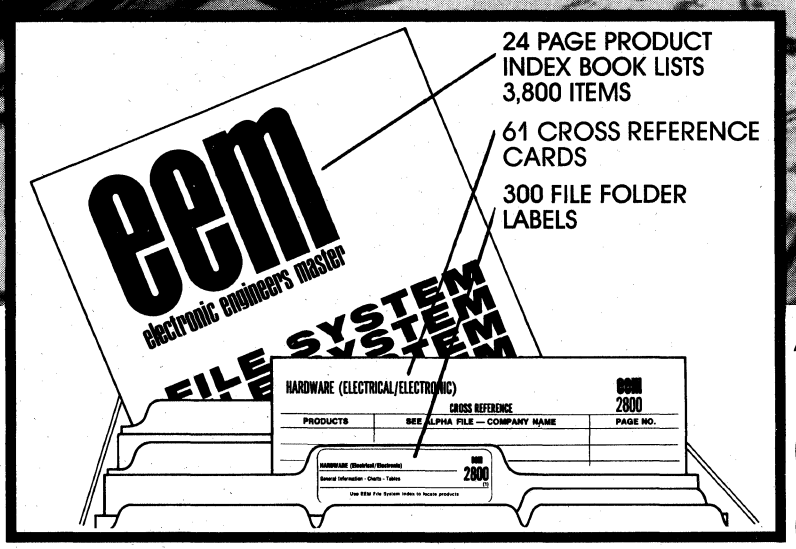
If you want beauty that lasts through the years, get the bare facts on NEC's Chip-In-Glass FIP modules.

Type No.	No. of Digits	Character Format, Symbol	Character Dimensions		Outline Dimensions		
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	P.T. (mm)
FC20X1JA-AB	20	5 x 7 DOT MATRIX, CURSOR	5.05	3.55	29	194	24
FC20X1NA-AB	20	5 x 7 DOT MATRIX	9	6.3	30	259	24
FC20X2FA-AB	40	5 x 7 DOT MATRIX	5.05	3.55	34	194	24
FC40X1KA-AB	40	5 x 7 DOT MATRIX, CURSOR	5.05	3.55	29	280	24
FC40X2DA-AB	80	5 x 7 DOT MATRIX, CURSOR	5.35	3.55	40	270	28

LARGE MODULES AND GRAPHICS

Type No.	No. of Digits	Character Format, Symbol	Character Dimensions		Outline Dimensions		
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	P.T. (mm)
FM40X6AA-A	240	5 x 7 DOT MATRIX, CURSOR	5.0	3.5	110	264	45
FM80X2AA-A	160	5 x 7 DOT MATRIX, CURSOR	3.5	2.05	66	388	43
FM180GX48BA-A	GRAPHIC	180 x 48 DOT MATRIX	—	—	90	200	45
FM256GX64AA-AA	GRAPHIC	256 x 64 DOT MATRIX	—	—	93	230	45
FM256GX128AA-AA	GRAPHIC	256 x 128 DOT MATRIX	—	—			45





24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS

61 CROSS REFERENCE CARDS

300 FILE FOLDER LABELS

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Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

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You say you want to file catalogs by type of product? That's easy to do with The System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

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NEI Ferranti-Packard

NEI FERRANTI-PACKARD ELECTRONICS

6030 AMBLER DRIVE, MISSISSAUGA, ONTARIO L4W 2P1 CANADA
416/624-3020 TELEX: 06-961437 FAX: 416/625-6197

DISPLAY COMPONENTS

Ferranti-Packard light reflecting electro-magnetic display components offer the user numerous benefits such as...

1. Excellent Visibility Utilizing a range of fluorescent colors in addition to white, the contrast ratio of an F-P display actually improves as the ambient light increases, ensuring excellent visibility both in low ambient light and direct sunlight.

2. High Reliability Virtually maintenance free operation is achieved since there are no lamps to burn out, and no mechanical linkages or bearings to wear.

3. Lower Power Consumption Because of our unique patented technology, no power is required to maintain the display, and only minimal energy is required to change the status of display.

4. Ruggedness Modules and indicators are highly resistant to shock and vibration and are ideally suited to mobile applications or displays in a high vibration environment.

COLORS The displays are available in a range of fluorescent colors including green, yellow, red and orange, in addition to white. For a complete listing of standard and non-standard colors refer to the individual product data sheet.

CHARACTER SIZE The general rule for selecting the optimum character size is to allow approximately 26mm (1 in.) of character height for every 15m (50 feet) of viewing distance. This will vary slightly depending on the color selected and the ambient light conditions.

STATUS INDICATORS Disk sizes are 7.6mm (0.3 in.) 8.9mm (0.35 in.) and 13mm (0.53 in.) diameter. A 13mm (0.5 in.) square flag is used in the series 50. These devices are current operated and can be driven from source voltages ranging from 3.3 Vdc to 25 Vdc, depending upon the model selected. Indicators are available for panel mounting or direct PCB mounting. Consult the individual data sheets to determine the indicator best suited for your requirements.

Typical applications include: Transient Recorders, Industrial Process Displays, Fault Indicators, Portable Field Equipment, Continuous Matrix Display

PRE-ENCODED MODULES These modules are designed for applications where a limited number of character symbols are required. Standard modules provide the numerals 0 to 9 plus blank. Non-standard modules can be supplied with up to 12 alphanumeric or special characters including blank. Three character heights are available, 70mm (2.7 in.), 104mm (4.1 in.) and 215mm (8.4 in.). Each character is encoded into the winding of the module coils and no external character generation is required. A single current pulse of 1 millisecond duration applied to the selected control wire erases the existing character and displays the desired character. The pulse can be driven from a single capacitor discharge circuit.

Typical applications include: Weigh-Scale Readouts, Industrial Instrumentation Displays, Cash Register Readouts for parking lots and toll booths, Scoreboards, Time/Temperature Displays, Vehicle Destination Signs.

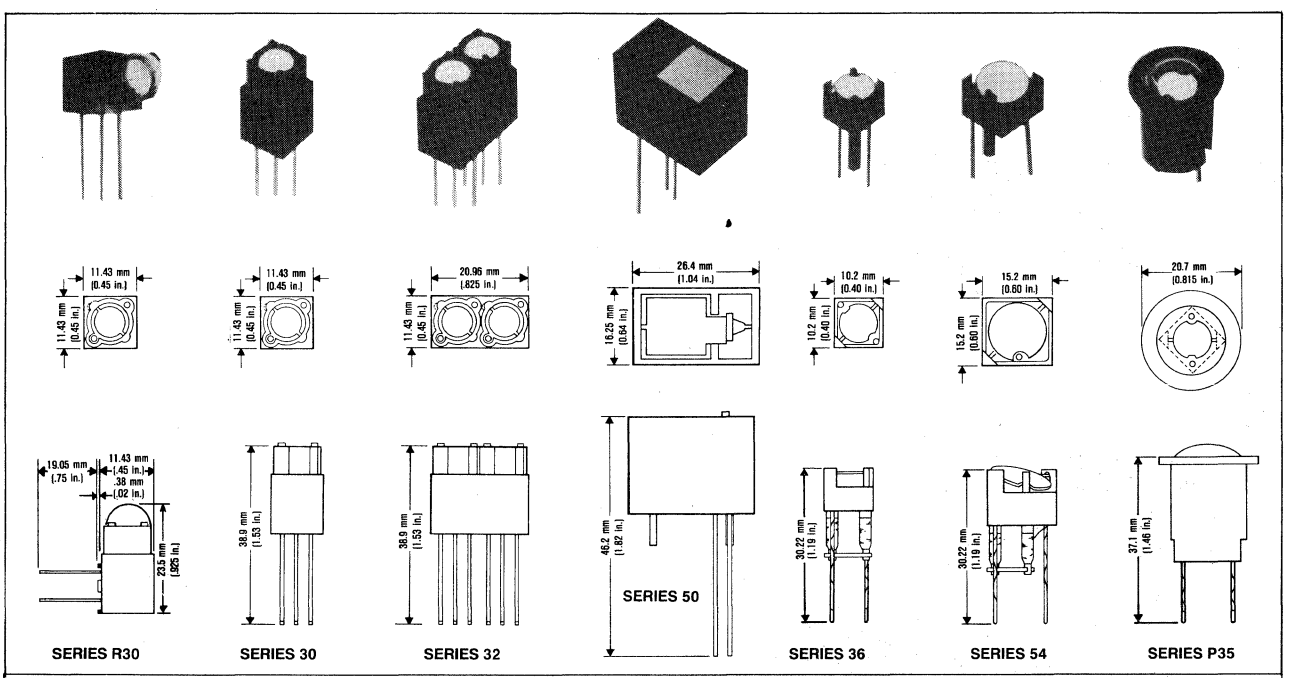
ALPHANUMERIC MODULES These modules offer the user a complete alphanumeric or special character capability. Each module contains 35 light reflecting disks or elements arranged in a 5 × 7 matrix. Five character heights are available — 70mm (2.7 in.), 104mm (4.1 in.), 215mm (8.4 in.), 328mm (12.9 in.) and 452mm (17.8 in.).

Typical applications include: Scoreboard Displays, Advertising Displays, Message Signs, Traffic Control Signs, Industrial Displays, Passenger Information Displays and Vehicle Destination Signs.

7 SEGMENT MODULES The 7 segment module is basically a numeric readout, but it can display a limited number of alpha characters within its 7 segment format. Five character heights are available — 26mm (1.0 in.), 135mm (5.3 in.), 230mm (9.0 in.), 305mm (12.0 in.) and 457mm (18.0 in.).

Typical applications include: Gasoline Pump Displays, Weigh Scale Readouts, Cash Register Readouts, Time/Temperature Displays, Gas Pricing Signs, Speed Limit Signs, Scoreboards, Industrial Displays.

STATUS INDICATORS



SERIES R30 SERIES 30 SERIES 32 SERIES 36 SERIES 54 SERIES P35

Specifications and Operating Parameters

Series	Temperature Range	Relative Humidity (non-condensing)	Minimum Pulse Current	Coil Resistance (at 20°C) (Ω)	Minimum Pulse Duration	Minimum Pulse (V) at 20°C	Data Sheet Reference	Disk Dia	Flag Size	Weight
R30 + 30	– 40 to 92°C	up to 95%	250mA	12Ω ± 10%	1.5 ms	3.3V	372	7.62 mm, 0.30 in.	—	0.16 oz., 4.5 g
32	– 40 to 92°C	up to 95%	250mA	12Ω ± 10%	1.5 ms	3.3V	372	7.62 mm, 0.30 in.	—	0.28 oz., 8.0 g
50	– 40 to 75°C	up to 95%	53mA	430 ± 10%	1.5 ms	25V	372	—	12.7 mm, 0.50 × 0.50 in.	0.50 oz., 14.2 g
36	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	372	8.9 mm, .350 in.	—	0.07 oz., 2.0 g
54	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	372	13.46 mm, .53 in.	—	0.11 oz., 3.2 g
P35	– 40 to 75°C	up to 95%	250mA	27 ± 10%	1 ms	10V	372	8.9 mm, .350 in.	—	0.14 oz., 3.9 g

* All products are current operated. Voltages shown are for reference only. Minimum drive voltage must be selected to achieve specified current over the full operating temperature range.

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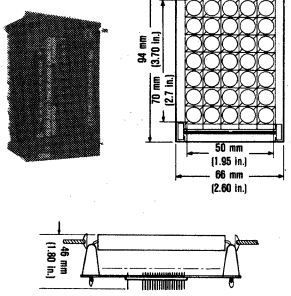
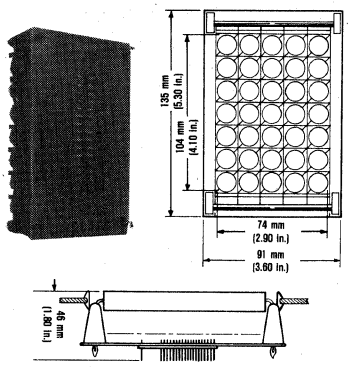
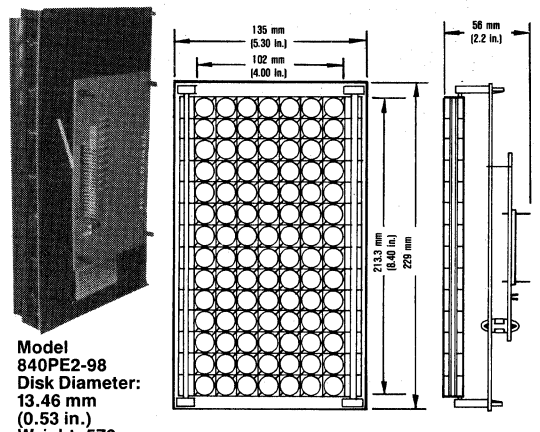
PRE-ENCODED MODULES



Model 270PE2-35
Disk Diameter: 8.9 mm (0.35 in.)
Weight: 142g



Model 410PE2-35
Disk Diameter: 13.46 mm (0.53 in.)
Weight: 227g

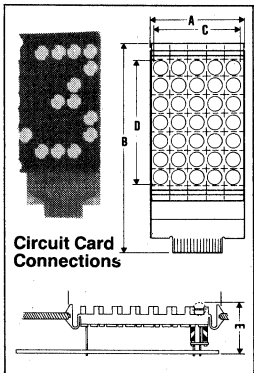


Model 840PE2-98
Disk Diameter: 13.46 mm (0.53 in.)
Weight: 570g

Specifications and Operating Parameters

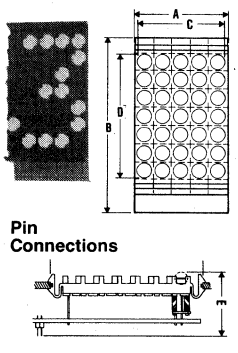
Model Number	Temperature Range	Relative Humidity (non-condensing)	Minimum Pulse Current	Coil Resistance (at 20°V) (Ω)	Minimum Pulse Duration	Minimum Pulse Voltage at	Data Sheet Reference
270PE2-35	– 40 to 75°C	up to 95%	10A	4.3 ± 10%	1 ms	48 V	778
410PE2-35	– 40 to 75°C	up to 95%	12A	5.5 ± 10%	1 ms	72 V	751
840PE2-98	– 40 to 75°C	up to 95%	16A	5.9 ± 10%	1 ms	96 V	759

ALPHANUMERIC MODULES



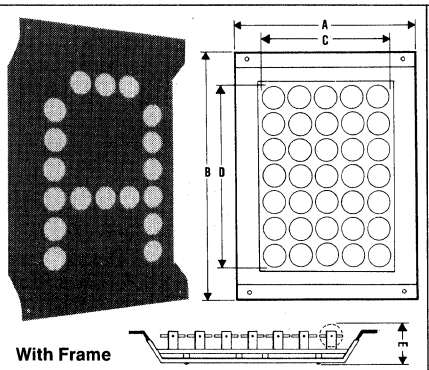
Circuit Card Connections

Model 270XY5-35SC
Model 410XY5-35SC



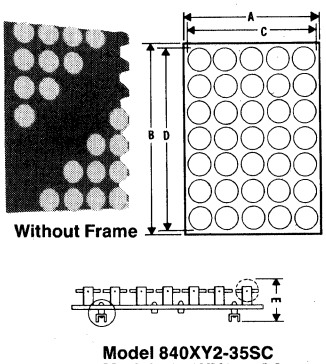
Pin Connections

Model 271XY5-35SC
Model 411XY5-35SC



With Frame

Model 842XY2-35SC
Model 1202XY2-35SC
Model 1802XY2-35SC



Without Frame

Model 840XY2-35SC
Model 1200XY2-35SC
Model 1800XY2-35SC

Specifications and Operating Parameters

Model Number	Temp. Range	Relative Humidity non-condensing	Min. Pulse Current	Coil Resistance (at 20°C) (Ω)	Min. Pulse Duration	Min. Pulse* Voltage at 20°	A × B	C × D	E	Disk Diameter	Weight (g)	Data Sheet Ref
270XY5-35SC	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	mm 52 × 116 in. 2.03 × 4.57	50 × 70 1.95 × 2.70	28.9 1.14	8.9 0.35	98g	797
410XY5-35SC	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	mm 77 × 167 mm 3.03 × 6.60	74 × 104 2.93 × 4.10	32 1.26	13.46 0.53	139g	797
271XY5-35SC	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	mm 52 × 116 in. 2.03 × 4.57	50 × 70 1.95 × 2.70	39.8 1.57	8.9 0.35	98g	797
411XY5-35SC	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	mm 77 × 167 in. 3.03 × 6.60	74 × 104 2.93 × 4.10	42 1.69	13.46 0.53	139g	797
842XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 215 × 312 in. 8.45 × 12.5	150 × 213 5.9 × 8.4	74 2.9	24 0.95	992g	586
1202XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 317 × 457 in. 12.5 × 18.0	231 × 328 9.1 × 12.9	81 3.2	38 1.5	1786g	586
1802XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 457 × 660 in. 18.0 × 26.0	320 × 452 12.6 × 17.8	91 3.6	56 2.2	3317g	586
840XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 163 × 221 in. 6.4 × 8.7	150 × 213 5.9 × 8.4	84 3.29	24 0.95	425g	586
1200XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 244 × 335 in. 9.6 × 13.2	231 × 328 9.1 × 12.9	87 3.42	38 1.5	595g	586
1800XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 333 × 457 in. 13.1 × 18.0	320 × 452 12.6 × 17.8	95 3.75	56 2.2	822g	586

*All products are current operated. Voltages shown are for reference only. Minimum drive voltage must be selected to achieve specified current over the full operating temperature range.

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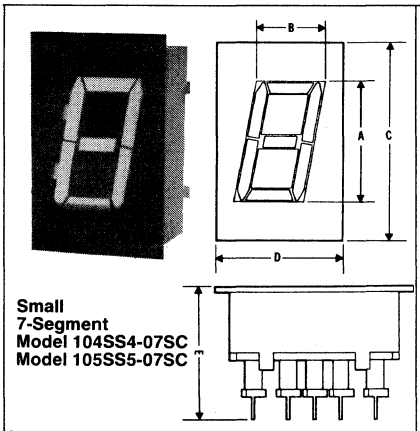
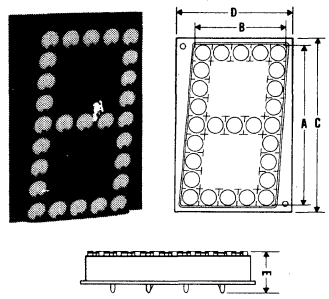
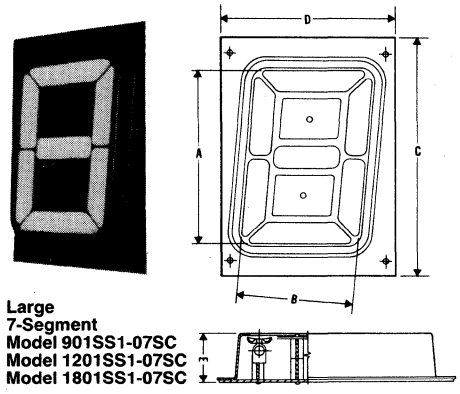
7-SEGMENT MODULES



Small
7-Segment
Model 104SS4-07SC
Model 105SS5-07SC



Disk Matrix
7-Segment
Model 531SS2-07SC



Large
7-Segment
Model 901SS1-07SC
Model 1201SS1-07SC
Model 1801SS1-07SC

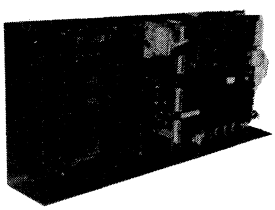
Specifications and Operating Parameters

Model Number	Temp. Range °C	Relative Humidity non-condensing	Min. Pulse Current	Coil Resistance at (20°C) (Ω)	Min. Pulse Duration	Min. Pulse* Voltage at 20°C	A x B	C x D	E	Weight (g)	Data Sheet Reference
104SS4-07SC	–40 to 75	up to 95%	1A	6.8 ± 10%	650μs	12	mm 25.4 x 14 in. 1.00 x 0.55	42.9 x 27.3 1.69 x 1.075	29 1.123	12.3	777
105SS5-07SC	–40 to 75	up to 95%	335 mA	45 ± 10%	1ms	19	mm 25.4 x 14 in. 1.00 x 0.55	42.9 x 27.3 1.69 x 1.075	29 1.123	13.8	777
531SS2-07SC	–40 to 75	up to 95%	1.8A	A, D, G, -60hms B, E -4-50hms C, F -3-60hms	1 ms	See Data Sheet 531	mm 135 x 76.2 in. 5.3 x 3.0	155.7 x 105.4 6.13 x 4.15	33 1.3	150	531
901SS1-07SC	–40 to 75	up to 95%	3.0A	8 ± 10%	1ms	32	mm 230 x 152 in. 9.0 x 6.0	312 x 230 12.3 x 9.0	76 3.0	936	200
1201SS1-07SC	–40 to 75	up to 95%	3.0A	8 ± 10%	1ms	32	mm 305 x 203 in. 12.0 x 8.0	457 x 318 18.0 x 12.5	76 3.0	1360	200
1801SS1-07SC	–40 to 75	up to 95%	3.0A	8 ± 10%	1ms	32	mm 457 x 305 in. 18.0 x 12.0	660 x 457 26.0 x 18.0	79 3.1	2495	200

(1) All erase coils connected in series.
(2) Individual erase coils. If connected in series the erase voltage must be 26V minimum.

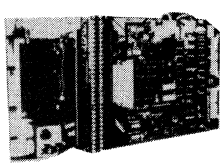
* All products are current operated. Voltages shown are for reference only. Minimum drive voltage must be selected to achieve specified current over the full operating temperature range.

DRIVE UNITS



FP601 CONTROLLER

The Ferranti-Packard Series FP601 Controller is a small, high speed, solid-state device which contains the power supply, logic and drive circuitry required to operate Ferranti-Packard alphanumeric display modules, Model 271XY5-35 and Model 411XY5-35. The suggested mounting is in a protected area preferably within the sign enclosure. Main features include remote driver board capability and various writing directions. (Data Sheet 601.)

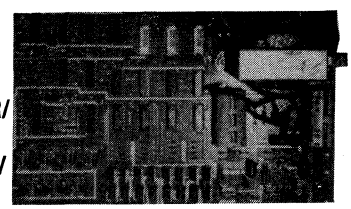


TYPE 1001 CONTROLLER

The 1001 Controller is a versatile, low cost powerful microprocessor based unit for use with displays using Ferranti-Packard large alphanumeric modules: (215mm) 8.4", (328mm) 12.9", and (457mm) 18", alphanumeric modules (70mm) 2.7", (104mm) 4.1", and large seven segment modules: (230mm) 9", (305mm 12", (457mm 18". The main feature of the 1001 Controller is its capability to store and cycle messages. (Data Sheet 1001.)

SERIES 300 DRIVER/DECODER BOARD

The Series 300 driver/decoder boards provide a simple, economical method of driving small display systems comprising either (70mm) 2.7 inch, (104mm) 4.1 inch or (215mm) 8.4 inch type DCP pre-encoded modules. (Data Sheet 265.)



MODEL 700DD DRIVER/ DECODER BOARD
MODEL 701DD DRIVER/ DECODER BOARD

The Model 700DD 7 bar module driver/decoder board provides a simple, economical method of driving small display systems utilizing (230mm) 9 inch, (305mm) 12 inch, (457mm) 18 inch large 7 bar modules. (Data Sheet 700.)

The Model 701DD 7 bar module driver/decoder board drives small display systems utilizing 135mm (5.3 in.) disk matrix segment modules. (Data Sheet 701.)

PRINCIPLES OF OPERATION

Alphanumeric Modules/Status Indicators

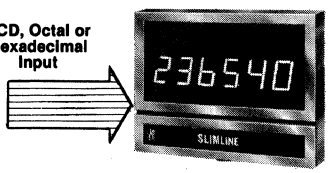
The basic display element is a magnetic disk. Short pulses of current in the coil assembly set the magnetic field in the stator pins in either one direction or the other. Each disk rotates to line up with the stator field and shows either its black side, or colored side.

Small 7-Segment Modules

The basic display element is a magnetic segment which pivots on its axis. Short pulses of current in the coil under each segment set the magnetic field in the stator pins in either one direction or the other. Attraction or repulsion by a segment's bar magnet, retracts or shows a segment.

SLIMLINE® Displays
LOCAL & DISTANT

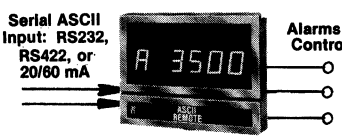
LOCAL DISPLAY



Accepts BCD, octal or hexadecimal code and displays up to 6 digits in either an LCD or LED display. Meter will accept full parallel or data bus input. Large, bright displays are highly readable even in high ambient light conditions. Easy panel drilling, mounting and wiring.

- ★ 2, 3, 4, 5 or 6 digit models
- ★ Non-glare faceplate
- ★ Polarity, decimal pt., colons available
- ★ Accepts 5 to 24 V input
- ★ Front panel mounting
- ★ LED or LCD displays
- ★ Price: $140 - $200

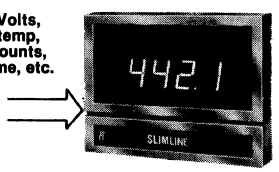
DISTANT DISPLAY



Units accept 2-wire serial ASCII input for numerical and most alpha character display. There are also ASCII controlled output capabilities to provide alarm or control functions. There is individual character control (dimming, flashing and blanking).

- ★ Accepts RS232, 422, 485 or 20/60 mA
- ★ 110 - 9600 baud
- ★ Limited alpha capability
- ★ Large, bright display, easily read
- ★ Flexible addressing capability
- ★ ASCII command switch outputs
- ★ Price: $325 - $450

SIGNAL READOUT



Display a wide range of volts, amps, watts, resistance, counts, temperature, etc. with these units. Meters include full input conditioning and built-in A-to-D signal conversion. Unit can be field scaled to read out directly in any desired engineering unit.

- ★ 2, 3, 4, 5 or 6 digit models
- ★ Rugged industrial design
- ★ Preset units
- ★ Data outputs available
- ★ Front panel mounting
- ★ Microprocessor-based units
- ★ Price: $140 - $350

LARGE DISPLAY

Meters feature 3 or 5-inch, 7 segment, incandescent displays. Many different colors are available. Meter will accept inputs from:

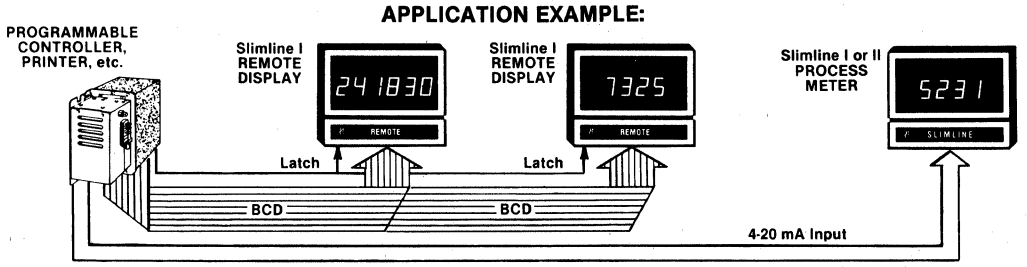
1) Parallel data (BCD, octal, hexadecimal)
2) Serial ASCII (RS232, 422, 20/60 mA)
3) Wide metering range (volts, amps, temperature, counts, time, etc.)

- ★ 4 - 6 digits available
- ★ Self-contained displays
- ★ Decimal point or colons available
- ★ Rugged Nema-12 industrial enclosure
- ★ Great for distances up to 250'
- ★ Latching and blanking capabilities
- ★ Price: $650 - $750

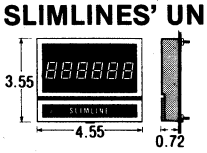
ADVANTAGES:

- ★ Individual digit strobe permits single or group digit control
- ★ Display may be selected by individual strobes (standard technique) or addressed by BCD (saves cost of I/O and wiring)
- ★ Interfaces with TTL, CMOS, 24 V and 48 V I/O modules
- ★ The BCD data and control lines may be negative or positive (0 or 1) true
- ★ Optional Stainless Steel Bezel – fully gasketed and sealed; built to NEMA 1, 2, 3, 3R, 4, 4X, 5, 6, 6P, 11, 12, 13; easy access to controls

APPLICATION EXAMPLE:



SLIMLINES' UNIQUE FEATURES



Size: 4.55" x 3.55" x 0.72". Panel surface mounting means easy & fast installation. Also fast wiring – no soldering needed.

High Quality: Less downtime, long useful life. Much better investment; socketed parts and highest quality components. Conservative design; works well in harsh factory environments, not like other meters that are made to only work in a laboratory.

Backed by 3-year warranty!

Who Uses: With over 2 million meters shipped, NES is recognized as the leader in high quality industrial meters. Some users are: the Space Shuttle, Air Force 1, most of the Fortune 500's and many more.

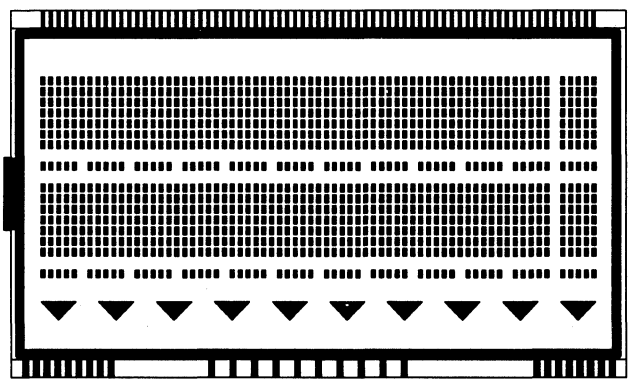
About NES: We design & manufacture over 3,000 different products from Broadcast Automation Computers to the broadest range of panel meters available. NES has been a leader in innovative panel meter technology with ASCII communication for nearly 20 years.

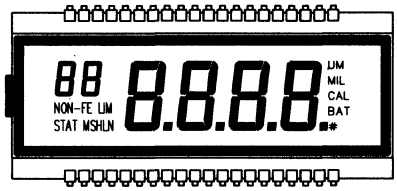
Please call us. It is easy to talk to one of our expert Application Engineers. They care about your problem and will do all they can to assure your success.

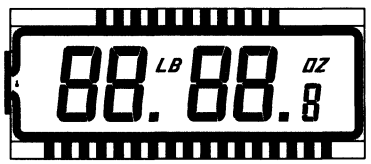
NES, Inc. NATIONWIDE ELECTRONIC SYSTEMS FAX: (312) 426-6630
3003 Wakefield Drive, Carpentersville, IL 60110 • (312) 426-5900 EASYLINK: 856845

FOR MORE, SEE EEM ON PG. D•1406-1411

OCULAR LIQUID CRYSTAL DISPLAY PRODUCTS







Ocular Inc. specializes in full custom Liquid Crystal Display manufacturing. A full line of standard devices are also available from our catalog.

Ocular is a service orientated company. Full engineering services are provided for our customers from the basic design of the display to custom designed packaging including housings and drive electronics for the display.

Equipped with advanced array processing capability, Ocular's LCD products feature:

* HIGH QUALITY STANDARDS MEETING MIL. SPEC.
* HIGH CONTRAST AND BRIGHTNESS
* QUICK SWITCHING TIME
* LOW POWER CONSUMPTION
* LARGE SIZE PANELS UP TO 35" SQUARE
* WIDE TEMPERATURE RANGE

SHORT LEAD TIME

*PROTOTYPES IN 6 WEEKS
*PRODUCTION IN 6 TO 8 WEEKS

EXPEDITING SERVICE AVAILABLE ON SPECIAL REQUEST

CUSTOM DISPLAY MODULES

*ENGINEERING DESIGN SERVICE FOR CUSTOM PACKAGING
*LOW COST INJECTION MOLDED OR METAL HOUSINGS
*PCB AND CIRCUIT DESIGN
*TURN-KEY OR SUBASSEMBLY CONTRACT MANUFACTURING

ENVIRONMENTAL TEST STANDARD

	COMMERCIAL TYPE	INDUSTRIAL TYPE
40°C,90% RH NONCONDENSING*	>1344 HOURS	>1344 HOURS
50°C,95% RH NONCONDENSING	>500 HOURS	>1000 HOURS
80°C,95% RH NONCONDENSING	N/A	>720 HOURS
60°C DRY HEAT	>500 HOURS	>1000 HOURS
80°C DRY HEAT	N/A	>1000 HOURS

*MIL-STD-202F METHOD 103B TEST CONDITION D

MIL-STD-202 TEMPERATURE CYCLING

MIL-STD-202F,TEST CONDITION A-1: 25 CYCLES OF -55 C FOR 15 MINUTES TO 25 C FOR 5 MINUTES TO 85 C FOR 15 MINUTES TO 25 C FOR 5 MINUTES TO -55 C FOR 15 MINUTES.

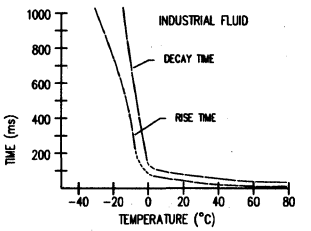
* 1701 N. COLLINS, RICHARDSON, TX 75080* TEL. (214) 437-2561* FAX. (214) 437-2562*

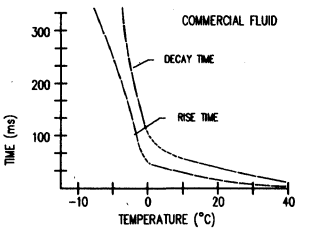
OCULAR LCD PERFORMANCE SPECIFICATION

		COMMERCIAL TYPE			INDUSTRIAL TYPE			UNITS
		MINIMUM	TYPICAL	MAXIMUM	MINIMUM	TYPICAL	MAXIMUM	
OPERATING VOLTAGE *		2.0	3.0	10.0	3.5	5.0	15.0	Vrms
OPERATING FREQUENCY		32	60	100	32	60	100	Hz
CURRENT (PER 1/2" DIGIT)			1.25	5		1.25	5	μA
NET DC DRIVE COMPONENT				50			50	mv
OPERATING TEMPERATURE		-10		55	-40		85	°C
STORAGE TEMPERATURE					-55		95	°C
CONTRAST RATIO		-20	20:1	60		20:1		
RESPONSE TIME	T_{RISE} @ 25 C		30	50		10	20	ms
	T_{DECAY} @ 25 C		50	75		45	65	
	T_R @ 0 C		200	350		60	100	
	T_D @ 0 C		350	500		100	220	
	T_R @-20 C		N/A	N/A		750	1100	
	T_D @-20 C		N/A	N/A		1000	1500	
	T_{R+D} @-40 C		N/A	N/A		5000	7500	
VIEWING ANGLE	TOP TO BOTTOM			+85 to -70		+85 to -70		Deg
	LEFT TO RIGHT			±75		±75		
CAPACITANCE (1/2" DIGIT)				750		750		pf
EXPECTED LIFE				>100,000		>100,000		hrs

* CUSTOM FLUIDS OTHER THAN SHOWN IN THIS SPECIFICATION ARE AVAILABLE CONSULT THE FACTORY FOR SPECIAL VOLTAGE REQUIREMENTS

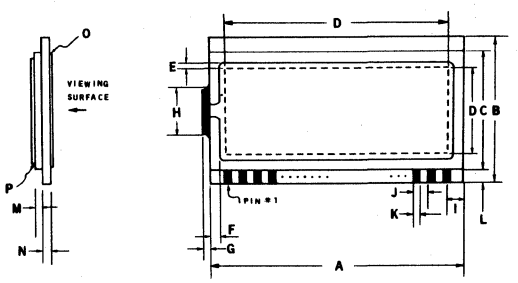
TYPICAL LIQUID CRYSTAL TEMPERATURE RESPONSE



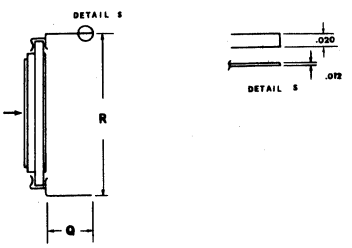


ENGINEERING DESIGN GUIDE

ELASTOMERIC



D.I.L. PACKAGE



Mechanical Specification:

A. Over-all length of glass: _____ ± 0.010" (± 0.254mm)
B. Over-all width of glass: _____ ± 0.010" (± 0.254mm)
C. Width of smaller glass: _____ ± 0.010" (± 0.254mm)
D. Dimension of viewing window: H ___ x W _____
E. Recommended minimum clearance between edge of seal to image area is 0.05" (1.27mm)
F. Perimeter seal: Recommended min width for displays under $(3")^2$: 0.075"
Recommended min width for displays over $(3")^2$: 0.100"
G. Maximum profile of end seal plug: 0.050" (1.27mm)
H. Maximum width of end seal: 0.30" (7.62mm) center line unless otherwise specified.
I. Distance of glass edge to the center of 1st pad: _____
J. Pitch of contact: _____ fixed at 0.10" (2.54mm) for D.I.L. termination
K. Width of contact pad: _____
L. Width of contact ledge: _____ min. 0.120" (3.048mm) for D.I.L. termination
M. Back glass thickness: _____ Recommended 0.028" (0.7 mm)
(Thinner glass for reduction of parallax effect)
N. Front glass thickness: _____ Recommended 0.043" (1.1 mm)
O. Front polarizer: 0.005" (0.127mm) regular material, 0.007" (0.178mm) wide temp. material
P. Pack polarizer and reflector: 0.012" (0.35mm) regular, 0.014" (0.356mm) wide temp. material
Q. Length of pin termination, measured from bottom of display: _____
R. Row to row spacing of pins fixed at B + 0.10" (2.54mm)

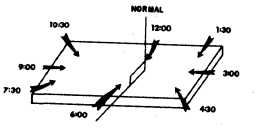
Optical Specification:

Viewing angle is defined as the angle referenced from the normal of the display at which maximum contrast can be achieved. Viewing angle is normally defined by the hour position of the clock.

Electrical Specification:

Multiplex level: _____
Vrms on: _____ V Vrms off: _____ V
Driving frequency: _____ Hz. min. 32 Hz max. 300 Hz
Operating temperature: _____ °C to _____ °C
Storage temperature: _____ °C to _____ °C

Lighting mode ☐ REFLECTIVE ☐ TRANSFLECTIVE
☐ POSITIVE ☐ REVERSE BACKGROUND
☐ TRANSMISSIVE



Arrow denotes direction of viewing
Viewing angle: _____ o'clock

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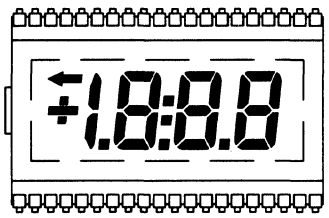
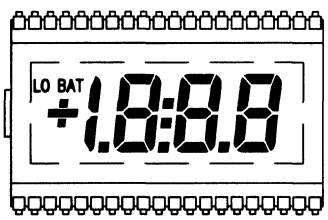
OCULAR STANDARD LCD PRODUCTS

*JH □-□□ 35 -□□ -□□



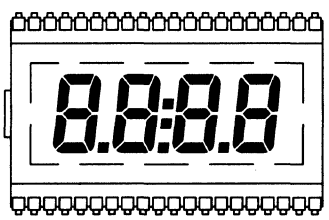
DIGIT HEIGHT OPTIONS:
* 0.35"
* 0.50"
* 0.70"

*JH □-□□ 36 -□□ -□□



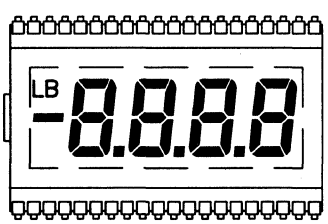
* 0.50"

*JH □-□□ 40 -□□ -□□



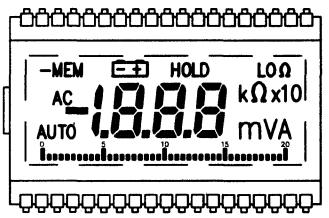
* 0.35"
* 0.50"
* 0.70"
* 1.00"

*JH □-□□ 41 -□□ -□□



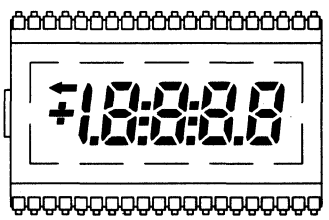
* 0.50"

*JH □-□□ 42 -□□ -□□



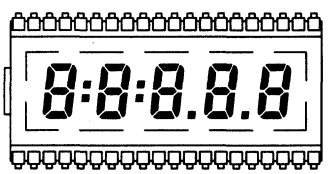
DIGIT HEIGHT OPTIONS:
* 0.35"

*JH □-□□ 45 -□□ -□□



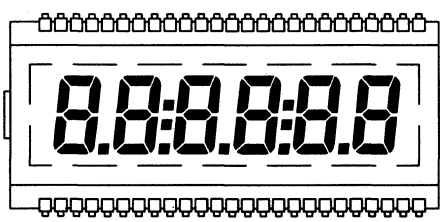
* 0.50"

*JH □-□□ 51 -□□ -□□



* 0.35"

*JH □-□□ 60 -□□ -□□



* 0.50"
* 0.70"

* ORDERING INFORMATION

*JH□ 35 35 □ □ □ □

FLUID TYPE
H=HIGH TEMPERATURE (INDUSTRIAL TYPE)
S=STANDARD TEMPERATURE (COMMERCIAL TYPE)
C=CUSTOM FLUID MIXTURE

CHARACTER HEIGHT
35=0.35"
50=0.50"
70=0.70"
100=0.100"

DIGIT TYPE
35=3-1/2, ARROW
36=3-1/2, LO BAT
40=4
45=4-1/2, ARROW
41=4,MINUS,LO BAT
42=METER LCD
51=5
60=6

POLARIZER TYPE
H=HIGH TEMPERATURE
S=STANDARD TEMPERATURE

POLARIZER MODE
R=REFLECTIVE
F=TRANSFLECTIVE
T=TRANSMISSIVE

POLARIZER COLOR
N=NEUTRAL
B=BLUE
R=RED
G=GOLD
S=SPECIAL

CONNECTOR
P=PIN
E=ELASTOMER

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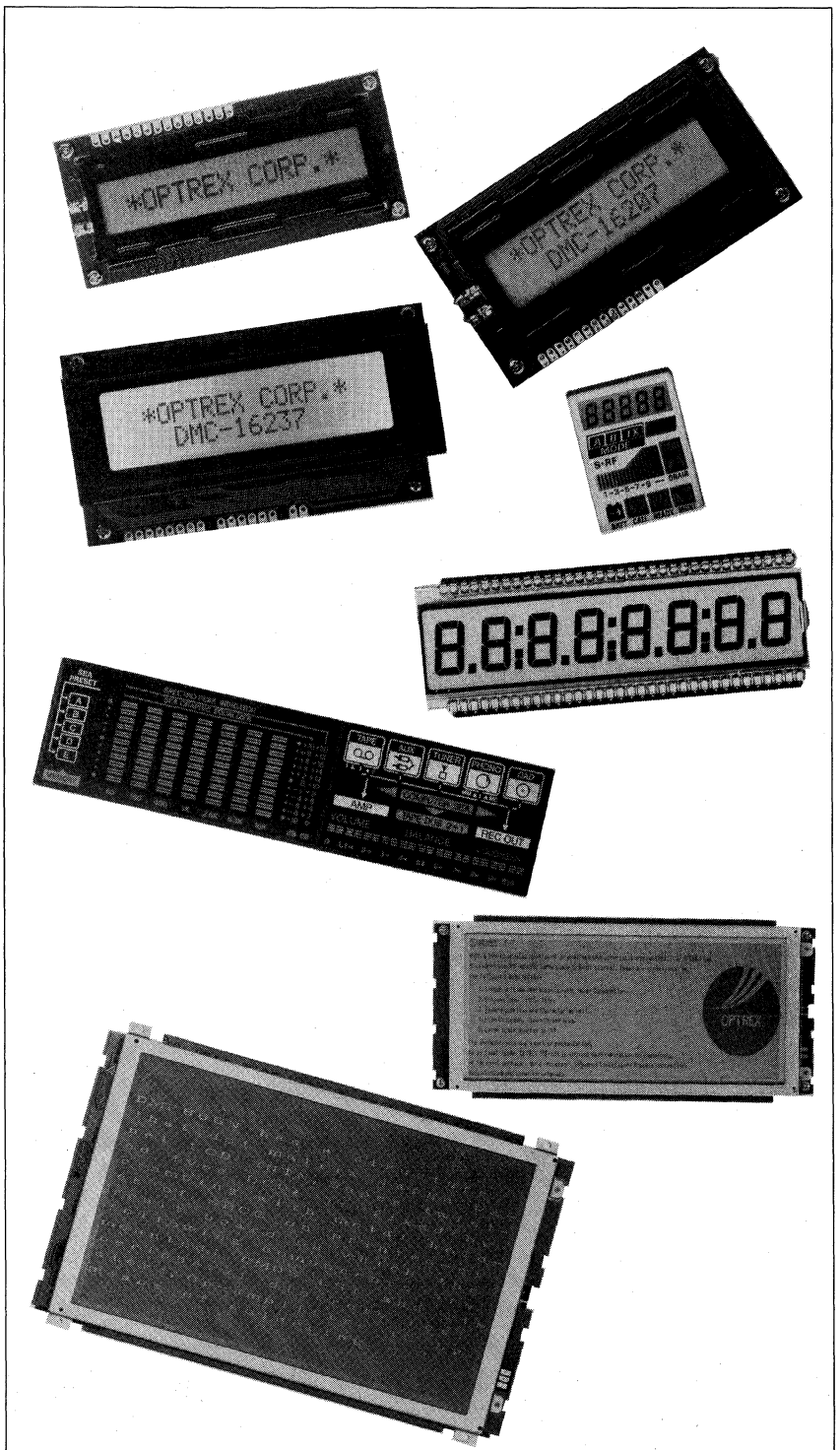
Optrex

LIQUID CRYSTAL DISPLAY TECHNOLOGIES

For products demonstrations and technical support in standard and custom LCD displays, contact:

SATORI ELECTRIC
23717 HAWTHORNE BLVD., SUITE 201
TORRANCE, CA 90505
TEL. (213) 378-9478 FAX (213) 375-8565



OPTREX CORP is a specialist liquid crystal display (LCD) manufacturer using the advanced technology of Asahi Glass Co., Ltd. and Mitsubishi Electric Corp.
With the technology inherited from these super-companies, we are preparing for a new stage of full-scale, aggressive and creative expansion.

DMC Series

OPTREX's Dot Matrix Liquid Crystal Display Module DMC Series can easily be connected to a micro computer by using LSI's which contain sophisticated control circuits, character generators, etc.
DMC Series is most suitable for use with micro computer peripheral, word processor, POS terminal and telecommunication systems etc.

DMF Series

With a liquid crystal display of an excellent characteristics and reliability, OPTREX has developed the "DMF Series" for large scale graphic display. Contact SATORI for details on the large selection of graphic modules from OPTREX.

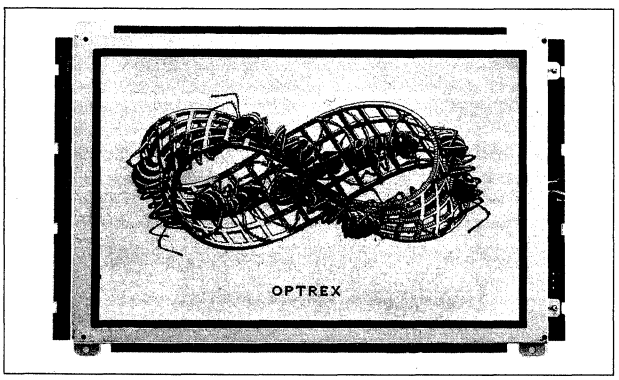
APPLICATIONS

- Personal Computer
- Electronic Typewriter
- Word Processor
- Facsimile
- Plain Paper Copier
- Telecommunication Systems
- Instrument Devices
- POS Terminal
- Medical Instruments
- Fish Finder
- Over Head Projector
- Oscillograph
- Handheld Terminal
- Other Peripherals

Optrex Corporation.

LIQUID CRYSTAL DISPLAY MODULE

Graphic Type/**DMF** Series



Features

(1) Low voltage operation, Low power consumption.
(2) Compact, Light, Thin.
(3) Graphic, Figure, and Character display.
(4) High contrast, Wide viewing angle as Super TN LCDP are employed.
(5) Large area display as CRT.
(6) Black and White Technology now available.
(7) Choices of EL or CCT Backlighting.

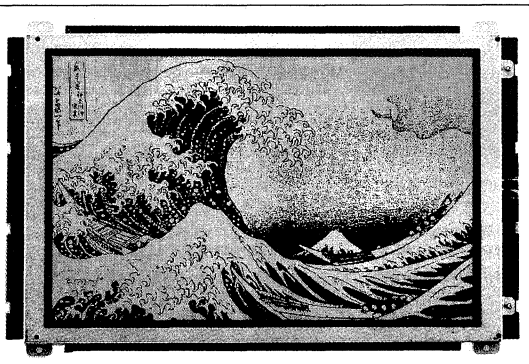
Standard Module Formats:

Dot Pixels (W x H)	*1) Type No.	Dot Size (W x H mm)	Dot Pitch (W x H mm)	Module Dimensions (W x H x D mm)	Viewing Area (W x H mm)	Driving Methods (duty/bias)		*2) Variation				
								R	EL	FL	OHP	BW
112 x 128	DMF5002N	0.49 x 0.50	0.53 x 0.54	90.6 x 110.0 x 12.8	66.0 x 77.0	1/128D	1/12B	○	○	—	—	—
160 x 128	DMF608N	0.55 x 0.55	0.60 x 0.60	129.0 x 102.0 x 11.2	101.0 x 82.0	1/64D	1/9B	○	○	—	—	—
	DMF5001N	0.54 x 0.54	0.58 x 0.58	129.0 x 102.0 x 12.8	101.0 x 82.0	1/128D	1/12B	○	○	—	—	—
	DMF5003NY-FW*5)	0.54 x 0.54	0.58 x 0.58	(152.0 x 112.0 x 23.0)	(101.0 x 82.0)	1/128D	1/12B	—	—	○	—	—
240 x 64	DMF633N	0.48 x 0.48	0.53 x 0.53	180.0 x 75.0 x 15.0	132.0 x 39.0	1/32D	1/6B	○	○	—	—	—
	DMF5005N*5)	0.49 x 0.49	0.53 x 0.53	(180.0 x 65.0 x 12.0)	(132.0 x 39.0)	1/64D	1/9B	○	○	—	—	—
240 x 128	DMF660N	0.40 x 0.40	0.45 x 0.45	144.0 x 104.0 x 12.5	114.0 x 64.0	1/128D	1/12B	○	○	—	—	—
256 x 128	DMF682N*5)	0.43 x 0.43	0.47 x 0.47	(147.0 x 116.0 x 12.0)	(127.0 x 70.0)	1/64D	1/9B	○	○	—	—	—
480 x 64	DMF612N	0.41 x 0.41	0.47 x 0.47	260.00 x 58.0 x 12.0	229.5 x 36.0	1/64D	1/9B	○	○	—	—	—
480 x 128	DMF605AN	0.41 x 0.41	0.47 x 0.47	259.0 x 90.0 x 12.6	229.5 x 66.0	1/64D	1/9B	○	○	—	—	—
	DMF624AN	0.41 x 0.41	0.47 x 0.47	259.0 x 90.0 x 12.6	229.5 x 66.0	1/64D	1/9B	○	○	—	—	—
	DMF6102N*5)	0.43 x 0.43	0.47 x 0.47	(268.0 x 94.0 x 12.6)	(229.5 x 66.0)	1/128D	1/12B	○	○	—	—	—
640 x 200	DMF651AN	0.32 x 0.46	0.35 x 0.49	275.0 x 132.0 x 12.6	232.0 x 106.0	1/200D	1/13B	○	○	○	—	—
	DMF6107NWU-FW*5)	0.32 x 0.46	0.35 x 0.49	(296.0 x 152.0 x 19.8)	(232.0 x 106.0)	1/200D	1/13B	—	—	○	—	○
640 x 400	DMF666AN	0.33 x 0.33	0.36 x 0.36	282.0 x 183.0 x 13.0	238.5 x 152.0	1/200D	1/13B	○	○	○	—	○
	DMF665NB	0.33 x 0.33	0.36 x 0.36	378.0 x 260.0 x 24.0	238.5 x 152.0	1/200D	1/12B	—	—	—	○	—
	DMF675NB*5)	0.29 x 0.29	0.32 x 0.32	(263.0 x 191.0 x 5.0)	(210.0 x 131.0)	1/200D	1/13B	—	—	—	○	—
	DMF694NWU-FW*5)	0.33 x 0.33	0.36 x 0.36	282.0 x 201.0 x 27.0	238.0 x 152.0	1/200D	1/13B	—	—	○	—	○
640 x 480	DMF6106N*5)	0.30 x 0.30	0.33 x 0.33	(271.0 x 195.4 x 13.5)	(219.0 x 166.0)	(1/240D	1/14B)	○	○	—	—	—

Neutral Mode, Yellow Mode and Blue Mode etc, are available.

Various types of back light are available in its series, and stated with following abbreviations.
R. . . . .Reflective Type EL...With EL
FL. . . .With Cold Cathode Fluorescent Tube
OHP . .Transmissive for OHP
BW . . .Black and White with FL

- **FOR ON-SITE DEMONSTRATIONS AND IN-DEPTH TECHNICAL ASSISTANCE REGARDING STANDARD AND *CUSTOM* DISPLAY REQUIREMENTS, PLEASE CONTACT US FOR AN IMMEDIATE RESPONSE:**

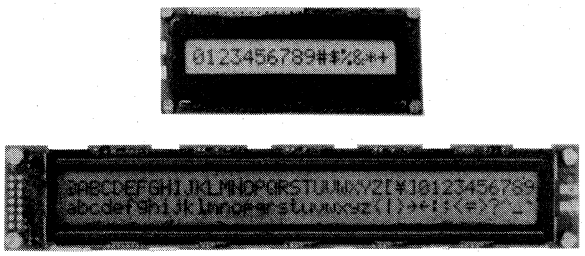


SATORI ELECTRIC (AMERICA) INC.
23717 HAWTHORNE BLVD., SUITE 201 TORRANCE, CA 90505
TEL. (213) 378-9478 FAX (213) 375-8565

Optrex Corporation.

LIQUID CRYSTAL DISPLAY MODULE

Character Type/DMC Series



Features

(1) 8-bit or 4-bit MPU interface is available.
(2) 160 JIS type characters such as Alphabet, Numeral and Kana and 32 special characters and symbols can be displayed by internal character generator (ROM).
(3) Random symbols can be displayed by character generator (RAM).
(4) Many instructional functions by means of program such as "clear display," "home cursor," "on/off cursor," "blink character," "shift display," "shift cursor," "read/write display data," etc. are available.
(5) Compact and light weight design enable easy assembly on device.
(6) Single "+5V" power supply (except for Extended Temperature Type).
(7) Low power consumption.

Standard Module Formats:

Display Format	*1) Type No.	Display Fonts	Character Size (W x H mm)	Dot Size (W x H mm)	Module Dimensions (W x H x D mm)	*2) Variation						
						TN Type				*3) NTN Type		
						R	H	EL	LED	R	EL	LED
16 characters x 1 line	DMC16106A	5 x 11 dots	3.2 x 8.2	0.6 x 0.7	80 x 36 x 10	○	○	○	—	—	—	—
	DMC16106C	5 x 8 dots	3.2 x 5.95	0.6 x 0.7	80 x 36 x 10	○	○	○	—	—	—	—
	DMC16117A	5 x 8 dots	3.2 x 5.95	0.6 x 0.7	80 x 36 x 10	○	○	○	—	○	○	—
	DMC16128	5 x 7 dots + Cursor	4.84 x 9.66	0.92 x 1.1	122 x 33 x 11	○	○	○	—	—	—	—
	DMC16129	5 x 7 dots + Cursor	4.84 x 9.66	0.92 x 1.1	122 x 33 x 11	○	○	○	—	—	—	—
	DMC16101A-EB	5 x 11 dots	8.2 x 3.2	0.7 x 0.6	85 x 36 x 10	—	—	○	—	—	—	—
	DMC16105-LY	5 x 8 dots	3.2 x 5.95	0.6 x 0.7	80 x 36 x 15	—	—	—	○	—	—	—
	DMC16188-LY	5 x 8 dots	6.0 x 14.54	1.152 x 1.765	151 x 50 x 14.2	—	—	—	○	—	—	○
16 characters x 2 lines	DMC16207	5 x 8 dots	2.95 x 5.55	0.55 x 0.65	80 x 44 x 11	○	○	○	—	○	○	—
	DMC16230	5 x 7 dots + Cursor	4.84 x 9.66	0.92 x 1.1	122 x 44 x 11	○	○	○	—	○	○	○
	DMC16249B	5 x 8 dots	2.95 x 4.35	0.55 x 0.5	80 x 36 x 11	○	○	○	—	○	○	—
	DMC16202-LY	5 x 8 dots	2.95 x 5.55	0.55 x 0.65	84 x 45 x 15.1	—	—	—	○	—	—	○
	DMC16204	5 x 8 dots	2.95 x 5.55	0.55 x 0.65	84 x 40 x 10.9	○	—	—	○	—	—	—
	DMC16204-LY	5 x 8 dots	2.95 x 5.55	0.55 x 0.65	80 x 40 x 16.1	○	—	—	○	—	—	—
16 characters x 4 lines	DMC16433	5 x 8 dots	2.95 x 4.75	0.55 x 0.55	87 x 60 x 11	○	○	○	—	○	○	—
20 characters x 1 line	DMC20171	5 x 7 dots + Cursor	3.2 x 5.55	0.6 x 0.65	182 x 33.5 x 13	○	○	○	—	—	—	—
20 characters x 2 lines	DMC20215	5 x 8 dots	3.2 x 5.55	0.6 x 0.65	116 x 44 x 11	○	○	○	—	○	—	—
	DMC20261	5 x 8 dots	3.2 x 5.55	0.6 x 0.65	116 x 37 x 11	○	○	○	—	○	○	○
20 characters x 4 lines	DMC20434	5 x 8 dots	2.95 x 4.75	0.55 x 0.55	98 x 60 x 11	○	○	○	—	○	○	○
	DMC20481-LY	5 x 8 dots	2.95 x 4.75	0.55 x 0.55	98.5 x 61 x 15.6	—	—	—	○	—	—	○
24 characters x 1 line	DMC24138	5 x 11 dots	3.2 x 8.2	0.6 x 0.7	118 x 36 x 11	○	○	○	—	○	—	—
24 characters x 2 lines	DMC24227	5 x 8 dots	3.2 x 5.55	0.6 x 0.65	118 x 36 x 11	○	○	○	—	○	○	—
32 characters x 1 line	DMC32132	5 x 11 dots	3.2 x 8.2	0.6 x 0.7	174.5 x 31 x 11	○	○	○	—	—	—	—
32 characters x 2 lines	DMC32216	5 x 8 dots	3.2 x 5.55	0.6 x 0.65	175 x 44 x 11	○	○	○	—	—	—	—
	DMC32239	5 x 8 dots	3.45 x 5.55	0.65 x 0.65	174.5 x 31 x 11	○	○	○	—	○	○	—
40 characters x 1 line	DMC40131	5 x 11 dots	3.2 x 8.2	0.6 x 0.7	182 x 33.5 x 11	○	○	○	—	—	—	—
40 characters x 2 lines	DMC40202-LY	5 x 8 dots	3.2 x 5.55	0.6 x 0.65	182 x 34.5 x 15.1	—	—	—	○	—	—	○
	DMC40205-LY	5 x 8 dots	3.2 x 5.55	0.6 x 0.65	170 x 31.5 x 15.5	—	—	—	○	—	—	—
	DMC40218	5 x 8 dots	3.2 x 5.55	0.6 x 0.65	182 x 33.5 x 11	○	○	○	—	○	○	○
40 characters x 4 lines	DMC4057	5 x 8 dots	2.78 x 4.89	0.5 x 0.55	190 x 54 x 10	○	○	○	—	○	○	○
	DMC40401N	5 x 8 dots	2.78 x 4.89	0.5 x 0.55	190 x 54 x 11	—	—	—	—	○	—	○

OPTREX LCD Character Modules are available in many backlighting options as well as in standard TN and N-TN Fluid Technologies.

Type	Operating Temp.	Storage Temp.
Normal Temp.	0°C ~ +50°C	-20°C ~ +70°C
Extended Temp.	-20°C ~ +70°C	-30°C ~ +80°C

• FOR ON-SITE DEMONSTRATIONS AND IN-DEPTH TECHNICAL ASSISTANCE REGARDING STANDARD AND *CUSTOM* DISPLAY REQUIREMENTS, PLEASE CONTACT US FOR AN IMMEDIATE RESPONSE:

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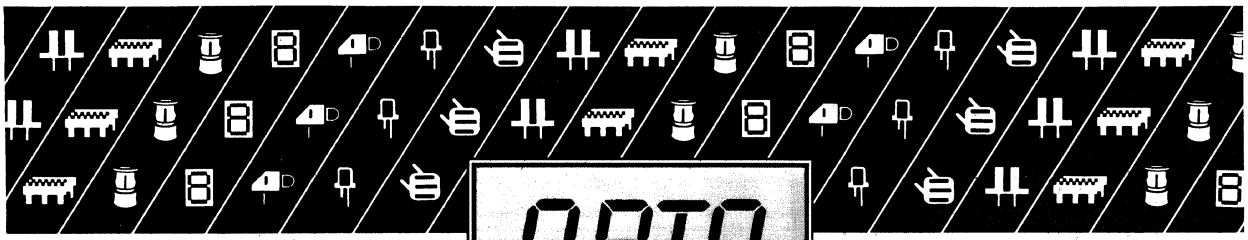

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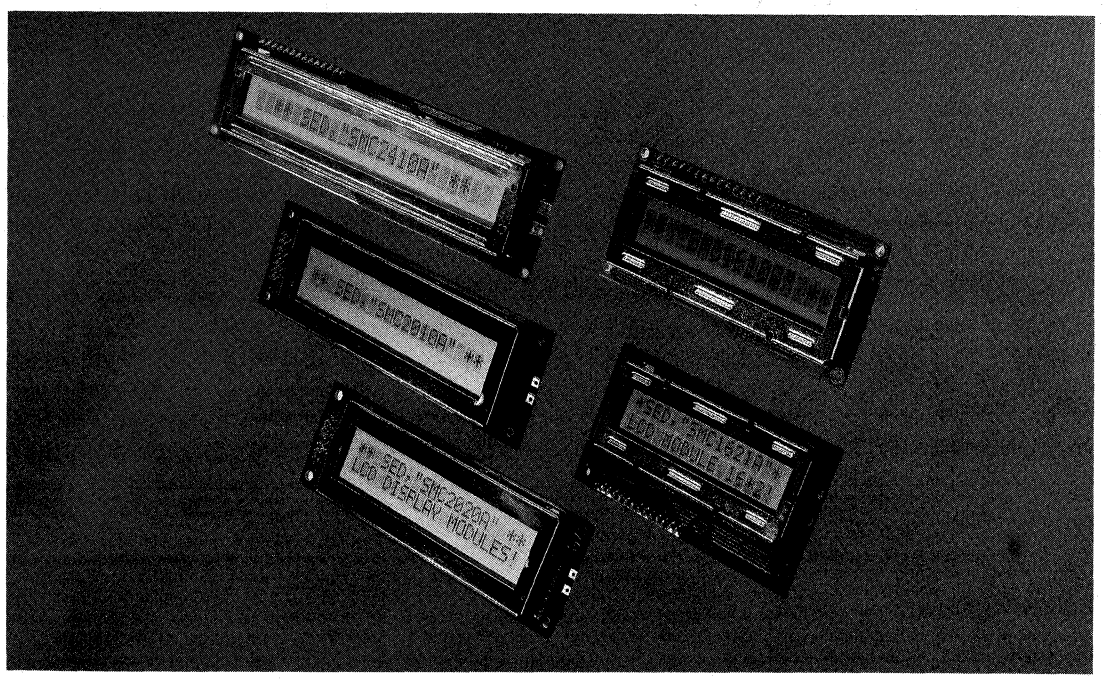
DOT MATRIX LCD MODULE



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- OA Equipments — ECR, Copier, Facsimile
- Data Products — Word Processor, Personal Computer, Typewriter
- Automotive — ETR, Speedometer, Dashboard
- Communications Equipments — Telephone, Telephone Terminal, Personal Wireless Terminal

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SAMTRON

LIQUID CRYSTAL DISPLAY

MODELS

MODEL	CHARACTER	VIEWING AREA (W×H)	CHARACTER SIZE (W×H)	DOT SIZE (W×H)	DUTY RATIO	OVERALL DIMENSIONS (W×D×H)
SMC — 1610A	16×1	64.5×13.8	3.07×6.56	0.55×0.75	1/16	80×36×9.8
SMC — 1621A	16×2	64.5×13.8	2.95×4.35	0.55×0.5	1/16	
SMC — 1640A	16×4	61.8×25.2	2.95×4.75	0.55×0.55	1/16	87×60×9.3
SMC — 2010A	20×1	83.0×18.6	3.2×5.95	0.6 ×0.7	1/16	116×37×9.3
SMC — 2020A	20×2	83.0×18.6	3.2×5.55	0.6 ×0.65	1/16	116×37×9.3
SMC — 2040A	20×4	76.0×25.2	2.95×4.75	0.55×0.55	1/16	98×60×10
SMC — 2410A	24×1	100 ×13.8	3.07×6.56	0.55×0.75	1/16	126×36×9.6
SMC — 2420A	24×2	93.5×15.8	3.15×5.75	0.55×0.55	1/16	118×36×9.6
SMC — 4011A	40×1	154.5×15.8	3.05×6.56	0.55×0.75	1/16	182×38.5×10
SMC — 4020A	40×2	154.5×15.8	3.2 ×5.55	0.6 ×0.65	1/16	182×35×10
SMC — 4040A	40×4	147.5×29.5	2.78×4.89	0.5 ×0.55	1/16	190×55×9.3
SMC — 8020A	80×2	222 ×5	2.2 ×4.35	0.4 ×0.5	1/16	259.8×38.9×9.8

ABSOLUTE MAXIMUM RATINGS

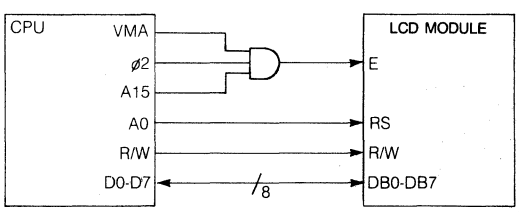
ITEM	SYMBOL	TEST CONDITION	STANDARD VALUE			UNIT
			MIN.	TYP.	MAX.	
POWER SUPPLY VOL. FOR LOGIC	Vdd-Vss	—	0	—	7	V
POWER SUPPLY VOL. FOR LCD DRIVE	Vdd-Vo	—	0	—	13.5	V
INPUT VOL.	VI	—	Vss	—	Vdd	V
OPERATING TEMPERATURE	Topr	—	0	—	+50	°C
STORAGE TEMPERATURE	Tstg	—	−20	—	+60	°C

ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	TEST CONDITION	STANDARD VALUE			UNIT
			MIN.	TYP.	MAX.	
INPUT HIGH VOL.	V_{IH}	—	2.2	—	Vdd	V
INPUT LOW VOL.	V_{IL}	—	−0.3	—	0.6	V
OUTPUT HIGH VOL.	V_{OH}	I_{OH} =0.21mA	2.4	—	—	V
OUTPUT LOW VOL.	V_{OL}	I_{OL} =1.2mA	—	—	0.4	V
POWER SUPPLY CURRENT	Idd	Vdd=5.0V	—	2.0	4.0	mA

I/O Terminals and an example of system block diagram

Terminal	I/O	Function
Vss	I	Power supply (GND)
Vdd	I	Power supply (5V)
Vo	I	LCD contrast adjustment
RS	I	Register selection
R/W	I	Read/Write selection
E	I	Enable input
DB0-DB7	I/O	Data input/output



Options

(1) STN type is also available.
(2) HQ type of wide range temperature is available on demand at operating: −10°C ~ +70°C
(3) BACKLIT type is available on demand.

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SAMTRON LIQUID CRYSTAL DISPLAY

FOR TIMEPIECE (WATCH, CLOCK)

MODEL	EXTERNAL DIMENSION (W×H×Tmm)	VIEWING AREA (W×Hmm)	DIGIT	DRIVING METHOD (DUTY, BIAS, VOL)	MATCHING LSI
SLW0601A	23.9×14.2×0.5	21.9×9.7	6	½ D, ½B, 3.0V	KS5189
SLW0402A	52.0×27.5×1.1	46.0×20.5	4	½D, ½B, 3.0V	MSM5004
SLW0603A	20.5×13.2×0.5	18.5×10.2	6	½D, ½B, 3.0V	MSM5003
SLW0403A	20.5×13.2×0.5	18.3×9.0	4	⅓D, ½B, 3.0V	
SLK0401A	52.0×22.0×1.1	47.0×13.0	4	½D, ½B, 3.0V	KS5171
SLK0303A	52.0×27.5×1.1	47.0×21.5	3½	⅓D, ⅓B, 4.5V	

FOR INDUSTRIAL USE

MODEL	EXTERNAL DIMENSION (W×H×Tmm)	VIEWING AREA (W×Hmm)	DIGIT	DRIVING METHOD (DUTY, BIAS, VOL)	MATCHING LSI
SLS0601A	93.98×38.1×1.1	88.8×25.4	6	⅓D, ⅓B, 5.0V	
SLS0313A	65.8×33.8×1.1	60.8×21.2	3½	STATIC, 5.0V	ICL7106 ICL7136
SLS0301A	50.7×30.4×1.1	46.7×18.4	3½	STATIC, 5.0V	ICL7106 ICL7136
SLS0404A	65.8×33.8×1.1	61.8×25.7	4½	⅓D, ⅓B, 5.0V	ICL7129
SLS0414A	65.8×33.8×1.1	60.8×21.2	4½	⅓D, ⅓B, 5.0V	ICL7129
SLS0308A	55.6×19.8×0.7	49.3×16.8	3½	STATIC, 5.0V	

FOR AUTOMOTIVE

MODEL	EXTERNAL DIMENSION (W×H×Tmm)	VIEWING AREA (W×Hmm)	DIGIT	DRIVING METHOD (DUTY, BIAS, VOL)	MATCHING LSI
SLA0401A	38.1×22.0×0.7	32.1×13.1	4	STATIC, 2.7V	
SLA0402A	59.0×13.0×1.1	53.0×7.4	4	½D, ½B, 5.0V	μPD1708G-011
SLA0403A	50.0×20.0×1.1	46.0×14.0	4	½D, ½B, 5.0V	μPD1708G-011
SLA0606A	40.0×18.0×1.1	35.5×12.0	6	½D, ½B, 5.0V	μPD1708G-011
SLA0604A	32.0×20.0×0.7	28.0×13.0	6	½D, ½B, 5.0V	μPD1708G-011
SLA0602A	40.0×17.9×1.1	35.5×10.7	6	½D, ½B, 5.0V	μPD1708AG-019

FOR CALCULATOR

MODEL	EXTERNAL DIMENSION (W×H×Tmm)	VIEWING AREA (W×Hmm)	DIGIT	DRIVING METHOD (DUTY, BIAS, VOL)	MATCHING LSI
SLC0803A	30.0×11.45×0.5	26.5×6.8	8	⅓D, ½B, 3.25V	KS6025A UM3128H
SLC0802A	28.2×10.0×0.5	25.3×6.3	8	⅓D, ½B, 3.25V	KS6021A
SLC0804A	34.0×12.8×1.1	29.5×6.3	8	⅓D, ½B, 2.85V	KS6025A
SLC0807A	40.0×14.4×1.1	35.0×7.65	8	⅓D, ½B, 2.85V	
SLC0811A	60.0×18.4×1.1	55.0×11.9	8	⅓D, ½B, 2.85V	
SLC0816A	53.0×14.5×1.1	44.0×9.0	8	⅓D, ½B, 3.0V	

TYPICAL ELECTRO-OPTICAL CHARACTERISTICS

GRADES		CONSUMER							HIGH RELIABILITY		UNIT
LIQUID CRYSTALS		STATIC	1/2 DUTY	1/3 DUTY	1/4 DUTY	1/8 DUTY	1/16 DUTY	1/32 DUTY	STATIC	1/2 DUTY	
OPERATING TEMPERATURE		0 ~ +50							−30 ~ +80		°C
STORAGE TEMPERATURE		−20 ~ +60							−40 ~ +85		°C
OPERATING VOLTAGE		3.0±0.1	3.0±0.1	3.1±0.1	3.1±0.1	6.0±0.5	7.5±0.5	10.0±0.5	5.0±0.5	5.0±0.5	V
POWER CONSUMPTION		1.2	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	μA/Cm²
RISE / FALL	+40°C	60/50	60/50	100/80	100/80	*80/80	*90/80	*100/80	45/40	*55/45	mS
	+25°C	100/80	100/80	120/100	120/100	*120/100	*120/100	*150/110	60/50	*80/65	
	0°C	600/400	400/350	400/350	600/400	*300/200	*400/300	*450/300	200/250	*300/250	
	−10°C	1000/800	1000/800	1200/1000	1300/900	*800/500	*850/550	*900/600	400/300	*600/500	
	−20°C	—	—	—	—	—	—	—	700/500	*900/700	
	−30°C	—	—	—	—	—	—	—	1000/800	*1200/1000	
CAPACITANCE		1200						1500	1500		pF/cm²
DC RESISTANCE		100							100		MΩ/mm²

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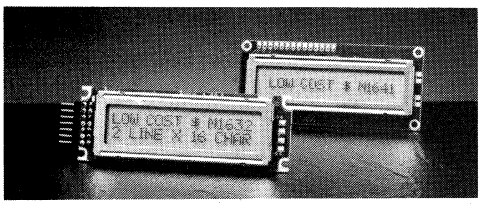
Seiko Instruments

LIQUID CRYSTAL DISPLAYS

DOT MATRIX MODULES

Seiko Instruments Dot Matrix Character Modules were designed with your application in mind. The expanded range offers a wide variety of sizes, all using industry standard controllers and drivers. They are now available with our grey-mode Supertwist option for enhanced contrast and viewing angle. The compact modules are also available with an electroluminescent (EL) backlight or LED panel for use in dark environments.



- ☐ 5 x 7 Dot Matrix plus cursor
- ☐ Character Generator and Data RAM on board
- ☐ Compact, lightweight, and low cost
- ☐ Single 5 volt input
- ☐ 4 or 8 bit Parallel Interface
- ☐ EL or LED Backlight available

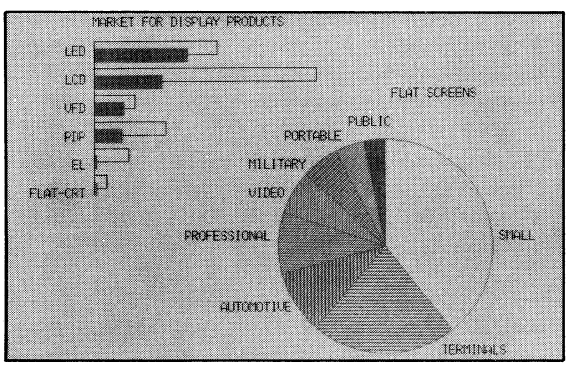
Model	Outside Dim.	No. Characters x No. Lines	Character Size	Dot Size
M1641	80 x 36 x 11.3	16 x 1 line	3.07 x 5.73	0.55 x 0.75
M1632	85 x 30 x 10.1	16 x 2 lines	2.78 x 4.27	0.50 x 0.55
L1612	80 x 36 x 11.3	16 x 2 lines	2.95 x 3.80	0.55 x 0.50
L1614	87 x 60 x 11.3	16 x 4 lines	2.95 x 4.15	0.55 x 0.55
L2012	116 x 37 x 11.3	20 x 2 lines	3.20 x 4.85	0.60 x 0.65
L2014	98 x 60 x 11.3	20 x 4 lines	2.95 x 4.15	0.55 x 0.55
*M24111	126 x 36 x 11.3	24 x 1 line	3.15 x 7.90	0.55 x 0.70
L2432	118 x 36 x 11.3	24 x 2 lines	3.20 x 4.85	0.60 x 0.65
*L4041	182 x 33.5 x 11.3	40 x 1 line	3.15 x 7.90	0.55 x 0.70
L4042	182 x 33.5 x 11.3	40 x 2 lines	3.20 x 4.85	0.60 x 0.65
M4024	190 x 54 x 10.1	40 x 4 lines	2.78 x 4.27	0.50 x 0.55

Unit: mm

*5 x 10 Dot Matrix plus cursor

GRAPHIC MODULES

The Seiko Twist technology featured in the following graphic modules solves many of the problems associated with large size, high resolution LCDs. Improved contrast and viewing angle combined with a variety of options make the Seiko Twist modules compatible with your display requirements.



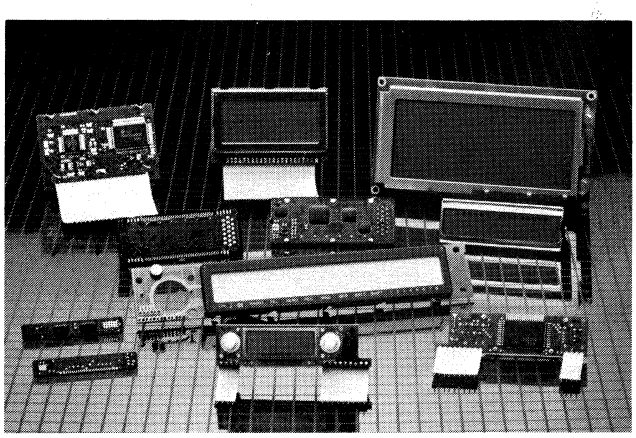
- ☐ Options
- ☐ Reflective or transflective polarizers
- ☐ Positive or negative character image
- ☐ Electroluminescent backlighting
- ☐ Grey or yellow background

Model	Outside Dim. (W x H x D)	Dot Format (Row x Column)	Display Area (W x H)	Dot Size (W x H)
G2436	180 x 75 x 12	64 x 240	127.2 x 33.9	0.49 x 0.49
G648D	270 x 150 x 12	220 x 640	224.0 x 98.0	0.32 x 0.46
G644F	270 x 198 x 12	400 x 640	230.3 x 143.9	0.33 x 0.33

Unit: mm

CUSTOM DISPLAYS

With over 15 years of custom LCD experience, Seiko Instruments can meet your needs for custom LCDs or custom Liquid Crystal Display Modules (LCM). Special type styles or graphic patterns are possible in glass sizes from ¼″ x ½″ up to 10″ x 7″. Static drive up to 1/200 duty cycle, colored polarizers, and a variety of backlighting methods round out Seiko's custom capabilities. Complete design and applications assistance is only a phone call away. Contact Seiko Instruments when your design calls for custom LCDs or LCMs, you will like the results.



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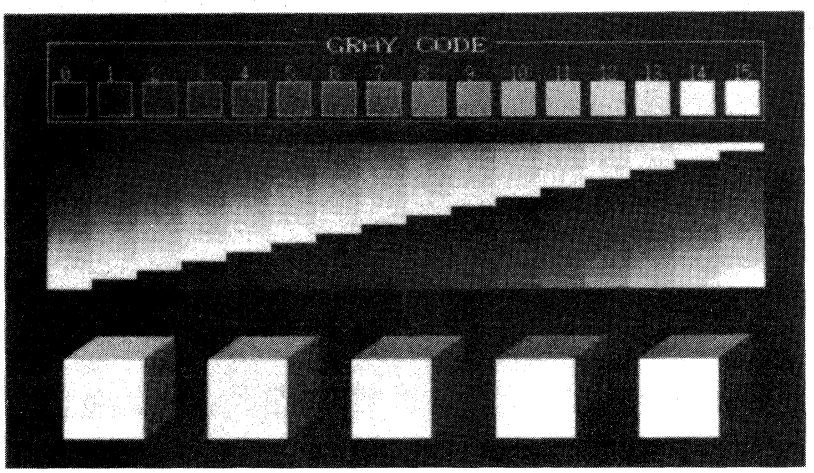
SHARP

EL Display Units

Five Good Reasons Why Sharp Remains the Leader in EL Display Innovation



Gray Scale

16 Levels of Gray Scale Capability

Sharp technology has found a way to create EL display units which offer 16 levels of gray scale capability. Gray scale gives images greater depth, clarity, and subtlety and extends the range of usable softwares, allowing difference of colours being expressed on the monochrome screen. This sophisticated feature is a result of two important Sharp innovations: unique drive electronics and advanced thin-film production technology.

Larger Displays with Finer Resolution

New large-size EL display units from Sharp open the door to a range of new EL display application. In addition to larger screen size, they offer higher precision and resolution for easier viewing and finer detail. New EL display unit with 1,024 x 800 dots—achieving 4 lines per millimeter, equivalent to a high-definition CRT—is ideal for CAD system applications. New 640 x 480-dot unit has the same display format as the IBM® PS/2.

*IBM Personal System/2 is a registered trademark of International Business Machines Corporation.

Wider Operating Temperature Range

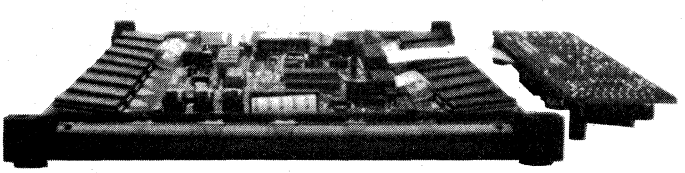
Operating in temperatures from −20°C to +65°C, Sharp's new EL display units assure high reliability in harsh environments. While Sharp has previously developed special EL display units for wide temperature ranges, new EL display units are available in a thinner and lighter package, consuming lower power.

Innovative Baseplate Structure

Placing the baseplate behind the EL panel and eliminating the aluminum front frame makes entire EL display unit thinner, lighter and easier to install.

Detachable DC/DC Converter

While current EL display units have the DC/DC converter built into the PCB, Sharp's new units are fitted with the DC/DC converter attached to the PCB via a flat, flexible cable. The cable and converter can either be mounted on the rear of the unit or trail outside. This structure makes the unit thinner and allows greater flexibility in assembly. By changing the detachable DC/DC converter, new EL display unit can be adapted to diversified voltage requirements.

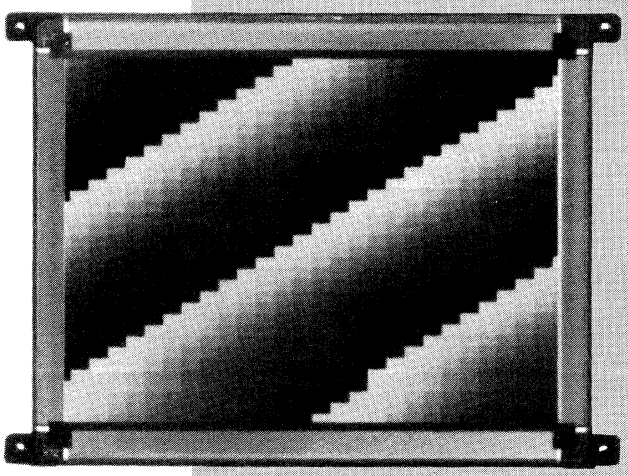


Detachable DC/DC Converter

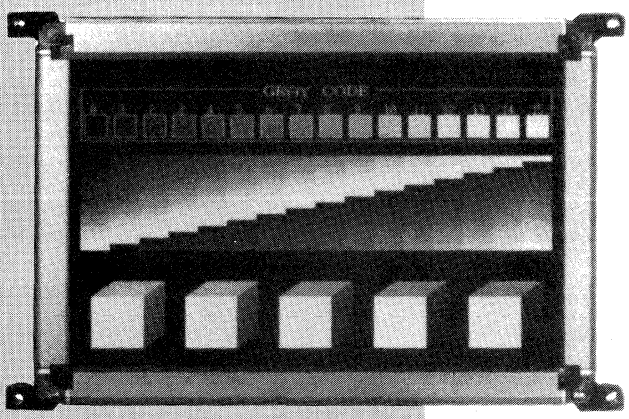
SHARP ELECTRONICS CORP., Micro Electronics Div., Sharp Plaza, Mahwah, NJ 07430-2135•201/529-8757 • Telex: 426903 (SHARPAM MAWA) • Fax: 201/529-8759

SHARP EL Display Units

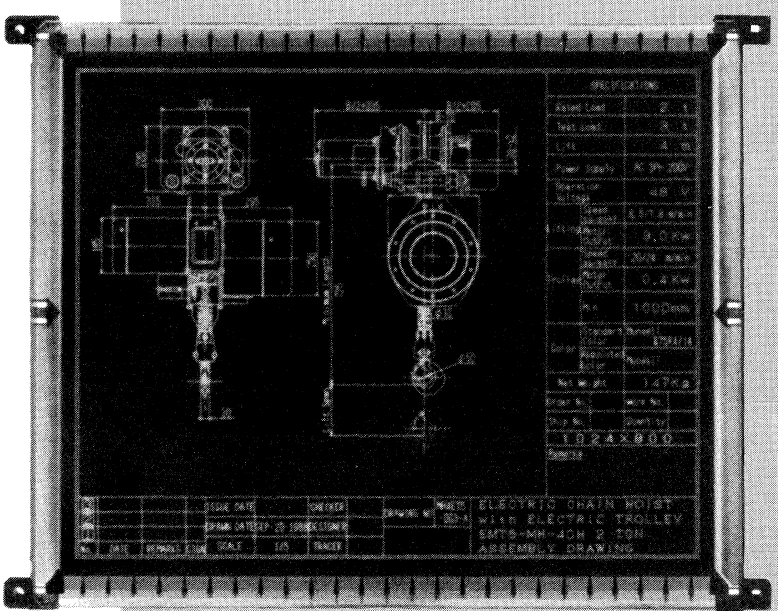
New Product



LJ64ZU48
Gray scale, Baseplate structure



LJ64ZU26
Gray scale, Baseplate structure



LJ024U32
Large-size display (1,024 x 800 dots), Baseplate structure, Detachable DC/DC converter
***Scheduled for market from November 1989**

SHARP ELECTRONICS CORP., Micro Electronics Div., Sharp Plaza, Mahwah, NJ 07430-2135•201/529-8757 • Telex: 426903 (SHARPAM MAWA) • Fax: 201/529-8759

SHARP EL Display Units

Specifications

Parameter	LJ320U21	LJ320U26	LJ512U21	LJ512U25
Effective Display Area (mm)	119.9(W) × 89.9(H)	95.9(W) × 76.7(H)	179.1(W) × 44.7(H)	191.9(W) × 95.9(H)
Display Format (dot)	320(W) × 240(H)	320(W) × 256(H)	512(W) × 128(H)	512(W) × 256(H)
Dot Size (mm)	0.275(W) × 0.225(H)	0.22(W) × 0.22(H)	0.25(W) × 0.20(H)	0.275(W) × 0.225(H)
Dot Pitch (mm)	0.375(W) × 0.375(H)	0.30(W) × 0.30(H)	0.35(W) × 0.35(H)	0.375(W) × 0.375(H)
Display Color	Orange-yellow (Peak Wavelength 5850Å)	Orange-yellow (Peak Wavelength 5850Å)	Orange-yellow (Peak Wavelength 5850Å)	Orange-yellow (Peak Wavelength 5850Å)
Luminance (fL)	30 (Typ.)	30 (Typ.)	33 (Typ.)	30 (Typ.)
Frame Frequency (Hz)	60 (Typ.)	60 (Typ.)	70 (Typ.)	60 (Typ.)
Input Signal Level	LS TTL Level	LS TTL Level	LS TTL Level	LS TTL Level
Supply Voltage (V)	+5, +15	+5, +15	+5, +15	+5, +15
Drive Method	P-N Symmetric Drive	P-N Symmetric Drive	P-N Symmetric Drive	P-N Symmetric Drive
Power Consumption (W)	8 (Typ.)	5 (Typ.)	6 (Typ.)	10 (Typ.)
Operating Temperature (°C)	0 to +55	0 to +55	0 to +55	0 to +55
Storage Temperature (°C)	−25 to +70	−25 to +70	−25 to +70	−25 to +70
Outline Dimensions (mm)	178.5(W) × 148.5(H) × 34.0(D*)	130.0(W) × 110.0(H) × 33.0(D*)	228.5(W) × 108.5(H) × 34.0(D*)	228.5(W) × 148.5(H) × 35.0(D*)
Weight (g)	Approx. 600*	Approx. 400*	Approx. 600*	Approx. 650*
Baseplate Structure	No	Yes	No	No
Detachable DC/DC Converter	No	No	No	No

Parameter	New LJ512U27	New LJ512U32	LJ640U21	LJ640U23
Effective Display Area (mm)	191.9(W) × 95.9(H)	191.9(W) × 95.9(H)	191.9(W) × 59.9(H)	191.9(W) × 83.9(H)
Display Format (dot)	512(W) × 256(H)	512(W) × 256(H)	640(W) × 200(H)	640(W) × 200(H)
Dot Size (mm)	0.275(W) × 0.225(H)	0.275(W) × 0.225(H)	0.23(W) × 0.20(H)	0.185(W) × 0.280(H)
Dot Pitch (mm)	0.375(W) × 0.375(H)	0.375(W) × 0.375(H)	0.30(W) × 0.30(H)	0.30(W) × 0.42(H)
Display Color	Orange-yellow (Peak Wavelength 5850Å)	Orange-yellow (Peak Wavelength 5850Å)	Orange-yellow (Peak Wavelength 5850Å)	Orange-yellow (Peak Wavelength 5850Å)
Luminance (fL)	34 (Typ.)	34 (Typ.)	30 (Typ.)	30 (Typ.)
Frame Frequency (Hz)	60 (Typ.)	60 (Typ.)	60 (Typ.)	60 (Typ.)
Input Signal Level	LS TTL Level	LS TTL Level	LS TTL Level	LS TTL Level
Supply Voltage (V)	+5, +12	+5, +12	+5, +15	+5, +15
Drive Method	P-P Symmetric Drive	P-P Symmetric Drive	P-P Symmetric Drive	P-P Symmetric Drive
Power Consumption (W)	7 (Typ.)	7 (Typ.)	7 (Typ.)	8 (Typ.)
Operating Temperature (°C)	−5 to +55	−5 to +55	0 to +55	0 to +55
Storage Temperature (°C)	−40 to +80	−40 to +80	−25 to +70	−25 to +70
Outline Dimensions (mm)	228.5(W) × 148.5(H) × 20.5(D) 34.0(D*)	246.0(W) × 148.0(H) × 16.9(D) 32.5(D*)	228.5(W) × 108.5(H) × 34.0(D*)	228.5(W) × 148.5(H) × 35.0(D*)
Weight (g)	Approx. 590 (650*)	Approx. 480 (540*)	Approx. 600*	Approx. 650*
Baseplate Structure	No	Yes	No	No
Detachable DC/DC Converter	Yes	Yes	No	No

Parameter	LJ640U24	LJ640U30	New LJ640U80	New LJ64ZU26
Effective Display Area (mm)	191.9(W) × 119.7(H)	191.9(W) × 95.8(H)	191.9(W) × 59.9(H)	191.9(W) × 119.9(H)
Display Format (dot)	640(W) × 200(H)	640(W) × 200(H)	640(W) × 200(H)	640(W) × 400(H)
Dot Size (mm)	0.18(W) × 0.30(H)	0.185(W) × 0.280(H)	0.23(W) × 0.20(H)	0.22(W) × 0.22(H)
Dot Pitch (mm)	0.30(W) × 0.60(H)	0.30(W) × 0.48(H)	0.30(W) × 0.30(H)	0.30(W) × 0.30(H)
Display Color	Orange-yellow (Peak Wavelength 5850Å)	Orange-yellow (Peak Wavelength 5850Å)	Orange-yellow (Peak Wavelength 5850Å)	Orange-yellow (Peak Wavelength 5850Å)
Luminance (fL)	30 (Typ.)	30 (Typ.)	34 (Typ.)	30 (Typ.)
Frame Frequency (Hz)	60 (Typ.)	60 (Typ.)	60 (Typ.)	60 (Typ.)
Input Signal Level	LS TTL Level	LS TTL Level	CMOS Level	LS TTL Level
Supply Voltage (V)	+5, +15	+5, +15	+5, +12	+5, +24
Drive Method	P-P Symmetric Drive	P-P Symmetric Drive	P-P Symmetric Drive	PWM Symmetric Drive
Power Consumption (W)	9 (Typ.)	8 (Typ.)	6 (Typ.)	18 (Typ.)
Operating Temperature (°C)	0 to +55	0 to +55	−20 to +65	−5 to +55
Storage Temperature (°C)	−25 to +70	−25 to +70	−40 to +80	−40 to +80
Outline Dimensions (mm)	228.5(W) × 158.5(H) × 35.0(D*)	228.5(W) × 148.5(H) × 35.0(D*)	238.0(W) × 108.0(H) × 31.0(D*)	246.0(W) × 158.0(H) × 34.0(D*)
Weight (g)	Approx. 750*	Approx. 650*	Approx. 520*	Approx. 650*
Baseplate Structure	No	No	Yes	Yes
Detachable DC/DC Converter	No	No	No	No

* Including DC/DC converter
**Scheduled for market from November, 1989
LJ512U10 (512 × 256 dots) and LJ640U11 (640 × 200 dots) with wider operating temperatures (−20°C to +65°C) are also available.

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SHARP

EL Display Units

Specifications

Parameter	LJ640U26	New LJ640U27	New LJ640U31	New LJ640U32
Effective Display Area (mm)	191.9(W) × 119.9(H)	191.9(W) × 119.9(H)	191.9(W) × 119.9(H)	191.9(W) × 119.9(H)
Display Format (dot)	640(W) × 400(H)	640(W) × 400(H)	640(W) × 400(H)	640(W) × 400(H)
Dot Size (mm)	0.22(W) × 0.22(H)	0.22(W) × 0.22(H)	0.22(W) × 0.22(H)	0.22(W) × 0.22(H)
Dot Pitch (mm)	0.30(W) × 0.30(H)	0.30(W) × 0.30(H)	0.30(W) × 0.30(H)	0.30(W) × 0.30(H)
Display Color	Orange-yellow (Peak Wavelength 5850Å)	Orange-yellow (Peak Wavelength 5850Å)	Orange-yellow (Peak Wavelength 5850Å)	Orange-yellow (Peak Wavelength 5850Å)
Luminance (fL)	30 (Typ.)	34 (Typ.)	34 (Typ.)	34 (Typ.)
Frame Frequency (Hz)	60 (Typ.)	60 (Typ.)	60 (Typ.)	60 (Typ.)
Input Signal Level	LS TTL Level	LS TTL Level	LS TTL Level	LS TTL Level
Supply Voltage (V)	+5, +15, +25	+5, +12	+5, +24	+5, +12
Drive Method	P-P Symmetric Drive	P-P Symmetric Drive	P-P Symmetric Drive	P-P Symmetric Drive
Power Consumption (W)	12 (Typ.)	11 (Typ.)	11 (Typ.)	11 (Typ.)
Operating Temperature (°C)	0 to +55	−5 to +55	−5 to +55	−5 to +55
Storage Temperature (°C)	−25 to +70	−40 to +80	−40 to +80	−40 to +80
Outline Dimensions (mm)	228.5(W) × 158.5(H) × 35.0(D*)	228.5(W) × 158.5(H) × 20.5(D) 35.0(D*)	246.0(W) × 158.0(H) × 15.5(D) 31.5(D*)	246.0(W) × 158.0(H) × 15.5(D) 31.5(D*)
Weight (g)	Approx. 800*	Approx. 590 (650*)	Approx. 480 (540*)	Approx. 480 (540*)
Baseplate Structure	No	No	Yes	Yes
Detachable DC/DC Converter	No	Yes	Yes	Yes
Parameter	**New LJ64ZU48**	**New LJ640U48**	**LJ720U22**	**New LJ024U32****
Effective Display Area (mm)	191.9(W) × 143.9(H)	191.9(W) × 143.9	215.9(W) × 119.9(H)	256.0(W) × 200.0(H)
Display Format (dot)	640(W) × 480(H)	640(W) × 480(H)	720(W) × 400(H)	1,024(W) × 800(H)
Dot Size (mm)	0.22(W) × 0.22(H)	0.22(W) × 0.22(H)	0.22(W) × 0.22(H)	0.19(W) × 0.18(H)
Dot Pitch (mm)	0.30(W) × 0.30(H)	0.30(W) × 0.30(H)	0.30(W) × 0.30(H)	0.25(W) × 0.25(H)
Display Color	Orange-yellow (Peak Wavelength 5850Å)	Orange-yellow (Peak Wavelength 5850Å)	Orange-yellow (Peak Wavelength 5850Å)	Orange-yellow (Peak Wavelength 5850Å)
Luminance (fL)	30 (Typ.)	30 (Typ.)	30 (Typ.)	30 (Typ.)
Frame Frequency (Hz)	60 (Typ.)	60 (Typ.)	60 (Typ.)	60 (Typ.)
Input Signal Level	LS TTL Level	LS TTL Level	LS TTL Level	LS TTL Level
Supply Voltage (V)	+5, +24	+5, +24	+5, +15, +25	+5, +12
Drive Method	PWM Symmetric Drive	P-P Symmetric Drive	P-P Symmetric Drive	P-P Symmetric Drive
Power Consumption (W)	22 (Typ.)	14 (Typ.)	13 (Typ.)	22 (Typ.)
Operating Temperature (°C)	−5 to +55	0 to +55	0 to +55	0 to +55
Storage Temperature (°C)	−40 to +80	−25 to +70	−25 to +70	−25 to +70
Outline Dimensions (mm)	246.0(W) × 180.0(H) × 34.0(D*)	246.0(W) × 180.0(H) × 25.0(D*)	270.0(W) × 168.0(H) × 25.5(D)	310.0(W) × 240.0(H) × 15.0(D) 35.0(D*)
Weight (g)	Approx. 700*	Approx. 660*	Approx. 910*	Approx. 1,000 (1,200*)
Baseplate Structure	Yes	Yes	Yes	Yes
Detachable DC/DC Converter	No	No	No	Yes

* Including DC/DC converter
** Scheduled for market from November, 1989
LJ512U10 (512 × 256 dots) and LJ640U11 (640 × 200 dots) with wider operating temperatures (−20°C to +65°C) are also available.

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SHARP

LCD Units

Sharp, unchallenged leader in the field of LCD units, is about to revolutionize the field.

Sharp's capacity for technological development is creating new worlds for LCD applications.

Since 1973, when Sharp introduced the use of the LCD in electronic calculators for the first time in the world, new fields of application have been rapidly opened up thanks to a series of constant technological improvements. This commitment to improvement has led to LCD units with superior readability over a wide range of adverse conditions.

As demand for large-size and high-resolution LCD units increased, Sharp responded by adding quality features, including high contrast, wide viewing angle and wide temperature range displays, all of which drew attention in various fields. Sharp's innovative approach to LCD design has led to LCD units which are lightweight, thin and power-saving for better cost performance with high reliability. Sharp's search for new possibilities in the application of the LCD has no limits.

Paper white mode Double Super Twisted LCD unit—synthesis of Sharp's LCD technology.

A large portion of the information we regularly read is in the form of black letters printed on white paper. This same format has long been deisred for the LCD, as well.

Sharp has taken the lead in developing and mass-producing a paper white mode Double Super Twisted (DST) LCD unit capable of reproducing an image close to the printed page to which we are accustomed. This advanced display, almost equivalent to a CRT, is about to change the current image of the LCD entirely.

With nearly 3 times higher contrast and a wider viewing angle compared with our conventional Super Twisted High Contrast (STHC) LCD units, this new product, with built-in CCFT backlight, is our answer to the call for brighter and clearer displays. Paper white mode DST LCD units are ideal for OA equipment, from personal computers to word processors.

Table of Graphic Display Type LCD Units

Display format (Dot)	Model No.	Type*1				Unit outline dimensions WxHxD (mm)*2	Effective viewing area WxH (mm)	Dot size WxH (mm)
		I	II	III	IV			
240 x 64	LM24008W	R	—	P	S	180x75x10.5	132.6x39	0.48x0.48
	LM24008M	M	E	P	S	180x75x10.5	132.6x39	0.48x0.48
	LM24013W	R	—	P	S	149x57x11.5	117x41	0.44x0.44
	LM24014W	R	—	P	S	180x65x10.5*	132.6x39	0.48x0.48
240 x 128	LM24009W	R	—	P	S	176x96x12	134x76	0.49x0.49
	LM24010J	T	C	P	S	176x96x19	134x76	0.49x0.49
640 x 200	LM64012C	T	C	P	S	274x130x21	232x106	0.31x0.45
	LM64014C	T	C	P	S	274x130x21	232x106	0.31x0.45
	LM64032W	R	—	P	S	256x128x12	232x106	0.32x0.46
	LM64032M	M	E	P	S	256x128x12	232x106	0.32x0.46
	LM64032X	T	E	P	S	256x128x12	232x106	0.32x0.46
	LM64050W	R	—	P	S	256x164x13	230x138	0.285x0.61
	LM64050M	M	E	P	S	256x164x16	230x138	0.285x0.61
640 x 400	LM64015T	T	C	N	S	300x174x30	237x151	0.33x0.33
	LM64023W	R	—	P	S	266x174x14.5	237x151	0.33x0.33
	LM64035W	R	—	P	S	266x174x14	237x151	0.33x0.33
	LM64035M	M	E	P	S	266x174x16	237x151	0.33x0.33
	LM64035X	T	E	P	S	266x174x16	237x151	0.33x0.33
	LM64135Z	T	C	N	D	300x166x26	218x139	0.30x0.30
640 x 480	LM64048Z	T	C	N	D	310x240x25	237x180	0.33x0.33
	LM64148Z	T	C	N	D	(280x180x25.5)	(205x155)	(0.28x0.28)
	LM64048E	T	—	N	D	(310x240x20)	(237x180)	(0.33x0.33)
	LM64148E	T	—	N	D	269.6x216x11.5	205x156	0.28x0.28
720 x 400	LM72060Z	T	C	N	D	320.4x170.4x34	260x147	0.32x0.32

*1 Type I: Transmissive: T / Transflective: M / Reflective: R
Type II: CCFT backlight is built in.: C / EL backlight can be installed.: E
Type III: Positive: P / Negative: N
Type IV: STHC LCD: S / DST LCD: D

*2 Excluding mounting tabs. D (Depth): max. value *3 Ta = 25°C

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SHARP

LCD Units

Sharp LCD units are the result of a fully integrated process, from initial development to final inspection.

Sharp offers a diverse line of LCD units, small, medium and large. And with the addition of the Double Super Twisted LCD unit to the large-size graphic display line and the Super Twisted High Contrast LCD unit to the character display line, even wider range of choices can now be offered.

Sharp's high quality LCD units guarantee high reliability for a wide variety of applications. This attractive product line is the ultimate response to customers' needs, from large-size displays for computers to displays for precision machinery.

Please feel free to consult us about custom-designed units to match your specific applications.

DST LCD Unit

Demand for even higher display quality is increasing with a trend toward larger, higher-resolution LCD units. Sharp has succeeded in developing and mass producing paper white mode DST LCD units with image quality approaching that of the printed page.

Features

- Advanced start-to-finish production system to maximize the product quality.
- A broad range of products, from 240x64 to 720x400 dot display formats.
- Thin, lightweight and compact in design.
- Low drive voltage and low power consumption.
- A bright, high contrast, Double Super Twisted (DST) LCD with a wide viewing angle, adopted for the large-size LCD unit.
- Backlit models are also available offering the optimum readability under diverse lighting conditions.

Table of Graphic Display Type LCD Units

Duty	Supply voltage (V)*3		Power consumption (mW)*3	Operating temperature (°C)	Storage temperature (°C)	Weight (g) (Approx.)	Applicable controller	Model No.
	V_{DD}-V_{SS}	V_{EE}-V_{SS}						
1/64	5.0	-11.0	48	0~45	-25~60	120	LR3692	LM24008W
1/64	5.0	-11.0	48	0~45	-25~60	120	LR3692	LM24008M
1/64	5.0	-11.0	30.0	0~45	-25~60	100	LR3692	LM24013W
1/64	5.0	-10.0	75	0~45	-25~60	120	Built-in controller	LM24014W
1/128	5.0	-17.5	343	0~45	-25~60	200	LR3692	LM24009W
1/128	5.0	-21.0 (Min.)	395	5~45	-20~60	365	LR3692	LM24020J
1/200	5.0	-21.1	526	0~45	-25~60	790	V6366	LM64012C
1/100	5.0	-16.0	318	0~45	-25~60	790	V6366	LM64014C
1/200	5.0	-21.1	534	0~45	-25~60	320	V6366	LM64032W
1/200	5.0	-21.1	534	0~45	-25~60	320	V6366	LM64032M
1/200	5.0	-21.1	534	0~45	-25~60	320	V6366	LM64032X
1/200	5.0	-19.8	407	0~45	-20~60	570	V6366	LM64050W
1/200	5.0	-21.1	526	0~45	-25~60	650	V6366	LM64050M
1/200	5.0	-21.1	495	0~45	-25~60	1200	V6366	LM64015T
1/200	5.0	-19.8	712	0~45	-20~60	690	Built-in controller	LM64023W
1/200	5.0	-16.0	495	0~45	-25~60	480	V6366	LM64035W
1/200	5.0	-16.0	495	0~45	-25~60	480	V6366	LM64035M
1/200	5.0	-16.0	495	0~45	-25~60	480	V6366	LM64035X
1/200	5.0	-15.7	430	0~45	-25~60	950	V6366	LM64135Z
1/240	5.0	-16.5	460	0~45	-25~60	1200	V6366	LM64048Z
(1/240)	(5.0)	TBD	TBD	(0~45)	(-25~60)	TBD	(V6366)	LM64148Z
(1/240)	(5.0)	(-16.5)	(460)	(0~45)	(-25~60)	TBD	(V6366)	LM64048E
1/240	5.0	-16.5	498	0~45	-25~60	650	V6366	LM64148E
1/200	5.0	-15.0	485	0~45	-25~60	1450	V6366	LM72060Z

Note 1) Above models may be discontinued without notice due to switching to new products or other reasons.
Note 2) ( ): Tentative

*Excluding oscillator

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SHARP

LCD Units

Sharp character type LCD Unit operates under the control of a 4 or 8-bit microcomputer

Features

- Interface with either 4-bit or 8-bit microprocessor.
- Display data RAM
  80 x 8 bits (80 characters).
- Character generator ROM
  160 different 5 x 7 dot-matrix character patterns.
- Character generator RAM
  8 different user programmed 5 x 7 dot-matrix patterns.
- Display data RAM and character generator RAM may be accessed by the microprocessor.
- Numerous instructions
  Clear Display, Cursor Home, Display ON/OFF, Cursor ON/OFF, Blink Character, Cursor Shift, Display shift.
- Built-in reset circuit is triggered at power ON.
- Built-in oscillator.

TN-FEM LCD UNITS

Number of characters	Model No.	Type*1				Unit outline dimensions W x H x D (mm)*2	Effective viewing area W x H (mm)	Character size W x H (mm)
		I	II	III	IV			
16 x 1	LM16152A	R	—	P	6	115 x 35 x 12	99 x 13	4.9 x 7.95
	LM16152D/E/H	M	L	P	6	115 x 39.5 x 16	99 x 13	4.9 x 7.95
	LM165159D/E/H	M	L	P	12	115 x 39.5 x 16	99 x 13	4.9 x 7.95
	LM16155	R	—	P	6	80 x 36 x 11	64.5 x 13.8	3.07 x 5.73
	LM16155K	R	—	P	6	80 x 36 x 11	64.5 x 13.8	3.07 x 5.73
	LM16155M	M	E	P	6	80 x 36 x 11	64.5 x 13.8	3.07 x 5.73
	LM16155N	M	E	P	12	80 x 36 x 11	64.5 x 13.8	3.07 x 5.73
	LM16155S	R	—	P	6	80 x 36 x 11	64.5 x 13.8	3.07 x 5.73
16 x 2	LM16255	R	—	P	6	84 x 44 x 11	61 x 15.8	2.96 x 4.86
	LM16255K	R	—	P	12	84 x 44 x 11	61 x 15.8	2.96 x 4.86
	LM16255M	M	E	P	6	84 x 44 x 11	61 x 15.8	2.96 x 4.86
	LM16255S	R	—	P	6	84 x 44 x 11	61 x 15.8	2.96 x 4.86
	LM16257	R	—	P	6	85 x 32.6 x 11	61 x 15.8	2.96 x 4.86
	LM162A01	T	L	P	6	84 x 44 x 16	61 x 15.8	2.96 x 4.86
	LM162B01	T	L	N	6	84 x 44 x 16	61 x 15.8	2.96 x 4.86
	LM162A02	T	L	P	6	84 x 44 x 16	61 x 15.8	2.96 x 4.86
	LM162B02	T	L	N	6	84 x 44 x 16	61 x 15.8	2.96 x 4.86
20 x 2	LM20255	R	—	P	6	115 x 36 x 11	83 x 18.6	3.2 x 4.85
	LM20255M	M	E	P	6	115 x 36 x 11	83 x 18.6	3.2 x 4.85
	LM20255S	R	—	P	6	115 x 36 x 11	83 x 18.6	3.2 x 4.85
	LM20256	R	—	P	6	115 x 36 x 11	83 x 18.6	3.2 x 4.85
	LM202A02	T	L	P	6	115 x 36 x 16	83 x 18.6	3.2 x 4.85
	LM202B02	T	L	N	6	115 x 36 x 16	83 x 18.6	3.2 x 4.85
24 x 2	LM24255	R	—	P	6	115 x 36 x 11	83 x 18.6	2.7 x 4.85
40 x 2	LM40255	R	—	P	6	183 x 33.5 x 11	154.4 x 15.8	3.2 x 4.85
	LM40255K	R	—	P	12	183 x 33.5 x 11	154.4 x 15.8	3.2 x 4.85
	LM40255M	M	E	P	6	183 x 33.5 x 11	154.4 x 15.8	3.2 x 4.85
	LM40255S	R	—	P	6	183 x 33.5 x 11	154.4 x 15.8	3.2 x 4.85
	LM402A01	T	L	P	6	182 x 33.5 x 16	154.4 x 15.8	3.2 x 4.85
	LM402B01	T	L	N	6	182 x 33.5 x 16	154.4 x 15.8	3.2 x 4.85
	LM402X01	T	L	P	6	182 x 33.5 x 16	154.4 x 15.8	3.2 x 4.85
	LM402Y01	T	L	N	6	182 x 33.5 x 16	154.4 x 15.8	3.2 x 4.85

STHC LCD UNITS

16 x 2	LM16A21	R	—	P	—	84 x 44 x 11	61 x 15.8	2.96 x 4.86
	LM16X21A	M	L	P	—	84 x 44 x 16	61 x 15.8	2.96 x 4.86
	LM16X21B	M	L	N	—	84 x 44 x 16	61 x 15.8	2.96 x 4.86
20 x 2	LM20A21	R	—	P	—	115 x 36 x 11	83 x 18.6	3.2 x 4.85
40 x 2	LM40A21	R	—	P	—	182 x 33.5 x 11	154.4 x 15.8	3.2 x 4.85
	LM40X21A	T	L	P	—	(182 x 33.5 x 16)	(154.4 x 15.8)	(3.2 x 4.85)
	LM40X21B	T	L	N	—	(182 x 33.5 x 16)	(154.4 x 15.8)	(3.2 x 4.85)

*1 Type I: Transmissive: T / Transflective: M / Reflective: R
Type II: LED backlight is built in.: L / EL backlight can be installed.: E
Type III: Positive: P / Negative: N
Type IV: 6 o'clock viewing direction: 6 / 12 o'clock viewing direction: 12
*2 D (Depth): max. value
*3 Ta = 25°C

SHARP ELECTRONICS CORP., Micro Electronics Div., Sharp Plaza, Mahwah, NJ 07430-2135•201/529-8757 • Telex: 426903 (SHARPAM MAWA) • Fax: 201/529-8759

SIGNALEX®

HIGH VISIBILITY DISPLAYS

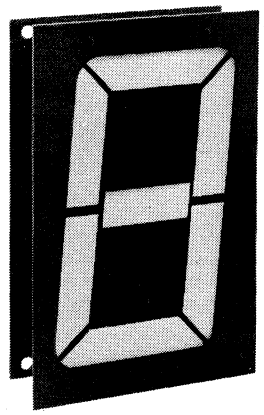
ENERGY-SAVING: Electromagnetically-operated Signalex displays require no power to maintain continuous indication. Inherently bi-stable, Signalex displays draw power only at the instant of change.

INHERENT MEMORY: Indication is maintained even with loss of power.

DIRECT ACCESS: Signalex displays can change from one number to any other—without a run-through of numbers. The unit immediately displays the transmitted number.

LOW MAINTENANCE: The rugged Signalex design assures long life and dependability. With no bulbs to replace, they are virtually maintenance-free.

HIGH-VISIBILITY: Signalex displays can be used indoors and out, in temperatures ranging from -40°C to +75°C. Their light-reflecting segments give high visibility in bright ambient light.



402L

7 SEGMENT MODELS

DISPLAY SIZES	1½"	4"	6"	9"	12"	18"	24"
SIGNALEX MODEL	152L	402L	602L	900L	1200L	1810L	2410L
Character Size H x W	1-9/16" x 15/16" (40 x 24 mm)	4-1/16" x 2-5/16" (103 x 59 mm)	6-1/16" x 3-9/16" (154 x 91 mm)	9" x 6" (228 x 152 mm)	12" x 8" (305 x 204 mm)	18" x 12" (46 x 30 cm)	24" x 16" (61 x 41 cm)
Vane Width	5/32" (4 mm)	7/16" (11 mm)	11/16" (17 mm)	1-1/8" (29 mm)	1-1/2" (38 mm)	2-1/4" (5.7 cm)	3" (7.6 cm)
Frame Size H x W	1-7/8" x 1-5/16" (49 x 33 mm)	5" x 3-1/4" (127 x 83 mm)	7-1/4" x 5-1/8" (184 x 130 mm)	11" x 8-1/4" (279 x 210 mm)	14" x 11" (356 x 279 mm)	21" x 16½" (533 x 419 mm)	28" x 22" (711 x 559 mm)
Pulse Length, min.	30 ms	50 ms	90 ms	150 ms	200 ms	300 ms	400 ms
Pulse Power, Each Vane	0.35 W	0.93 W	1.4 W	3.6 W	3.6 W	9.0 W	9.0 W
Viewing Dist., max.	50 Feet (15 Meters)	160 Feet (50 Meters)	240 Feet (75 Meters)	360 Feet (110 Meters)	480 Feet (150 Meters)	720 Feet (220 Meters)	960 Feet (300 Meters)
Weight	2-1/4 oz. 65 gm.	8-1/2 oz. 240 gm.	12-2/3 oz. 360 gm.	1-1/2 lbs. 680 gm.	2-1/4 lbs. 1020 gm.	4-1/2 lbs. 2. kg	6 lbs. 2.7 kg

U.S. Patent Nos. 3,886,545; 4,117,478; U.S. Design Patent 249,985 and Patents Pending

Operation: Individually controlled segments, pulse-operated through a bi-stable magnetic circuit.

Voltage: 12.V. DC ±10% standard. Other voltages available.

Coils: Standard is bifilar wound with 3 leads per segment. Model 152L has terminal pins for direct PCB mounting.

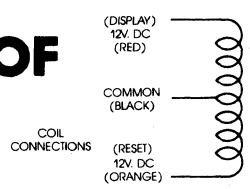
Temperature: -40°C to +75°C.

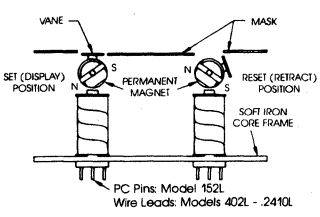
Relative Humidity: Up to 95% R.H. at any temperature in the range, provided no consideration present.

Power to Maintain Display: NONE

Vane Colors: White, Saturn-Yellow, Orange-Red Fluorescents. Black background standard. Other high-visibility colors available.

PRINCIPLE OF OPERATION





Signalex® displays operate on a well-proven electromagnetic principle. A short pulse in a coil produces a magnetic field that acts upon a permanent magnet located in a rotor, part of which is the vane itself.

The magnet is either attracted or repelled, turning the rotor and vane with it. In either display or reset position the magnetic circuit is stable so that the vane can remain in either position with no power in the coil. The permanent magnet pole is attracted to the soft iron core which will hold the vane in position until a reverse pulse is passed.

The rotor and magnet assemblies are the only moving parts in the display. Their light weight and low inertia give fast response time. High lubricity plastic bearings are used.

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SIGNALEX

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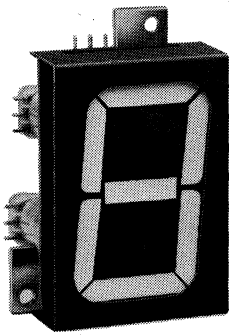
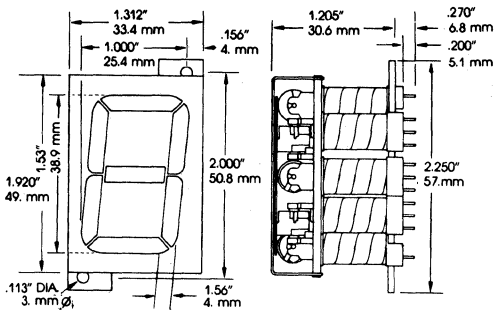
HIGH VISIBILITY 7-SEGMENT DISPLAYS

MODEL 152L

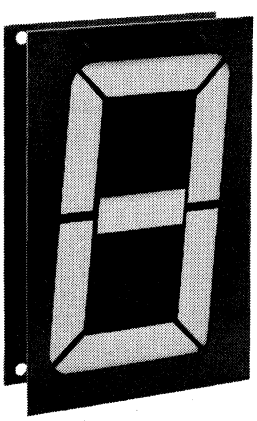


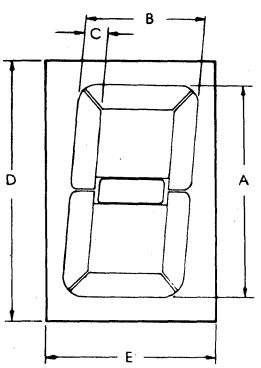


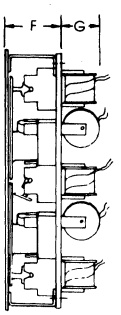
The Signalex 152L is used world-wide in readout applications for toll booths, clocks, gas pumps, arcade games, oil rig instrumentation, currency exchange panels, and industrial controls. Since Signalex readouts draw no power while maintaining position, they are ideal for battery-powered systems as well as AC.

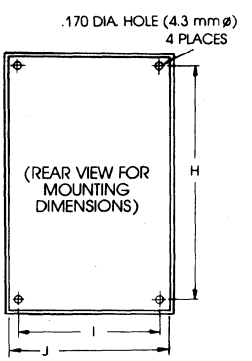
Connections: 3 per coil
(1 to display, 1 to reset, 1 common)
Pulse Power: 31ma at 12V.
Pulse Length: 30ms min., display or reset
Character Slope: 5°
Visibility: Up to 70° either side of perpendicular to the front face.
Temperature Range: -40°C to + 75°C
Materials: Front Mask: Steel, Bearings: Polyester.
Hazardous Areas: Recognized by Underwriters Laboratories, Inc.,
No. MH10471. BASEEFA Class 2 No. 4054 J.

MODELS 402L & 602L

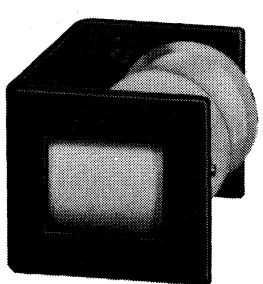








(in.) Dim.	A	B	C	D	E	F	G	H	I	J
Model 402L	4-1/16	2-5/16	7/16	5	3-1/4	1-1/16	3/4	4-1/2	2-5/8	3-1/8
Model 602L	6-1/16	3-9/16	11/16	7-1/4	5-1/8	1-5/16	3/4	6-1/2	4-1/2	5



SIGNALEX® TYPE A

The Type A Indicator is a bi-stable electromagnetic annunciator showing alternate display faces in its window. It may be mounted for operation in any position. It is driven in either direction by 1.1 watt pulses as short as 30 ms and remains in its last position without power input until pulsed to the opposite position.

Signalex Type A indicators are used in hospital, apartment house, and commercial call boards, as well as in circuit indicators, alarm systems, and a variety of other applications.

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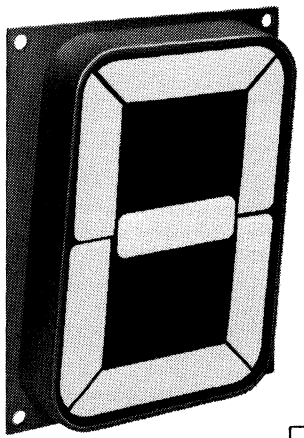
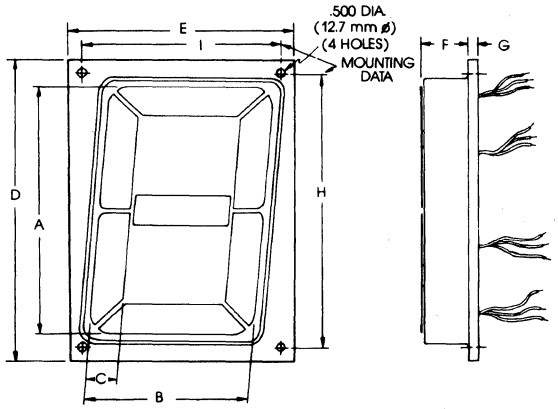
HIGH VISIBILITY 7-SEGMENT DISPLAYS

MODELS 900L & 1200L

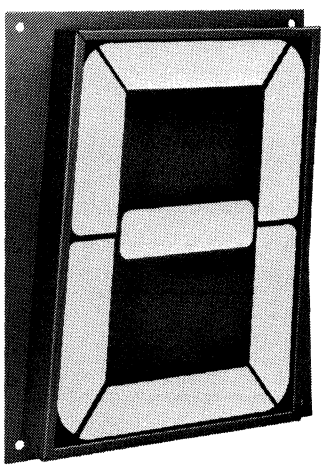


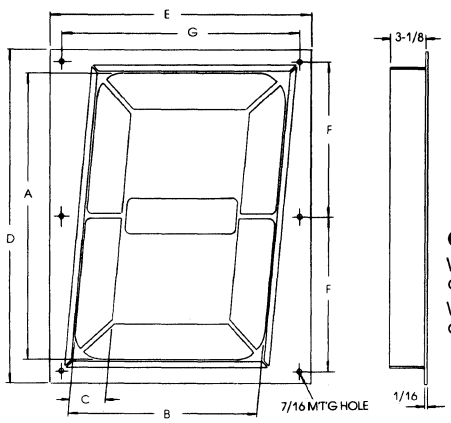


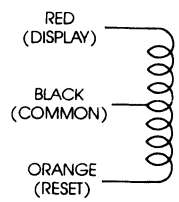
Length of Leads: 7" Min. for 402L & 602L.
30" Min. for 900L & 1200L
Bearings: High lubricity polyester, replaceable.
Vanes: Individually replaceable.
Visibility: 402L & 602L Series—To 60° either side.
900L & 1200L Series—To 75° either side.

(in.) Dim.	A	B	C	D	E	F	G	H	I
Model 900L	9	6	1-1/8	11	8-1/4	2-1/32	3/16	10*	7-1/4*
Model 1200L	12	8	1-1/2	14	11	2-1/16	3/16	13	10

MODELS 1810L & 2410L







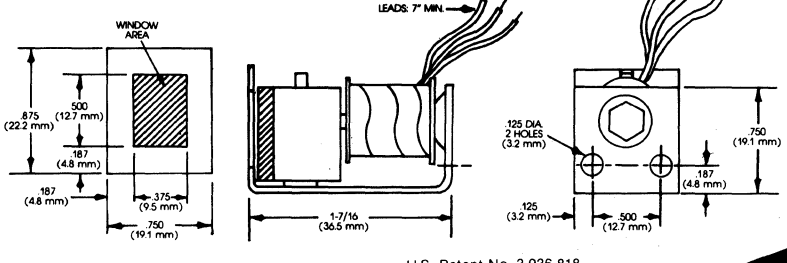
Coil Connection (402L & larger) (7 coils per digit)
With black lead connected to (-), (+) on red lead displays white. (+) on orange lead resets to black.
With black lead connected to (+), (-) on orange lead displays white. (-) on red lead resets to black.

(in.) Dim.	A	B	C	D	E	F	G
TYPE 1810L	18"	12	2 1/4	21	16 1/2	19 1/2*	15
TYPE 2410L	24"	16	3	28	22	13	20

*20" From Top to Bottom MT'G Hole. No Center Holes.

ANNUNCIATOR

Window Size: 3/8" H x 1/2" W (9.5 mm x 12.7 mm)
Displays per Window: 2
Operating Temp. Range: -40°C to +75°C
Operating Mode: Bi-stable, pulsed
Min. Pulse Length: 30ms. either display
Power/Pulse: 1.1W
Coil Resistance: 125. Ω ± 10%
Standard Voltage: 12 V. DC*
Standard Colors: Black & White, Yellow, Red.*
Leads: 7" Min.:
*Others Available.



U.S. Patent No. 3,936,818

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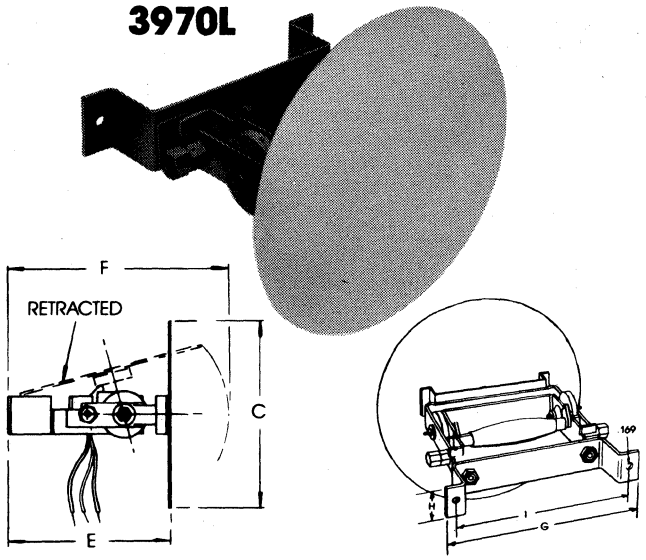
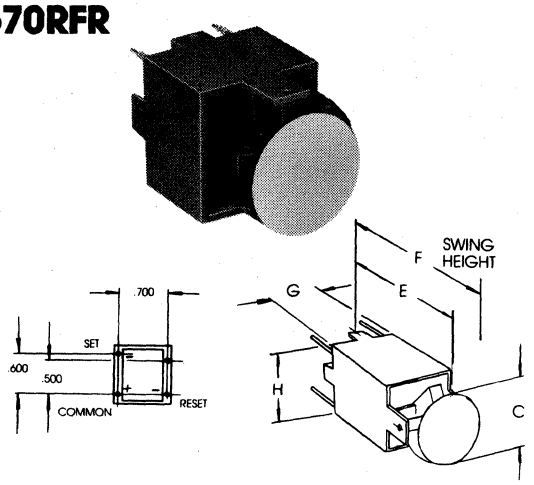
HIGH VISIBILITY ALPHANUMERIC DISPLAYS AND INDIVIDUAL GRAPHIC ELEMENTS

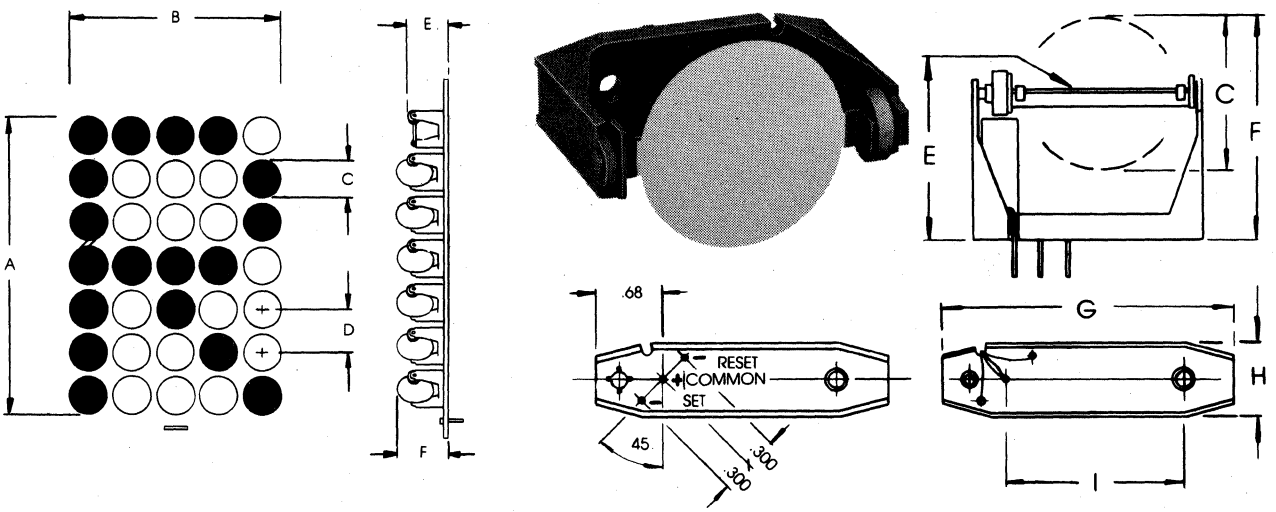
3970L



670RFR



972-1872RFR



Model Number	Dim. A Char. Hgt. in.	mm.	Dim. B Char. Width in.	mm.	Dim. C Dot Dia. in.	mm.	Dim. D Dot Pitch in.	mm.	Dim. E Display Hgt. in.	mm.	Dim. F Swing Hght. in.	mm.	Dim. G Length in.	mm.	Dim. H Width in.	mm.	Dim. I Mounting in.	mm.
670RFR	6.00	152	4.25	108	.75	19.0	.875	22.2	1.33	33.8	1.57	39.7	.84	21.3	.84	21.3	—	—
972RFR	9.00	230	6.37	162	1.12	28.0	1.31	33.3	1.45	36.8	2.10	53.3	1.81	46.0	.75	19.0	.596	15.1
1272RFR	12.00	300	8.50	216	1.50	38.0	1.75	44.5	1.45	36.8	2.29	58.2	2.24	56.9	.75	19.0	1.026	26.1
1672RFR	16.00	406	11.37	289	2.00	51.0	2.34	59.5	1.45	36.8	2.54	64.5	2.74	69.6	.75	19.0	1.526	38.8
1872RFR	18.00	457	12.75	324	2.25	57.0	2.62	66.7	1.45	36.8	2.66	67.6	2.99	76.0	.75	19.0	1.776	45.1
3970L	39.50	1000	28.00	711	5.00	127.0	5.75	146.0	4.30	109.2	5.87	149.1	4.50	114	1.0	25.4	4.000	102.0

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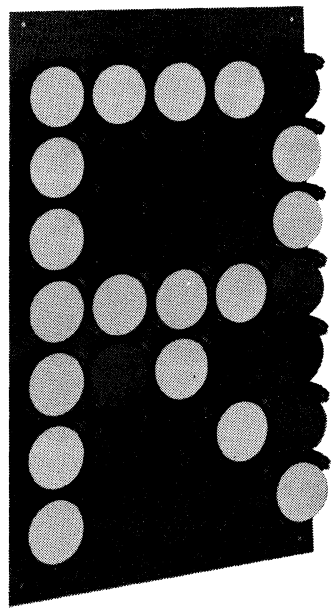
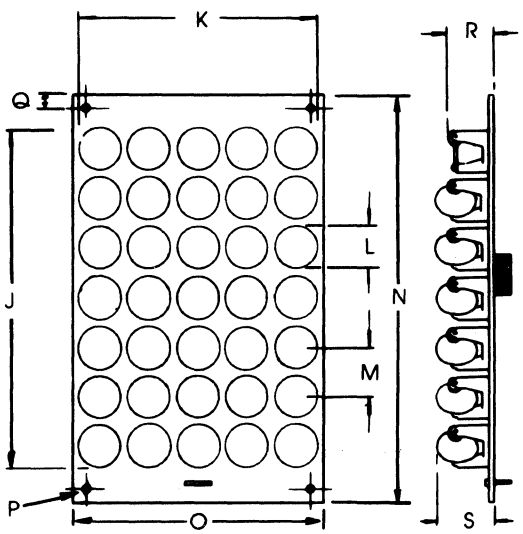
HIGH VISIBILITY ALPHANUMERIC DISPLAYS AND INDIVIDUAL GRAPHIC ELEMENTS

Signalex Individual Alphanumerics are bi-stable electromagnetic displays which require only a very short pulse to change position. Inherent latching memory requires no power except during the moment of change. The magnetic design permits operation of most models using 12vdc with a 2 msec. pulse and, at higher voltages, at 1 msec. or less.

The standard 7 by 5 matrix of 35 dots gives full alphanumeric capability, and is available in sizes which can create characters 6", 9", 12", 16", 18" and 39" high. The flexibility of Signalex individual alphanumerics permits the creation of custom displays. In addition to the standard (7 x 5) format, the 28-dot (7 x 4) numeric format, a 23-dot (7-Bar) format, or other desired shapes may be used.





670-1872RFR-35BC

SPECIFICATIONS—ALL MODELS

	670RFR-35BC	972-1872RFR-35BC
Pulse Length, Min. @ 12V	2ms	2ms
Pulse Length, Min. @ 18V	1ms	1ms
Maximum Duty Cycle @ 12V	5%	5%
Current Each Dot @ 12V	680ma	580ma
Coil Res. Center to Each Side	17.5 ohms	20.5 ohms
Coil Winding	Center Tapped Coil	
Coil Addressing	All Models	X-Y Matrix
Ground Polarity	Negative	Negative
Diodes	1N4004	1N4004
PCB Material	FR-4 or Equivalent	
Operating Temperature Range	All Models: -40 C to +90 C	
Operating Rel. Humidity	All Models: Up to 95% @ +90 C*	
Standard Colors	All Models: White, Yellow, Red	

*Provided No Condensation Present

35 DOT 7 BY 5 ALPHANUMERIC MATRICES

	Dim. J Char. Hgt		Dim. K Char. Width		Dim. L Dot Dia.		Dim. M Dot Pitch		Dim. N Matrix Hgt		Dim. O Matrix Wdth		Dim. P Mtg. Hole		Dim. Q Hole Offset		Dim. R Thickness		Dim. S Swing Hgt.	
	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.
670RFR-35BC	6	152	4.25	108	.75	19	.875	22.2	7.75	197	4.25	114	.178	4	.25	6	1.35	34	1.57	39.7
972RFR-35BC	9	230	6.37	162	1.12	28	1.31	33.3	11.87	301	6.53	166	.195	5	.25	6	1.80	43	2.07	52.6
1272RFR-35BC	12	300	8.50	216	1.50	38	1.75	44.5	15.00	386	8.72	224	.195	5	.50	13	1.80	43	2.25	57.2
1672RFR-35BC	16	406	11.37	289	2.00	51	2.34	59.4	19.50	502	11.69	301	.195	5	.50	13	1.80	43	2.54	64.5
1872RFR-35BC	18	457	12.75	324	2.25	57	2.62	66.7	21.63	557	13.09	337	.195	5	.50	13	1.80	43	2.66	67.6

THE STAVER COMPANY INCORPORATED
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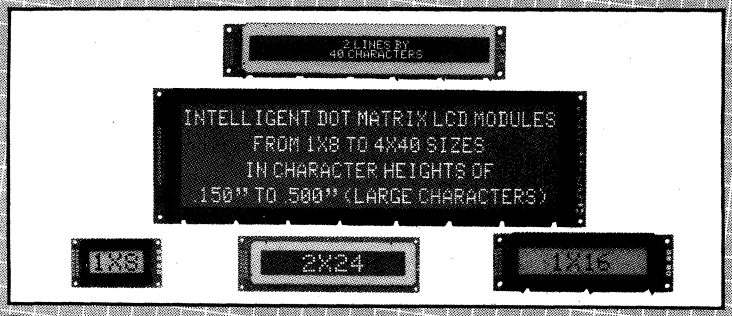
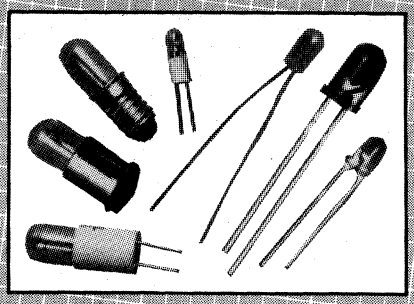
SIGNALEX®

Optoelectronics from Shelly!

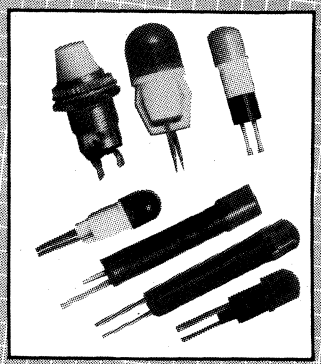


DOT MATRIX LCD MODULES

■ 1x8 to 4x80 sizes ■ .15 to .5" character heights ■ EL, LED and fluorescent backlighting ■ commercial wide temperature and Supertwist fluids

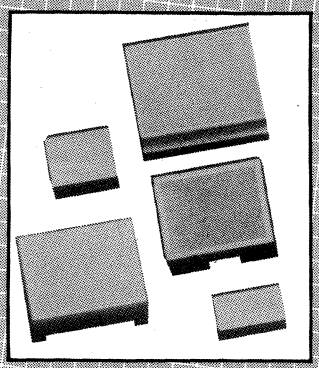


INCANDESCENT, NEON AND LED LAMPS



INDICATORS

■ based lamp ■ front relampable ■ incandescent ■ LED ■ neon

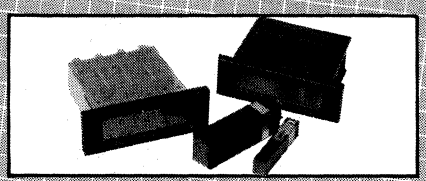


LED LIGHT BARS

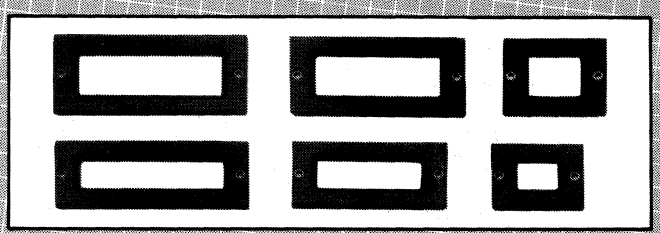
■ large area indicators

MULTI-DIGIT 7- SEGMENT LCDs

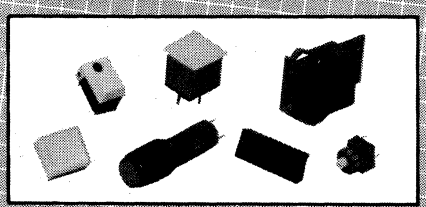
■ commercial & industrial temperature range fluids



MULTI-MESSAGE DISPLAYS



LCD DISPLAY BEZELS



SWITCHES

■ lighted and unlighted switches

14811 Myford Road • Tustin, California 92680
(714) 669-9850 • TLX: 85-2263 • FAX: 714-669-1081

SHELLY associates

For manufacturers' sales offices, see yellow pages

VL ELECTRONICS, INC. VARITRONIX

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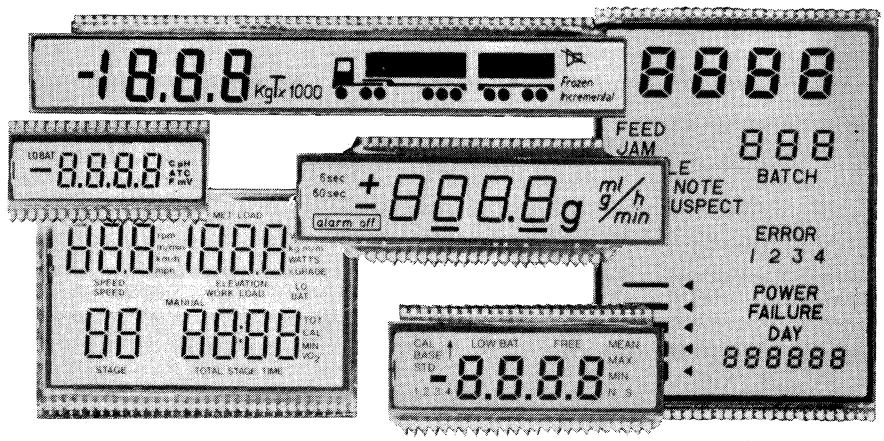
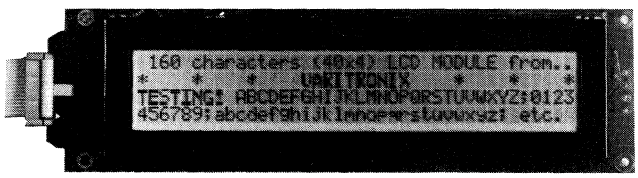
custom designs

LIQUID CRYSTAL DISPLAYS



FEATURES

- Highest Quality
- LCD Prototypes from approved drawings in 6-9 weeks
- Supertwist available
- Send us your artwork for a quotation



- High contrast
- Wide viewing angle
- Industry standard controller
- Int. ROM with 96 ASCII char.
- Options available:
  - EL & LED backlighting
  - negative image
  - wide temperature
  - color polarizer
  - supertwist

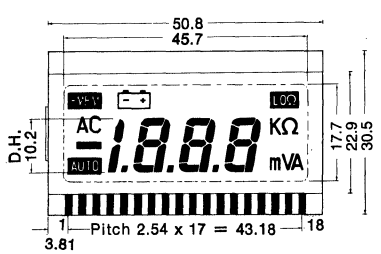
alpha-numeric modules

partial list

Model Number	Characters x Lines	Character Format	Digit Size	Module Size (WxHxD)
MDL-15701	1x1	5x7	59.9	96x57x12
MDL-81820	8x1	5x7	20.8	172x52x12
MDL-16166	16x1	5x8	6.3	80x36x12
MDL-16188	16x1	5x8	9.2	122x33x11
MDL-16265	16x2	5x8	5.6	84x44x12
MDL-201612	20x1	5x8	12.7	180x48x11
MDL-20188	20x1	5x8	9.2	146x33x11
MDL-202612	20x2	5x8	12.7	182x60x11
MDL-20265	20x2	5x8	5.6	116x37x12
MDL-20268	20x2	5x8	9.2	146x43x11
MDL-204612	20x4	5x8	12.7	182x90x11
MDL-20464	20x4	5x8	4.8	98x60x12
MDL-20468	20x4	5x8	9.2	146x63x11
MDL-24166	24x1	5x8	6.3	126x36x12
MDL-24265	24x2	5x8	5.2	118x36x11
MDL-40166	40x1	5x8	6.3	192x56x12
MDL-40266	40x2	5x8	5.5	182x34x12
MDL-40466	40x4	5x8	5.5	196x56x12

standard LCD'S for general applications

VIM-309



VI-302

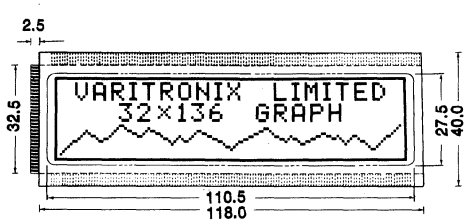
NEW

partial list

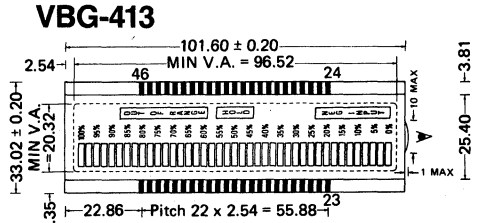
Model	Char. Ht.	Digits
VI-102	76.0	1
VI-201	12.7	2
VI-351	6.4	3½
VIM-309	10.2	3½
VI-302	12.7	3½
VI-320	25.4	3½
VI-402	12.7	4
VI-50402	50.0	4
VI-509	10.2	4½
VI-510	20.5	4½
VI-505	17.8	5
VIM-806	9.0	8
VG-080	32x 80	Graphic
VG-136	32x136	Graphic

All dimensions in mm

VG 136-32



VBG-413



W O R L D P R O D U C T S

ELECTROLUMINESCENT BACKLIGHTS

FROM NEC

THE WORLD LEADER IN EL TECHNOLOGY AND MANUFACTURING

NEC offers a broad range of colors including:

- White - standard and high brightness
- Blue-green
- Yellow-green
- Green
- European yellow

The manufacturing process is based on providing quality EL backlights that feature:

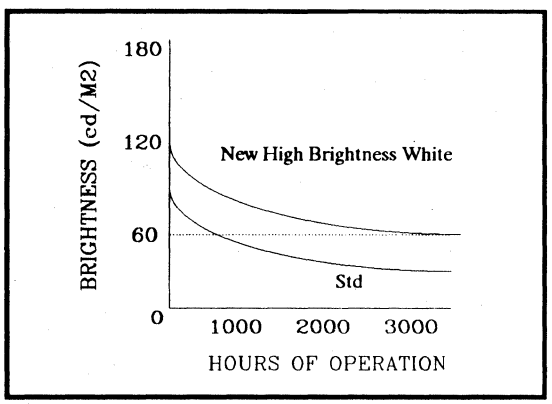
- High brightness
- Long life
- Excellent brightness uniformity
- Low power consumption

Custom sizes and shapes for applications such as backlighting keyboards, control panels, indicator panels and decorative lighting.

From: 14mm X 20mm
To: 200mm X 450mm

For ease of operation NEC offers a complete line of DC-AC inverters featuring:

- 5VDC input
- High efficiency
- Standard and low profile packages



HI-RESOLUTION COLOR CRT'S

NEC

Diagonal (inches) STD: 9, 10, 12, 14, 16, 20
FLAT FACE: 12, 15, 21

Dot Pitch (mm): .21, .26, .28, .31, .38, .39, .44

Glass types: Clear, Gray, Tinted, Hi-Contrast Filter and Anti-Reflection

Phosphor Types: Medium Short, Medium Long, Long Persistence and Broadcast

Phosphor Color: Red, Green, Blue, Light-Blue, White

Deflection Yoke: STD and Litz Wire

Electron Guns: Superposed Electric Field Lens Gun, Dynamic Quadrapole Focus Gun

WP® WORLD PRODUCTS INC.
19654 8TH ST. EAST, SONOMA, CA 95476 PHONE (707) 996-5201 FAX (707) 996-3380

Refer to Sections 1500, 4800 and 5300 for additional product listings.

W O R L D P R O D U C T S

AC PLASMA DISPLAYS

NEC

- Low Power
- Full Graphic Dot Matrix Panels
- 9" to 26" Diagonal Sizes
- 512 x 256
- 640 x 200
- 576 x 256
- 640 x 400
- 720 x 350
- 512 x 342
- 640 x 480*
- CGA, EGA, VGA* Compatible
- TTL Clock - Data - H Sync - V Sync Interface
- 12 Volt Display-Power
- Grayscale*
- 40,000 Hour Life
- 25 : 1 Contrast
- 120° View Angle

	DISPLAY AREA			DOT PITCH		TYPICAL PWR
MATRIX	W	x H	x DIAG	W	x H	WATTS
512 x 256	7.7"	3.8"	8.6"	.015"	.015"	9.6
576 x 256	8.4"	3.7"	9.2"	.014"	.014"	14
576 x 256	22.7"	12.8"	26"	.027"	.038"	50
512 x 342	8.1"	5.5"	9.8"	.016"	.016"	12
640 x 200	8.8"	3.8"	9.6"	.014"	.019"	10
640 x 400"C"	10"	6.3"	11.9"	.016"	.016"	15
640 x 400"D"	8.5"	5.7"	10.3"	.013"	.014"	12
720 x 350	11.3"	8.2"	14"	.016"	.024"	20
640 x 480*	9.1"	6.8"	11.4"	.014"	.014"	26

* 4th Quarter 1989 Product

STC/DISPLAYTECH LCD DISPLAYS

- SEGMENTED TYPES
- DOT MATRIX
- COLOR FILTERS
- BACKGROUND MASK FEATURE
- LCD ONLY & MODULES
- DIMMABLE VIEW WINDOWS FOR LIGHT CONTROL
- SHUTTER TYPES
- SUPPLIERS TO NORMAL & EXTENDED ENVIRONMENT

APPLICATIONS - PORTABLE TERMINALS - PAGERS - PANEL METERS - POINT OF SALE - MEDICAL ELECTRONICS - AUTOMOTIVE -3-D - LIGHT CONTROL

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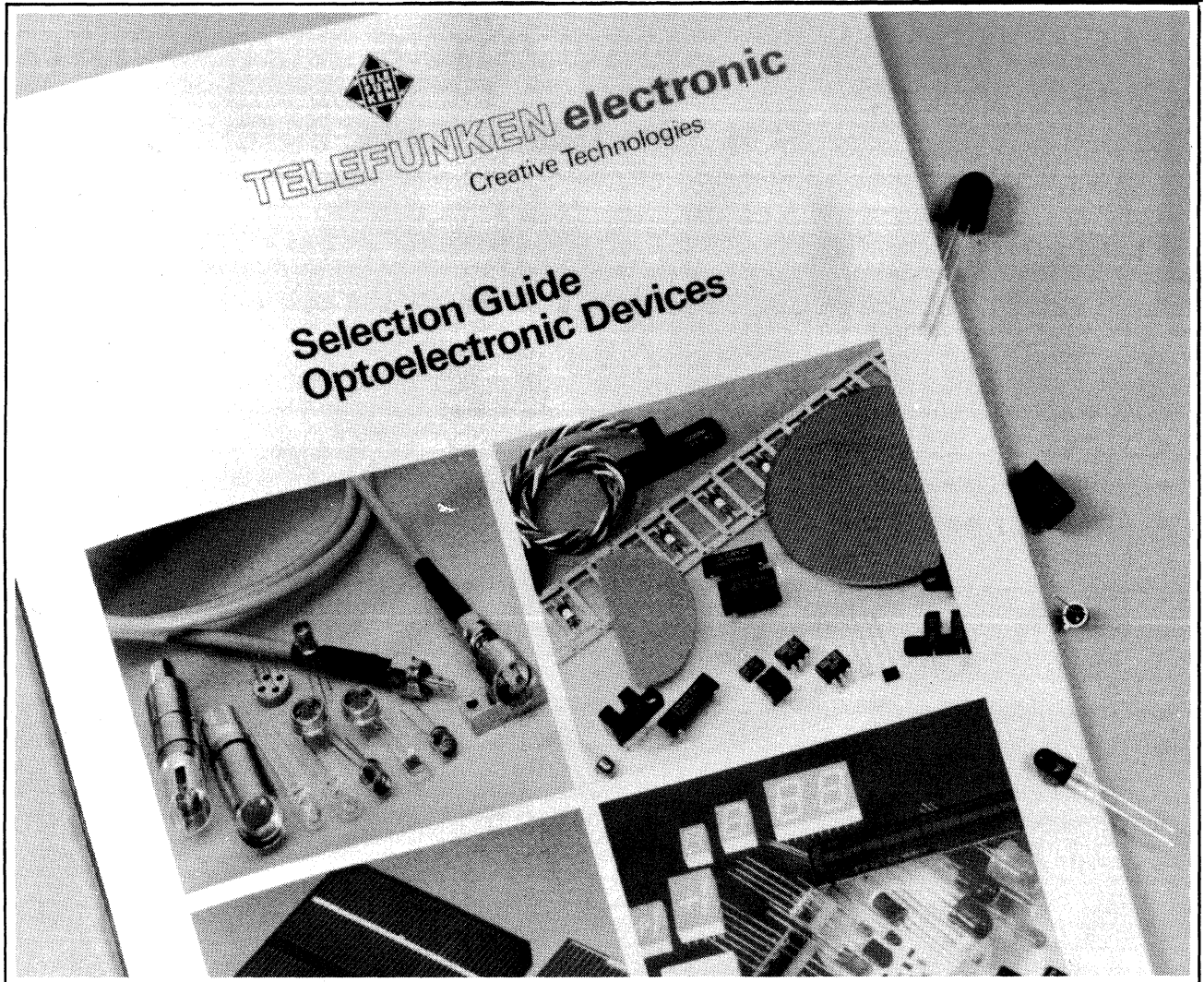
Refer to Sections 1500, 4800 and 5300 for additional product listings.

INDICATOR LIGHTS

Manufacturer	Starting EEM Page No.	Light Type				Accessories/Hardware		Features				
		Incandescent	LED	Neon	Fluorescent	Sockets/ Holders/ Clips	Caps & Lenses	Panel Mount	Relampable PC Mount	Assemblies	Rectangular	Waterproof
AEG Corp.	B•1127		√			√		√	√	√	√	√
Altair	B•1128	√	√			√						
AND	B•1129		√								√	
Arcolectric Corp.	B•1130	√	√	√		√		√		√	√	√
Bonar Kard-O-Lite Inc.	B•1132	Electroluminescent										
Dialight Corp.	B•1133	√	√	√		√	√	√		√	√	√
Endicott Research Group	B•1142	√				√		√	√			
Everlight USA	B•1143		√			√		√		√	√	
Gilway Technical Lamp	B•1144	√	√	√	√	√			√	√		
Golden Pacific	B•1151		√							√		
GTE Products Corp.	B•1152	√		√		√	√	√		√		
IDEA Inc.	B•1166		√			√	√	√		√	√	
Industrial Devices	B•1158	√	√	√		√	√	√	√			
Intermarket Inc.	B•1178	√	√	√			√	√				
JKL Components	B•1163	√	√	√	√	√	√	√		√		
Lamb Industries	B•1164	√				√		√	√	√		
Lamptronix Co. Ltd.	B•1165	√		√		√		√	√			
Ledtronics	B•1167	√	√			√	√	√	√			
Littelfuse Electronic Div.	B•1171	√				√		√	√	√		
Marktech Int'l Corp.	B•1172		√									
Minelco/Tally Inc.	B•1175	√	√					√		√		
Oshino Electric Lamp Works	B•1176	√				√		√	√	√		
Oxley	B•1179		√	√		√	√	√		√		√
Sharp Electronics, Microelectronics Div.	B•1180		√								√	
Shogyo Int'l Corp.	B•1186	√		√	√	√						
Shokai Far East Ltd.	B•1187	√	√	√	√	√	√	√	√	√	√	√
Sloan Co.	B•1188	√	√	√		√	√	√	√	√		√
Sorenson	B•1198	√	√	√		√		√			√	
Visual Communication Co.	B•1199	√	√			√	√	√	√	√		



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Creative Technologies

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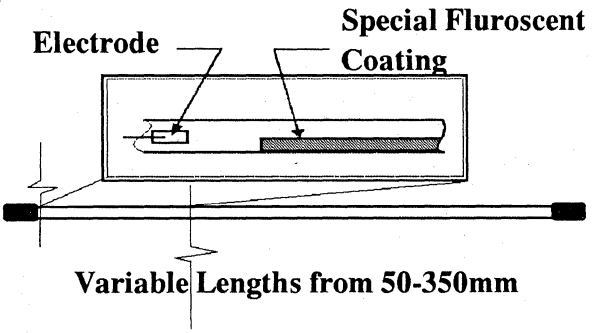
MINIATURE FLUORESCENTS
Cold Cathodes for Backlight Applications
For More Information Call (818) 775-1007

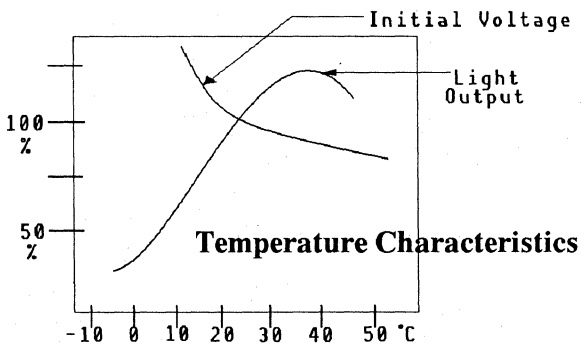
FEATURES

- (4) Colors (B)lue, (G)reen, (YG)yel/green, (R)ed
- (3) Whites (NW)natural white, (DW)daylight white, (BW)blue white
- Variable Lengths from 50-350mm.
- Variable Diameters from 4.1-12.25mm
- Aperture types for increased area luminance
- Wire terminal or End Cap termination
- Wide Color Temperature range from 5000°K to 8500°K
- Low Power Consumption
- Tipless Design for tight space requirements
- Very Low Heat generation
- Long Life -- up to 20,000 hours for larger diameter types
- High brightness -- up to 8000 cd/M^2
- Available with (3) bends for illuminating larger areas
- Both Mercury and Non-Mercury *(low temp.)* types available
- Inverters available for prototyping and preproduction units

APPLICATIONS

- Backlighting for Liquid Crystal Displays
- Lighting for Panel legends
- Slide and Document Scanners
- Copy and FAX Machines





Examples of standard 100mm units in Natural White (NW)

Type	Dia. (mm)	MOL (mm)	Eff. Light Length (mm)	Current (mA)	Voltage (Vrms)	Watts (W)	Brightness (cd/m2)	Life (hrs)
HMB4(NW)100B	4.10	100	75	3.5	270	0.95	8000	5000
HMB5(NW)100B	4.80	100	65	4.0	230	0.92	7500	10000
HMB6(NW)100B	5.80	100	65	5.0	210	1.05	6500	10000
HMB7(NW)100B	6.50	100	65	5.0	200	1.00	5500	10000
HMB8(NW)100FS	8.15	100	70	5.0	195	0.98	4000	20000
HMB10(NW)100FS	9.80	100	60	10.0	190	1.90	5000	20000
HMB12(NW)100FS	12.25	100	55	20.0	180	3.60	5000	20000

Pacific Industrial Components Corporation * 19201E Parthenia Street * Northridge, CA 91324 * FAX (818) 701-5508

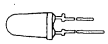
AND
ONE OF THE PURDY GROUP OF COMPANIES

Light Emitting Diodes
Discrete Lamps and Display

770 AIRPORT BLVD., BURLINGAME, CA 94010 • TEL (415) 347-9916 • FAX (415) 340-1670 • MCI/TLX 677-1439 (PURDY UW)

LED LAMPS
*NEW GaAlAs (AlGaAs)

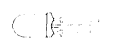
*KILO BRIGHT (Up To 3000 mcd)

Color	 φ5 mm (T1¾)	Luminous Intensity mcd (I_f = 20 mA)
Red Colorless Clear, θ = 20°	AND120BR AND120CR	750 1400
Red Colorless Clear, θ = 8	AND180BRP AND180CRP	2300 4100
Red Colorless Clear, θ = 15	AND130BR AND130CR	1280 2300

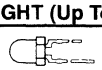
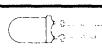
SPECIAL SHAPES

Color	3 x 4 x 4 mm	φ2 mm	Mini φ2 mm	1 x 5 mm	2 x 4mm	2 x 5 mm	2.5 x 2.0 mm
Red Diffused	AND207R	AND206R	AND226R	AND205R	AND211R	AND208R	AND221S
Green Diffused	AND207G	AND206G	AND226G	AND205G	AND211G	AND208G	AND211G
Yellow Diffused	AND207Y	AND206Y	AND226Y	AND205Y	AND211Y	AND208Y	AND221Y

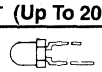
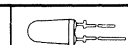
DUAL COLOR/THREE COLOR

Color	φ4 mm	 φ5 mm (T1¾)	1 x 5 mm	2 x 5 mm	φ5 mm (T1¾)	T1	2.2 x 3.2 mm
Red/Grn	AND101RG	AND116SG	AND205SG	AND208SG	AND2451RGL	AND126SG	AND222SG
Yel/Grn		AND116YG	AND205YG	AND208YG			
Orge/Grn		AND116OG	AND205OG	AND208OG			

STANDARD BRIGHT (Up To 10 mcd)

Color	 φ3.1 mm (T1)	Luminous Intensity mcd (I_f = 20 mA)	 φ5 mm (T1¾)	Luminous Intensity mcd (I_f = 20 mA)
Red Clear	AND123R	2.5	AND113R	3.5
Red Diffused	AND124R	1.5	AND114R	1.5
Green Clear	AND123G	6	AND113G	1.7
Green Diffused	AND124G	4	AND114G	5
Yellow Clear	AND123Y	4	AND113Y	9
Yellow Diffused	AND124Y	2.5	AND114Y	5
Orange Clear	AND123O	3.5	AND113O	8
Orange Diffused	AND124O	2	AND114O	4

ULTRA BRIGHT (Up To 200 mcd)

Color	 φ3.1 mm (T1)	Luminous Intensity mcd (I_f = 20 mA)	 φ5 mm (T1¾)	Luminous Intensity mcd (I_f = 20 mA)
Red Clear	AND163UR*	40	AND153UR*	200
Red Diffused	AND164UR*	20	AND154UR*	100
Green Clear	AND163UG	40	AND153UG	120
Green Diffused	AND164UG	20	AND154UG	60
Yellow Clear	AND163UY	40	AND153UY	120
Yellow Diffused	AND164UY	20	AND154UY	60

LED DISPLAYS *NEW GaAlAs—X-TRA BRIGHT DISPLAYS

Character Height		0.3 Inch		.43 Inch		.56 Inch	
7 Segments Display Font	Common	Cathode	Anode	Cathode	Anode	Cathode	Anode
	Standard Bright	AND332	AND333	AND342	AND343	AND362	AND353
	Super Bright (Red)	AND332S	AND333S	AND342S	AND343S	AND263S	AND363S
	Ultra Bright (Red)	*AND332UR	*AND333UR	*AND342UR	*AND343UR	*AND362UR	*AND363UR
	Low Current (Red)	AND332TR	AND333TR	AND342TR	AND343TR	AND362TR	AND363TR

*Refers to GaAlAs

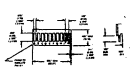
ALPHANUMERIC

		Common	
	Digit Height	Cathode	Anode
	.5 inch	AND370R	AND371R
	.8 inch	AND8010SCLB	AND8010SALB
	2.3 inch	AND2316SCLB	AND2316SALB

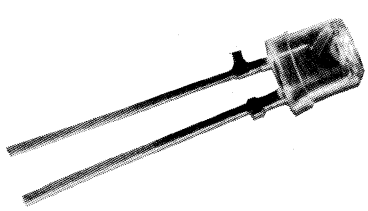
LARGE SIZE

		Common	
	Digit Height	Cathode	Anode
	.8 inch	AND8010SCL	AND8010SAL
	1.8 inch	AND380R	—
	2.3 inch	AND2307SCL	AND2307SAL
	4.0 inch	AND4107SCL	AND4107SAL

BAR GRAPH

Display Font	Color	Type No.
 1" x .4" 10 Segment	RED GREEN	AND10KRL AND10KGL

FIBER OPTIC EMITTER



FEATURES

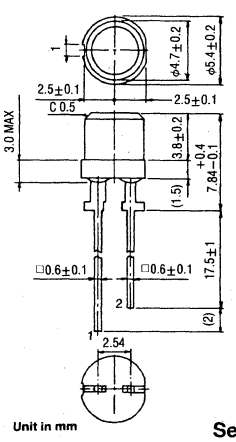
- 660 nm emitter optimized for plastic fiber cable, GaAlAs
- High output power coupled into plastic fiber

FIBER OPTIC EMITTER SERIES

Part Number	Fiber Coupled Power (dBm)	Test Condition (mA)	Forward Voltage (V)	Cut-Off Frequency (MHz)	Total Capacitance (pF)
AND280	−4.0	30	1.9	3	80
AND281	−4.0	30	1.9	3	80

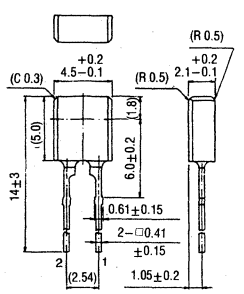
OUTLINE DIMENSIONS

AND280



Unit in mm

AND281



Unit in mm

See our pages on Displays, Section 2450, pages B•1048, B•1049

ARCOLECTRIC

For detailed information request our main catalog.

INDICATOR LIGHTS

CODE: Most products UL, CSA and VDE approved.

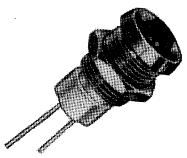
FL Non replaceable incandescent lamps in 6, 12 and 28 volt.

LE LED lamps incorporated into body, various voltages/colors.

LH Lamp holders for replaceable lamps 6v to 250 volts.

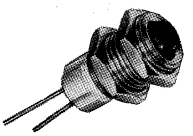
NL Neon lamps in a selection of sizes, 125v to 250v.

1048B Black
1048 Chrome **LH**



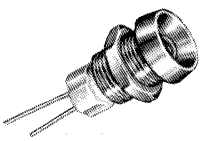
T1.3/4 (5mm) LED Lamp holder — Mtg 8.0mm (.3125″)

1049B Black
1049 Chrome **LH**



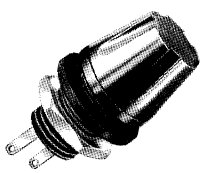
T1.3/4 (5mm) LED Lamp holder — Mtg 8.0mm (.3125″)

1050B Black
1050 Chrome **LH**



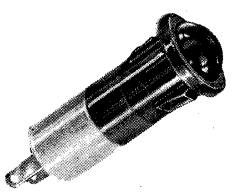
T1.3/4 (5mm) LED Lamp holder — Mtg.8.0mm (.3125″)

60 **LH**



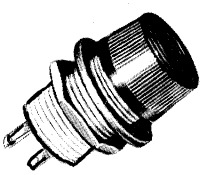
Mtg. 9.5mm (.375″)

61 **LH**



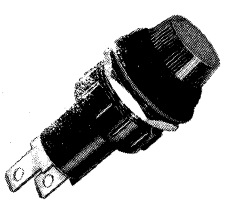
Mtg 9.5mm (.375″)

62 **LH**



Mtg 12.7mm (.50″)

382 **LH**

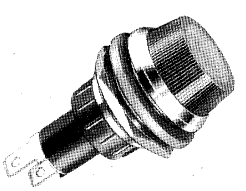


Mtg. 19.0mm (.750″)

392 **LH**

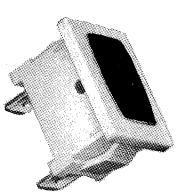
Mtg 19.0mm (.750″)

692 **LH**



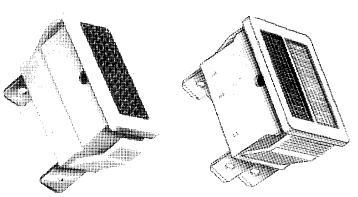
Mtg 25.4mm (1.0″)

8630 **FL, NL**



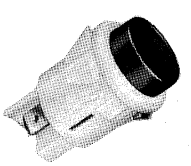
Mtg 19.1 x 12.9mm

430, 480 **FL, NL**



Various sizes consult factory

7030 **FL, NL**



Mtg. 25.4mm (1.0″)

Specifications subject to change without notice. Not all combinations always available.

SEE OUR SWITCH PRODUCTS AD IN SECTION 5100 PGS. B•1682, 1683

ARCOLECTRIC CORPORATION, 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 FAX: (818) 700-9541

ARCOLECTRIC

For detailed information request our main catalog.

INDICATOR LIGHTS

CODE: Most products UL, CSA and VDE approved.

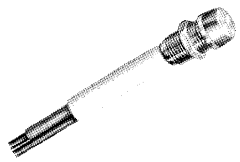
FL Non replaceable incandescent lamps in 6, 12 and 28 volt.

LE LED lamps incorporated into body, various voltages/colors.

LH Lamp holders for replaceable lamps 6v to 250 volts.

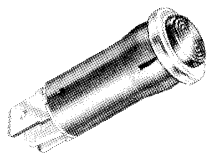
NL Neon lamps in a selection of sizes, 125v to 250v.

40 **FL**



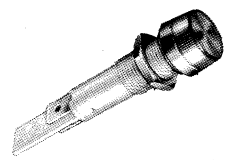
Mtg 6.3mm (.250″)

67 **FL, LE, LH, NL**



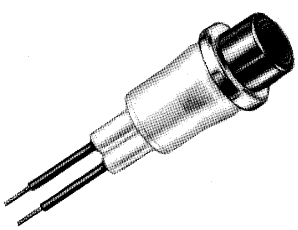
Mtg. 12.7mm (.50″)

177 **FL, NL**



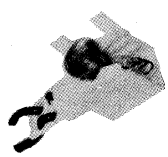
Mtg 12.7mm (.50″)

193 **FL, NL**



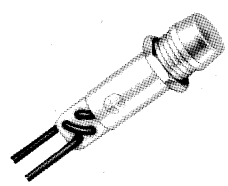
Mtg. 12.7mm (.50″)

195 **FL, NL**



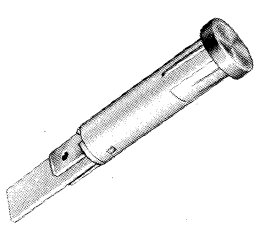
Mtg 8.0mm (.3125″)

245C **FL, NL**



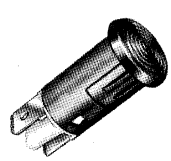
Mtg 7.1-8.00mm (.250-.3125″)

273 **FL, NL**



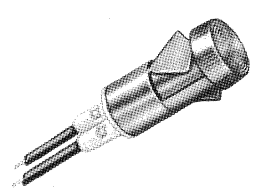
Mtg. 9.0mm (.354″)

589 **FL, LE, NL**



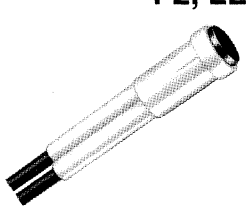
Mtg 12.7mm (.50″)

2870 **FL, LE, NL**



Mtg. 12.7mm (.50″)

2950 **FL, LE, NL**

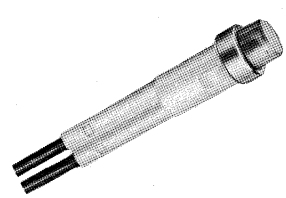


Mtg 8.0mm (.3125″)

2950C **FL, LE, NL**

Mtg. 8.0mm (.3125″)

2951 **FL, LE, NL**



Mtg. 8.0mm (.3125″)

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SEE OUR SWITCH PRODUCTS AD IN SECTION 5100 PGS. B•1682, 1683

ARCOLECTRIC CORPORATION, 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 FAX: (818) 700-9541

BKL — Electroluminescent Lamps

Lighting Today with Tomorrow's Technology

BKL Lamps are low cost, high quality, low power consuming, flexible, and thin.

BKL EL lamps, encapsulated in "Aclar" for maximum moisture protection, can be made into a variety of sizes and shapes:

Backlighting Electronic Displays

- Liquid Crystals
- Membrane Switches
- Graphic Panels
- Instrument Clusters

Prime Lighting Source

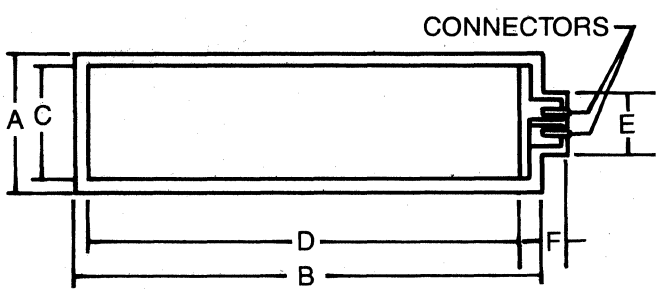
- Emergency Lighting
- Strip Lighting
- Decorative Lighting
- Identification Panels

Technical Data for BKL Lamps

- Operating Voltage: 0 - 250V ac
- Operating Frequency: 40 - 2000Hz
- Wave Shape: Sine Preferred
- Brightness Range: 0 - 80ft-L
- Time to Brightness: 120V; 400 Hz - 1200 Hrs.
  Inverter - 1800 Hrs.
- Power Consumption: 40mW/IN²
- Dynamic Capacitance: 0.002μf/IN₂
- Current Draw: 0.8mA/IN² (120V 400 Hz)
- Leading Current Phase Angle at 120V 400Hz: 70°
- Operating Temperature: 40°C - 55°C
- Storage Temperature: 65°C - 85°C
- Dielectric Breakdown: 500V dc

EL Lamps are available from stock or on very short lead time.
Custom lamps are available upon request.

P/N	LCD Size	Lit Area (C × D)
A1019	240 × 64	5.20 × 1.54
A1168	640 × 200	9.10 × 4.14
A1332	640 × 400	9.06 × 5.75
A1443	160 × 128	3.98 × 3.23
A1444	120 × 64	2.46 × 1.71
A1452	128 × 128	2.44 × 2.44
A1583	231 × 175	9.09 × 6.89
A1593	240 × 128	7.09 × 4.00
A1594	240 × 200	4.49 × 3.78



*Please call for other stock sizes.

Compensating inverters are available through BKL to handle dc to ac conversion.

This data is offered in good faith as typical and not as product specification. No warranty, either expressed or implied, is hereby made.

For the fastest industry turnaround
Call the BKL Sales Department.

(BKL) Bonar Kard-O-Lite, Inc.
421 Feheley Drive
King of Prussia, PA 19406
(215) 277-2910 or FAX your specs to (215) 277-2956.

If this is how you see LEDs, the ad is over.

The popular myth goes something like this: "An LED, is an LED, is an LED." Or: "If you've seen one, you've seen them all." And of course: "LEDs? They're commodity products."

Notions we at Dialight, steadfastly reject. And once you're familiar with our products, you'll know why.

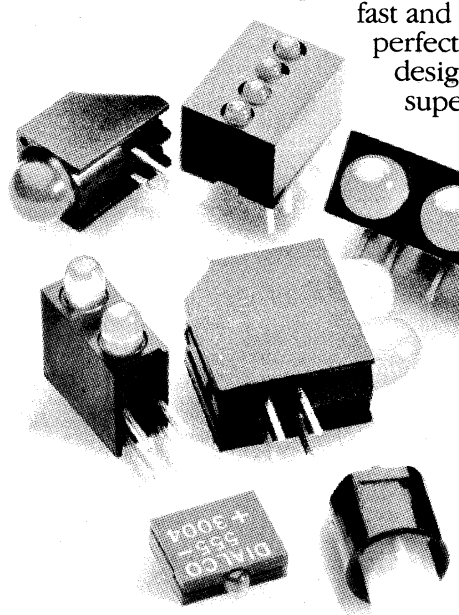
Take our Circuit Board Indicators. Single or multiple discretes aligned in a sturdy plastic housing, complete with their own current limiting resistor. The entire assembly polarity-keyed to guarantee correct insertion.

Each unit is 100% tested—ready to insert for wave soldering. No leads to bend, trim, or break. No time wasted fumbling with discretes.

Dialight pioneered the concept more than fifteen years ago to satisfy the OEM need for fast and reliable circuit board installation of LEDs. And we've been perfecting it ever since. Developing hundreds of standard and custom designs. A heritage of technological advance you can see in our new super-bright gallium aluminum arsenide units.

All meticulously engineered with the understanding that the failure of a "jelly bean product" can cost thousands in end-user downtime, and who-knows-what in customer loyalty.

The same understanding might bring you to call 201-223-9400, or write Dialight Corporation, 1913 Atlantic Ave., Manasquan, NJ 08736, and ask for our catalog or a product sample. At the very least, it's brought you to the real end of our ad.



DIALIGHT CORPORATION

A Cambridge Electronic Industries Company

Engineering is the only commodity we sell.

DIALIGHT LED CIRCUIT BOARD INDICATORS

PASSIVE COMPONENTS, ACTIVELY ENGINEERED

Dialight originated the idea of packaging LEDs for easy mounting on PC boards almost 15 years ago. So it's no wonder we now have the industry's widest selection.

Choose single-element LEDs in a wide range of voltages (with or without current-limiting resistors) or QUAD-LED® four-element arrays. We offer standard and high-efficiency LEDs, as well as new super bright models that are 4 times brighter than ordinary LEDs but operate on a fraction of the power.

We have just the right color for your application, too. Red, green, yellow or red/green bicolor. The combinations are virtually limitless. That's why your search for the perfect LED circuit board indicator should begin and end with the company that started it all and has been lighting the way ever since. Dialight.

STANDARD

PART NUMBER	DIFFUSED LED COLOR	TYPICAL FORWARD VOLTAGE†	TYPICAL FORWARD CURRENT†	TYPICAL LUMINOUS INTENSITY	FIGURE/PHOTO NUMBER
547-2001	Red	1.6V @ 20mA	■	3.0mcd @ 20mA	AA
547-2002	Red	—	20mA @ 3.6V	3.0mcd @ 3.6V	
547-2007	Red	—	3.0mA @ 5.0V	0.6mcd @ 5.0V	
547-2003	Red	—	6.0mA @ 5.0V	1.2mcd @ 5.0V	
547-2004	Red	—	16mA @ 5.0V	2.0mcd @ 5.0V	
547-2005	Red	—	14mA @ 10.0V	1.8mcd @ 10.0V	
547-2006	Red	—	10mA @ 14.0V	1.3mcd @ 14.0V	
547-2008	Red	—	3.0mA @ 24.0V	0.4mcd @ 24.0V	
547-2301	Green	2.4V @ 20mA	■	1.0mcd @ 20mA	
547-2303	Green	—	4.7mA @ 5.0V	0.5mcd @ 20mA	
547-2401	Yellow	2.2V @ 20mA	■	2.0mcd @ 20mA	
547-2403	Yellow	—	4.7mA @ 5.0V	0.6mcd @ 20mA	
550-0204	Green	2.3V @ 20mA	■	3.2mcd @ 20mA	BB
550-0304	Yellow	3.2V @ 20mA	■	3.2mcd @ 20mA	
550-0404	Red	1.7V @ 20mA	■	2.0mcd @ 20mA	
550-0504	Red	—	13mA @ 5.0V	2.0mcd @ 5.0V	
550-0604	Red	—	13mA @ 12.0V	2.0mcd @ 12.0V	
550-0704	Green	—	13mA @ 5.0V	2.0mcd @ 5.0V	
550-0804	Yellow	—	13mA @ 5.0V	2.0mcd @ 5.0V	
550-3004▲	Red/Green	2.3V @ 10mA	■	1.8mcd @ 20mA (Red)	
550-0205	Green	2.3V @ 20mA	■	3.2mcd @ 20mA	CC
550-0305	Yellow	2.3V @ 20mA	■	3.2mcd @ 20mA	
550-0405	Red	1.7V @ 20mA	■	2.0mcd @ 20mA	
550-0505	Red	—	13mA @ 5.0V	2.0mcd @ 5.0V	
550-0605	Red	—	13mA @ 12.0V	2.0mcd @ 12.0V	
550-0705	Green	—	13mA @ 5.0V	2.0mcd @ 5.0V	
550-0805	Yellow	—	13mA @ 5.0V	2.0mcd @ 5.0V	
550-3005▲	Red/Green	2.3V @ 10mA	■	1.8mcd @ 20mA (Red)	
550-0206	Green	2.3V @ 20mA	■	3.2mcd @ 20mA	DD
550-0306	Yellow	2.3V @ 20mA	■	3.2mcd @ 20mA	
550-0406	Red	1.7V @ 20mA	■	2.0mcd @ 20mA	
550-0506	Red	—	13mA @ 5.0V	2.0mcd @ 5.0V	
550-0606	Red	—	13mA @ 12.0V	2.0mcd @ 12.0V	
550-0706	Green	—	13mA @ 5.0V	2.0mcd @ 5.0V	
550-0806	Yellow	—	13mA @ 5.0V	2.0mcd @ 5.0V	
550-3006▲	Red/Green	2.3V @ 10mA	■	1.8mcd @ 20mA (Red)	
550-0207	Green	2.3V @ 20mA	■	3.2mcd @ 20mA	EE
550-0307	Yellow	2.3V @ 20mA	■	3.2mcd @ 20mA	
550-0407	Red	1.7V @ 20mA	■	2.0mcd @ 20mA	
550-0507	Red	—	13mA @ 5V	2.0mcd @ 5.0V	
550-0607	Red	—	13mA @ 12V	2.0mcd @ 5.0V	
550-0707	Green	—	13mA @ 5V	2.0mcd @ 5.0V	
550-0807	Yellow	—	13mA @ 5V	2.0mcd @ 5.0V	
550-3007▲	Red/Green	2.3V @ 20mA	■	1.8mcd @ 20mA	
550-0204-004*	Green	2.3V @ 20mA	■	3.2mcd @ 20mA	FF
550-0304-004*	Yellow	2.3V @ 20mA	■	3.2mcd @ 20mA	
550-0404-004*	Red	1.7V @ 20mA	■	2.0mcd @ 20mA	

STANDARD

PART NUMBER	DIFFUSED LED COLOR	TYPICAL FORWARD VOLTAGE†	TYPICAL FORWARD CURRENT†	TYPICAL LUMINOUS INTENSITY	FIGURE/PHOTO NUMBER/PHOTO
550-0504-004•	Red		15mA @ 5V	2mcd @ 5V	FF
550-0604-004•	Red		15mA @ 12V	2mcd @ 5V	
550-0704-004•	Green		15mA @ 5V	2mcd @ 5V	
550-0804-004•	Yellow		15mA @ 5V	2mcd @ 5V	
550-0205-004*	Green	2.3V @ 20mA	■	3.2mcd @ 20mA	GG
550-0305-004*	Yellow	2.3V @ 20mA	■	3.2mcd @ 20mA	
550-0405-004*	Red	1.7V @ 20mA	■	2.0mcd @ 20mA	
550-0505-004•	Red		13mA @ 5V	2mcd @ 5V	
550-0605-004•	Red		13mA @ 12V	2mcd @ 5V	
550-0705-004•	Green		13mA @ 5V	2mcd @ 5V	
550-0805-004•	Yellow		13mA @ 5V	2mcd @ 5V	
550-0206-004*	Green	2.3V @ 20mA	■	3.2mcd @ 20mA	HH
550-0306-004*	Yellow	2.3V @ 20mA	■	3.2mcd @ 20mA	
550-0406-004*	Red	1.7V @ 20mA	■	2.0mcd @ 20mA	
550-0506-004•	Red		13mA @ 5V	2mcd @ 5V	
550-0606-004•	Red		13mA @ 12V	2mcd @ 5V	
550-0706-004•	Green		13mA @ 5V	2mcd @ 5V	
550-0806-004•	Yellow		13mA @ 5V	2mcd @ 5V	
550-3006-004*▲	Red/Green	2.3V @ 10mA (Red)	■	1.8mcd @ 10mA (Red)	
		2.3V @ 10mA (Green)	■	1.8mcd @ 10mA (Green)	
551-0205	Green	2.4V @ 20mA	■	2.0mcd @ 20mA	JJ
551-0305	Yellow	2.2V @ 10mA	■	2.5mcd @ 10mA	
551-0405	Red	1.6V @ 20mA	■	2.0mcd @ 20mA	
551-0505	Red	—	16mA @ 5V	0.8mcd @ 5V	
551-0605	Green	—	12mA @ 5V	4mcd @ 5V	
551-0705	Yellow	—	10mA @ 5V	4mcd @ 5V	
551-1105	Red	1.8V @ 2mA	■	1.8mcd @ 2mA	
551-1205	Yellow	1.9V @ 2mA	■	1.6mcd @ 2mA	
551-1305	Green	1.8V @ 2mA	■	1.6mcd @ 2mA	
551-0207	Green	2.1V @ 10mA	■	2.6mcd @ 10mA	KK
551-0307	Yellow	2.1V @ 10mA	■	2.6mcd @ 10mA	
551-0407	Red	1.7V @ 20mA	■	1.6mcd @ 20mA	
551-0507	Red	—	16mA @ 5V	.8mcd @ 5V	
551-0607	Green	—	12mA @ 5V	4mcd @ 5V	
551-0707	Yellow	—	10mA @ 5V	4mcd @ 5V	
551-1107	Red	1.8V @ 2mA	■	1.8mcd @ 2mA	
551-1207	Yellow	1.9V @ 2mA	■	1.6mcd @ 2mA	
551-1307	Green	1.8V @ 2mA	■	1.6mcd @ 2mA	
551-0207-004*	Green (D)	2.1V @ 10mA	■	2.6mcd @ 10mA	LL
551-0307-004*	Yellow (D)	2.1V @ 10mA	■	2.6mcd @ 10mA	
551-0407-004*	Red (D)	1.6V @ 20mA	■	1.6mcd @ 20mA	
551-0507-004*	Red (D)	—	16mA @ 5V	.8mcd @ 5V	
551-0607-004•	Green	—	12mA @ 5V	4mcd @ 5V	
551-0707-004•	Yellow	—	10mA @ 5V	4mcd @ 5V	
551-1107-004•	Red	1.8V @ 2mA	■	1.8mcd @ 2mA	
551-1207-004•	Yellow	1.9V @ 2mA	■	1.6mcd @ 2mA	
551-1307-004•	Green	1.8V @ 2mA	■	1.6mcd @ 2mA	

†Typical Forward Current is specified for indicators with integral current limiting resistors; typical Forward Voltage is specified for indicators without integral current limiter. *LED array. Specifications are "per LED".
▲Bicolor LED. ■Current limiting required. • Other configurations available. Consult factory.

STANDARD

PART NUMBER	DIFFUSED LED COLOR	TYPICAL FORWARD VOLTAGE†	TYPICAL FORWARD CURRENT†	TYPICAL LUMINOUS INTENSITY	FIGURE/PHOTO NUMBER
555-2001	Red	1.6V @ 20mA	■	3.0mcd @ 20mA	MM
555-2002	Red	—	20mA @ 3.6V	3.0mcd @ 3.6V	
555-2009	Red	—	1.0mA @ 5V	0.6mcd @ 5V	
555-2007	Red	—	3.0mA @ 5.0V	0.6mcd @ 5.0V	
555-2003	Red	—	6.0mA @ 5.0V	1.2mcd @ 5.0V	
555-2004	Red	—	16mA @ 5.0V	2.0mcd @ 10.0V	
555-2005	Red	—	14mA @ 10.0V	1.8mcd @ 10.0V	
555-2006	Red	—	10mA @ 14.0V	1.3mcd @ 14.0V	
555-2008	Red	—	3.0mA @ 24.0V	0.4mcd @ 24.0V	
555-2301	Green	2.4V @ 20mA	■	1.0mcd @ 20mA	
555-2303	Green	—	4.7mA @ 5.0V	0.5mcd @ 5.0V	
555-2401	Yellow	2.2V @ 20mA	■	2.0mcd @ 20mA	
555-2403	Yellow	—	4.7mA @ 5.0V	0.6mcd @ 5.0V	
555-3001	Red	1.6V @ 20mA	■	3.0mcd @ 20mA	NN
555-3002	Red	—	20mA @ 3.6V	3.0mcd @ 3.6V	
555-3009	Red	—	1.0mA @ 5V	0.6mcd @ 5V	
555-3007	Red	—	3.0mA @ 5.0V	0.6mcd @ 5.0V	
555-3003	Red	—	6.0mA @ 5.0V	1.2mcd @ 5.0V	
555-3004	Red	—	16mA @ 5.0V	2.0mcd @ 5.0V	
555-3005	Red	—	14mA @ 10.0V	1.8mcd @ 10.0V	
555-3006	Red	—	10mA @ 14.0V	1.3mcd @ 14.0V	
555-3008	Red	—	3.0mA @ 24.0V	0.4mcd @ 24.0V	
555-4001*	Red	1.6 @ 20mA	■	3.0mcd @ 20mA	PP
555-4007*	Red	—	3mA @ 5.0V	0.6mcd @ 5.0V	
555-4009*	Red	—	1.0mA @ 5V	0.6mcd @ 5V	
555-4003*	Red	—	6mA @ 5.0V	1.2mcd @ 5.0V	
555-4301*	Green	2.4V @ 20mA	■	1.0mcd @ 20mA	
555-4303*	Green	—	4.7mA @ 5.0V	0.5mcd @ 5.0V	
555-4401*	Yellow	2.2V @ 20mA	■	2.0mcd @ 20mA	
555-4403*	Yellow	—	4.7mA @ 5.0V	0.6mcd @ 5.0V	
555-5001*	Red	1.6V @ 2.0mA	■	3.0mcd @ 20mA	QQ
555-5003*	Red	—	6mA @ 5V	1.2mcd @ 5V	
555-5004*	Red	—	16mA @ 5V	2mcd @ 5V	
555-5007*	Red	—	3mA @ 5V	0.6mcd @ 5V	
555-5009*	Red	—	1mA @ 5V	0.6mcd @ 5V	
555-5301*	Green	2.4V @ 20mA	■	1.0mcd @ 20mA	
555-5401*	Yellow	2.2V @ 20mA	■	2.0mcd @ 20mA	
555-5303*	Green	—	4.7mA @ 5V	0.5mcd @ 20mA	
555-5403*	Yellow	—	4.7mA @ 5V	0.6mcd @ 20mA	
561-0101-050	Red	1.9V @ 5.0mA	■	3.0mcd @ 10mA	RR
561-0101-060	Red	1.9V @ 5.0mA	■	3.0mcd @ 10mA	
561-0101-070	Red	1.9V @ 5.0mA	■	3.0mcd @ 10mA	
561-0101-080	Red	1.9V @ 5.0mA	■	3.0mcd @ 10mA	
561-0101-090	Red	1.9V @ 5.0mA	■	3.0mcd @ 10mA	
561-0101-100	Red	1.9V @ 5.0mA	■	3.0mcd @ 10mA	
561-0104-XX0	Red	—	5V @ 16mA	2mcd @ 5V	

†Typical Forward Current is specified for indicators with integral current limiting resistors; typical Forward Voltage is specified for indicators without integral current limiter.
*LED array. Specifications are "per LED".
▲Bicolor LED. ■Current limiting required.
• Other configurations available. Consult factory.

HIGH EFFICIENCY Current Limiting Required

PART NUMBER	LED COLOR Diffused (D) Water Clear (W.C.)	TYPICAL FORWARD VOLTAGE	TYPICAL LUMINOUS INTENSITY	FIGURE/PHOTO NUMBER
550-2204	Green (D)	2.2V @ 10mA	3.0mcd @ 10mA	BB
550-2304	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
550-2404	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
550-2205	Green (D)	2.2V @ 10mA	3.0mcd @ 10mA	CC
550-2305	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
550-2405	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
550-2206	Green (D)	2.2V @ 10mA	3.0mcd @ 10mA	DD
550-2306	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
550-2406	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
550-2207	Green (D)	2.2V @ 10mA	3mcd @ 10mA	EE
550-2307	Yellow (D)	2.2V @ 10mA	3mcd @ 10mA	
550-2407	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
550-2204-004 *	Green (D)	2.2V @ 10mA	3.0mcd @ 10mA	FF
550-2304-004 *	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
550-2404-004 *	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	

HIGH EFFICIENCY Current Limiting Required

PART NUMBER	LED COLOR Diffused (D) Water Clear (W.C.)	TYPICAL FORWARD VOLTAGE	TYPICAL LUMINOUS INTENSITY	FIGURE/PHOTO NUMBER
550-2205-004 *	Green (D)	2.2V @ 10mA	3.0mcd @ 10mA	GG
550-2305-004 *	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
550-2405-004 *	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
550-2206-004 *	Green (D)	2.2V @ 10mA	3.0mcd @ 10mA	HH
550-2306-004 *	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
550-2406-004 *	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
561-2101-050	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	RR
561-2101-060	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
561-2101-070	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
561-2101-080	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
561-2101-090	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
561-2101-100	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
561-2201-050	Green (D)	2.2V @ 20mA	6.0mcd @ 20mA	
561-2201-060	Green (D)	2.2V @ 20mA	6.0mcd @ 20mA	
561-2201-070	Green (D)	2.2V @ 20mA	6.0mcd @ 20mA	
561-2201-080	Green (D)	2.2V @ 20mA	6.0mcd @ 20mA	
561-2201-090	Green (D)	2.2V @ 20mA	6.0mcd @ 20mA	
561-2201-100	Green (D)	2.2V @ 20mA	6.0mcd @ 20mA	
561-2301-050	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
561-2301-060	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
561-2301-070	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
561-2301-080	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
561-2301-090	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
561-2301-100	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
561-2401-050	Red (W.C.)	2.2V @ 10mA	24.0mcd @ 10mA	
561-2401-060	Red (W.C.)	2.2V @ 10mA	24.0mcd @ 10mA	
561-2401-070	Red (W.C.)	2.2V @ 10mA	24.0mcd @ 10mA	
561-2401-080	Red (W.C.)	2.2V @ 10mA	24.0mcd @ 10mA	
561-2401-090	Red (W.C.)	2.2V @ 10mA	24.0mcd @ 10mA	
561-2401-100	Red (W.C.)	2.2V @ 10mA	24.0mcd @ 10mA	
561-2501-050	Green (W.C.)	2.2V @ 20mA	25.0mcd @ 20mA	
561-2501-060	Green (W.C.)	2.2V @ 20mA	25.0mcd @ 20mA	
561-2501-070	Green (W.C.)	2.2V @ 20mA	25.0mcd @ 20mA	
561-2501-080	Green (W.C.)	2.2V @ 20mA	25.0mcd @ 20mA	
561-2501-090	Green (W.C.)	2.2V @ 20mA	25.0mcd @ 20mA	
561-2501-100	Green (W.C.)	2.2V @ 20mA	25.0mcd @ 20mA	
561-2601-050	Yellow (W.C.)	2.2V @ 10mA	16.0mcd @ 10mA	
561-2601-060	Yellow (W.C.)	2.2V @ 10mA	16.0mcd @ 10mA	
561-2601-070	Yellow (W.C.)	2.2V @ 10mA	16.0mcd @ 10mA	
561-2601-080	Yellow (W.C.)	2.2V @ 10mA	16.0mcd @ 10mA	
561-2601-090	Yellow (W.C.)	2.2V @ 10mA	16.0mcd @ 10mA	
561-2601-100	Yellow (W.C.)	2.2V @ 10mA	16.0mcd @ 10mA	

SUPER BRIGHT Current Limiting Required

550-5104	Red (D)	1.7V @ 20mA	30mcd @ 20mA	BB
550-5204	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
550-5304	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
550-5404	Amber (D)	2.2V @ 20mA	24mcd @ 20mA	
550-5504	Red (W.C.)	1.7V @ 20mA	160mcd @ 20mA	
550-5604	Green (W.C.)	2.1V @ 20mA	80mcd @ 20mA	
550-5704	Yellow (W.C.)	2.1V @ 20mA	160mcd @ 20mA	
550-5804	Amber (W.C.)	2.2V @ 20mA	90mcd @ 20mA	
550-5105	Red (D)	1.7V @ 20mA	30mcd @ 20mA	CC
550-5205	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
550-5305	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
550-5405	Amber (D)	2.2V @ 20mA	24mcd @ 20mA	
550-5505	Red (W.C.)	1.7V @ 20mA	160mcd @ 20mA	
550-5605	Green (W.C.)	2.1V @ 20mA	80mcd @ 20mA	
550-5705	Yellow (W.C.)	2.1V @ 20mA	160mcd @ 20mA	
550-5805	Amber (W.C.)	2.2V @ 20mA	90mcd @ 20mA	
550-5106	Red (D)	1.7V @ 20mA	30mcd @ 20mA	DD
550-5206	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
550-5306	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
550-5406	Amber (D)	2.2V @ 20mA	24mcd @ 20mA	
550-5506	Red (W.C.)	1.7V @ 20mA	160mcd @ 20mA	
550-5606	Green (W.C.)	2.1V @ 20mA	80mcd @ 20mA	
550-5706	Yellow (W.C.)	2.1V @ 20mA	160mcd @ 20mA	
550-5806	Amber (W.C.)	2.2V @ 20mA	90mcd @ 20mA	

*LED array. Specifications are "per LED."
• Other configurations available. Consult factory.

SUPER BRIGHT Current Limiting Required

PART NUMBER	LED COLOR Diffused (D) Water Clear (W.C.)	TYPICAL FORWARD VOLTAGE	TYPICAL LUMINOUS INTENSITY	FIGURE/PHOTO NUMBER
550-5107	Red (D)	1.7V @ 20mA	30mcd @ 20mA	EE
550-5207	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
550-5307	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
550-5407	Amber (D)	2.2V @ 20mA	24mcd @ 20mA	
550-5507	Red (W.C.)	1.7V @ 20mA	160mcd @ 20mA	
550-5607	Green (W.C.)	2.1V @ 20mA	80mcd @ 20mA	
550-5707	Yellow (W.C.)	2.1V @ 20mA	160mcd @ 20mA	
550-5807	Amber (W.C.)	2.2V @ 20mA	90mcd @ 20mA	
550-5104-004*	Red (D)	1.7V @ 20mA	30mcd @ 20mA	FF
550-5204-004*	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
550-5304-004*	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
550-5404-004*	Amber (D)	2.2V @ 20mA	24mcd @ 20mA	
550-5504-004*	Red (W.C.)	1.7V @ 20mA	160mcd @ 20mA	
550-5604-004*	Green (W.C.)	2.1V @ 20mA	80mcd @ 20mA	
550-5704-004*	Yellow (W.C.)	2.1V @ 20mA	160mcd @ 20mA	
550-5804-004*	Amber (W.C.)	2.2V @ 20mA	90mcd @ 20mA	
550-5105-004*	Red (D)	1.7V @ 20mA	30mcd @ 20mA	GG
550-5205-004*	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
550-5305-004*	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
550-5405-004*	Amber (D)	2.2V @ 20mA	24mcd @ 20mA	
550-5505-004*	Red (W.C.)	1.7V @ 20mA	160mcd @ 20mA	
550-5605-004*	Green (W.C.)	2.1V @ 20mA	80mcd @ 20mA	
550-5705-004*	Yellow (W.C.)	2.1V @ 20mA	160mcd @ 20mA	
550-5805-004*	Amber (W.C.)	2.2V @ 20mA	90mcd @ 20mA	
550-5106-004*	Red (D)	1.7V @ 20mA	30mcd @ 20mA	HH
550-5206-004*	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
550-5306-004*	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
550-5406-004*	Amber (D)	2.2V @ 20mA	24mcd @ 20mA	
550-5506-004*	Red (W.C.)	1.7V @ 20mA	160mcd @ 20mA	
550-5606-004*	Green (W.C.)	2.1V @ 20mA	80mcd @ 20mA	
550-5706-004*	Yellow (W.C.)	2.1V @ 20mA	160mcd @ 20mA	
550-5806-004*	Amber (W.C.)	2.2V @ 20mA	90mcd @ 20mA	
561-5101-XX0	Red (D)	1.7V @ 20mA	30mcd @ 20mA	RR
561-5201-XX0	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
561-5301-XX0	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
561-5401-XX0	Amber (D)	2.2V @ 20mA	24mcd @ 20mA	
561-5501-XX0	Red (W.C.)	1.7V @ 20mA	160mcd @ 20mA	
561-5601-XX0	Green (W.C.)	2.1V @ 20mA	80mcd @ 20mA	
561-5701-XX0	Yellow (W.C.)	2.1V @ 20mA	160mcd @ 20mA	
561-5801-XX0	Amber (W.C.)	2.2V @ 20mA	90mcd @ 20mA	

SUPER EFFICIENCY CBIs Operate @ 2mA input current

550-1104	Red (D)	1.8V @ 20mA	2.0mcd @ 2mA	BB
550-1105	Red (D)	1.8V @ 20mA	2.0mcd @ 2mA	CC
550-1106	Red (D)	1.8V @ 20mA	2.0mcd @ 2mA	DD
550-1104-004*	Red (D)	1.8V @ 20mA	2.0mcd @ 2mA	FF
550-1105-004*	Red (D)	1.8V @ 20mA	2.0mcd @ 2mA	GG
550-1106-004*	Red (D)	1.8V @ 20mA	2.0mcd @ 2mA	HH
550-1204	Yellow (D)	1.9V @ 20mA	1.8mcd @ 2mA	BB

SUPER EFFICIENCY CBIs Operate @ 2mA input current

PART NUMBER	LED COLOR Diffused (D) Water Clear (W.C.)	TYPICAL FORWARD VOLTAGE	TYPICAL LUMINOUS INTENSITY	FIGURE/PHOTO NUMBER
550-1205	Yellow (D)	1.9V @ 20mA	1.8mcd @ 2mA	CC
550-1206	Yellow (D)	1.9V @ 20mA	1.8mcd @ 2mA	DD
550-1204-004*	Yellow (D)	1.9V @ 20mA	1.8mcd @ 2mA	FF
550-1205-004*	Yellow (D)	1.9V @ 20mA	1.8mcd @ 2mA	GG
550-1206-004*	Yellow (D)	1.9V @ 20mA	1.8mcd @ 2mA	HH
550-1304	Green (D)	1.8V @ 2mA	1.8mcd @ 2mA	BB
550-1305	Green (D)	1.8V @ 2mA	1.8mcd @ 2mA	CC
550-1306	Green (D)	1.8V @ 2mA	1.8mcd @ 2mA	DD
550-1304-004*	Green (D)	1.8V @ 2mA	1.8mcd @ 2mA	FF
550-1305-004*	Green (D)	1.8V @ 2mA	1.8mcd @ 2mA	GG
550-1306-004*	Green (D)	1.8V @ 2mA	1.8mcd @ 2mA	HH
561-1101-XX0	Red (D)	1.8V @ 2mA	2.0mcd @ 2mA	RR
561-1201-XX0	Yellow (D)	1.9V @ 2mA	1.8mcd @ 2mA	
561-1301-XX0	Green (D)	1.8V @ 2mA	1.8mcd @ 2mA	

BILEVEL T-1 3/4

552-0111*	Red (D)	1.7V @ 20mA	2mcd @ 20mA	SS
552-0122*	Green (D)	2.3V @ 20mA	3.2mcd @ 20mA	
552-0133*	Yellow (D)	2.3V @ 20mA	3.2mcd @ 20mA	
552-0211*	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
552-0222*	Green (D)	2.2V @ 10mA	3.0mcd @ 10mA	
552-0233*	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
552-0311*	Red (D)	2.2V @ 10mA	2.0mcd @ 5V	
552-0322*	Green (D)	2.2V @ 10mA	4mcd @ 5V	
552-0333*	Yellow (D)	2.2V @ 10mA	2.4mcd @ 5V	
552-0711*	Red/Green (D)	2.3V @ 20mA	1.8mcd @ 20mA	
552-0811*	Red (D)	1.7V @ 20mA	30mcd @ 20mA	
552-0822*	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
552-0833*	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
552-0911*	Red (D)	1.8V @ 2mA	2.0mcd @ 2mA	
552-0922*	Green (D)	1.8V @ 2mA	1.8mcd @ 2mA	
552-0933*	Yellow (D)	1.9V @ 2mA	1.8mcd @ 2mA	

BILEVEL T-1

553-0111*	Red (D)	1.6V @ 20mA	1.6mcd @ 20mA	TT
553-0122*	Green (D)	2.0V @ 10mA	2.6mcd @ 10mA	
553-0133*	Yellow (D)	2.0V @ 10mA	2.6mcd @ 10mA	
553-0211*	Red (D)	1.8V @ 2mA	1.8mcd @ 2mA	
553-0222*	Green (D)	1.8V @ 2mA	1.6mcd @ 2mA	
553-0233*	Yellow (D)	1.9V @ 2mA	1.6mcd @ 2mA	
553-0311*	Red (D)	—	.8mcd @ 5V	
553-0322*	Green (D)	—	4mcd @ 5V	
553-0333*	Yellow (D)	—	4mcd @ 5V	

OTHER COLORS & BRIGHTNESSES AVAILABLE— Contact Factory

*LED array. Specifications are "per LED."

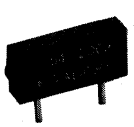


PHOTO AA

PHOTO BB

PHOTO CC

PHOTO DD

PHOTO EE

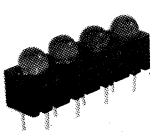


PHOTO FF

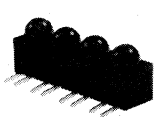


PHOTO GG

TYPICAL ILLUSTRATION

PHOTO HH

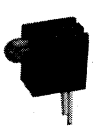


PHOTO JJ

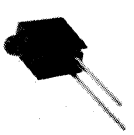


PHOTO KK

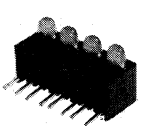


PHOTO LL

PHOTO MM

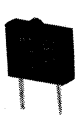


PHOTO NN

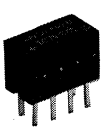


PHOTO PP

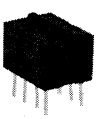


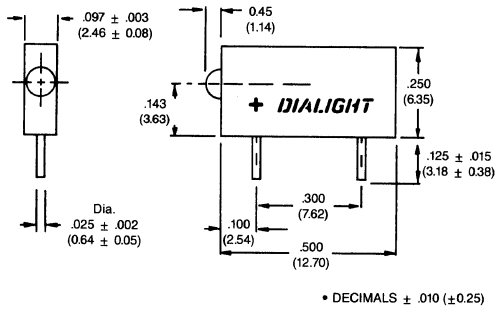
PHOTO QQ

PHOTO RR

PHOTO SS

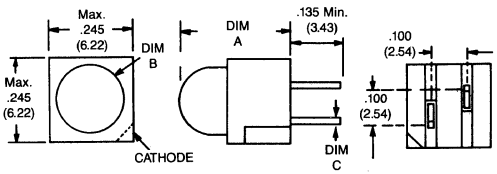
PHOTO TT

FIGURE AA



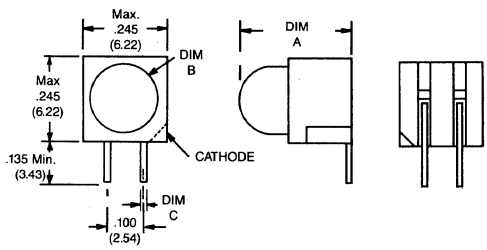
• DECIMALS ± .010 (±0.25)

FIGURE BB



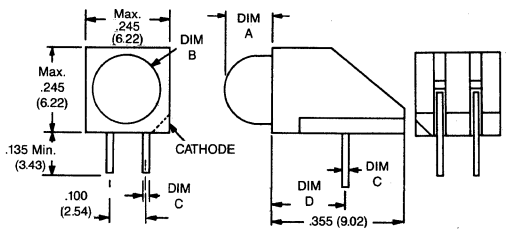
Dimensions	Standard	High Efficiency	550-0504 550-0604
A Max.	.380 (9.65)	.438	.437 (11.10)
B Dia.	.185 (4.70)	.185	.185 (4.70)
C	.020 (0.51)	.020	.025 (0.64)

FIGURE CC



Dimensions	Standard	High Efficiency	550-0505 550-0605
A Max.	.380 (9.65)	.438	.437 (11.10)
B Dia.	.185 (4.70)	.185	.185 (4.70)
C	.020 (0.51)	.020	.025 (0.64)

FIGURE DD



Dimensions	Standard	High Efficiency	550-0504 550-0604
A	.125 (3.18)	.183	.187 (4.75)
B Dia.	.185 (4.70)	.185	.185 (4.70)
C	.020 (0.51)	.020	.025 (0.64)
D	.200 (5.08)	.203	.210 (5.33)

FIGURE EE

550-0207 Green
550-0307 Yellow
550-0407 Red
550-0507 Red with integral resistor for operation at 5V †
550-0607 Red " " " " " " 12V †, ††
550-0707 Green " " " " " " 5V †, ††
550-0807 Yellow " " " " " " 5V †, ††

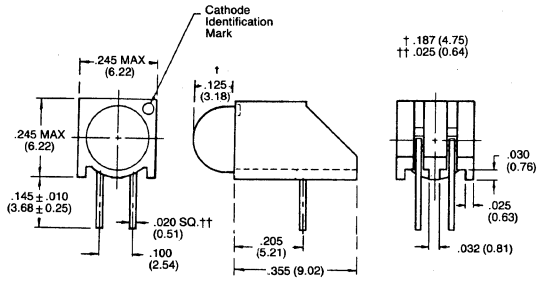


FIGURE FF

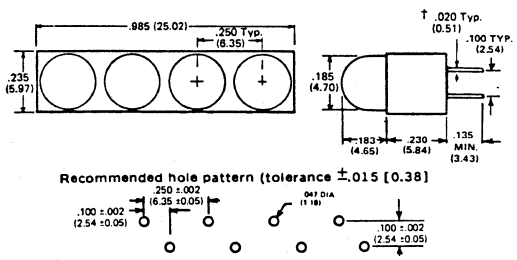


FIGURE GG

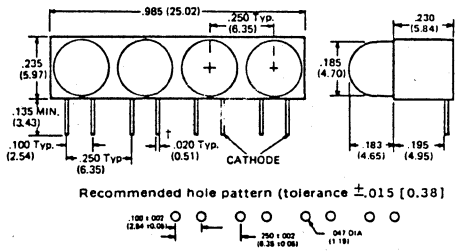
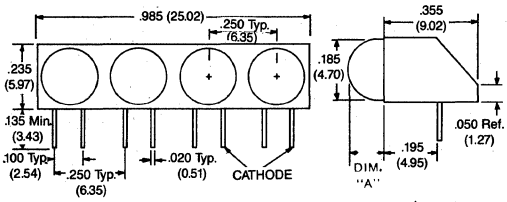


FIGURE HH

QUAD-LED®

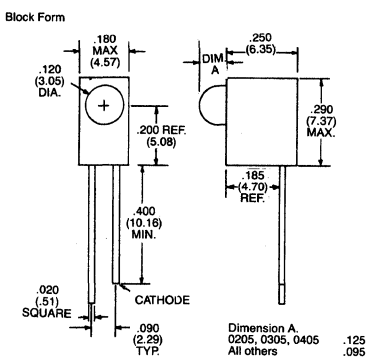


Dimension "A"	
Std.	Hi Eff.
.125	.183

THE CATHODE, AS MARKED, IS THE RED CATHODE FOR THE RED/GREEN BICOLOR LED.

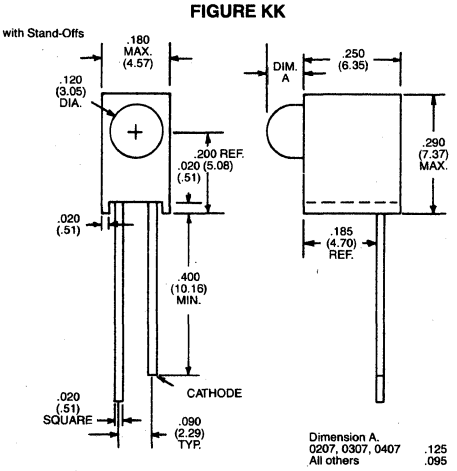
• DECIMALS ± .015 (±0.38)

FIGURE JJ



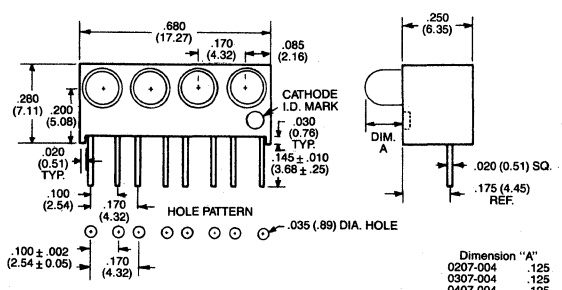
Dimension A.	
0205, 0305, 0405	.125
All others	.095

FIGURE KK



Dimension A.	
0207, 0307, 0407	.125
All others	.095

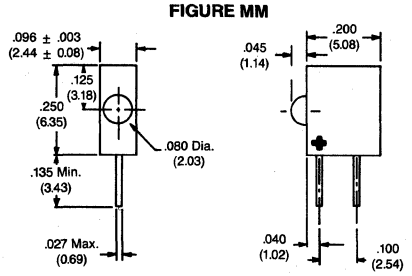
FIGURE LL



( ) Metric dimension in mm.

Dimension "A"	
0207-004	.125
0307-004	.125
0407-004	.125
All others	.095

FIGURE MM



• DECIMALS ± .015 (±0.38)

FIGURE NN

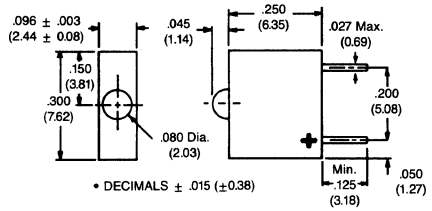
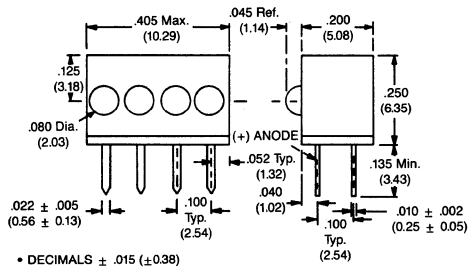


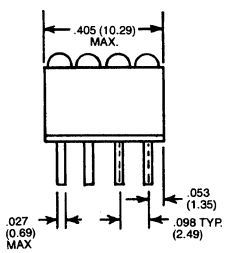
FIGURE PP

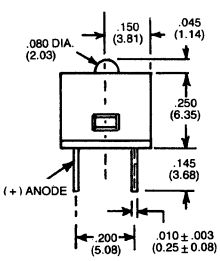
QUAD-LED®



U.S. Pat. No. 4,206,493

FIGURE QQ

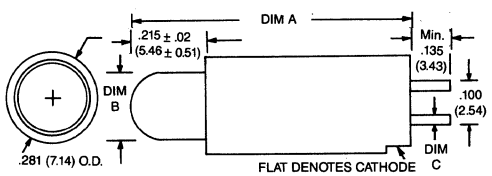




( ) Metric dimension in mm.

Decimals ±0.015 (0.38)

FIGURE RR



DIMENSIONS	STANDARD & HIGH EFFICIENCY
Dimension A + .010 (0.25) − .031 (0.79)	
561XXXX050	0.500 (12.70)
561XXXX060	0.600 (15.24)
561XXXX070	0.700 (17.78)
561XXXX080	0.800 (20.32)
561XXXX090	0.900 (22.86)
561XXXX100	1.000 (25.40)
Dimension B	0.200 (5.08)
Dimension C	0.020 (0.51)

FIGURE SS

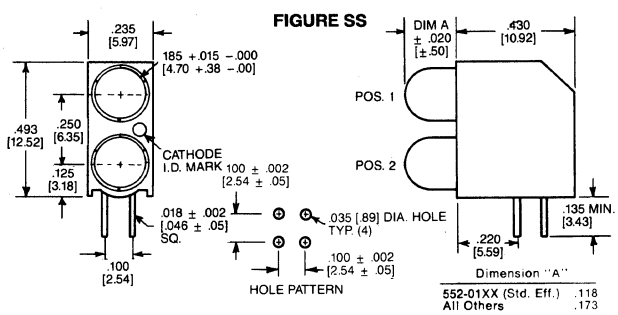
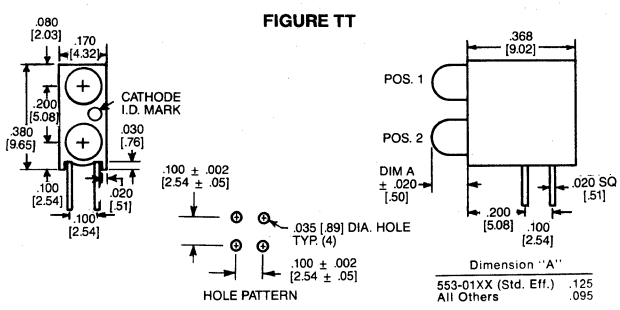


FIGURE TT



DIALIGHT INDICATOR LIGHTS

PASSIVE COMPONENTS, ACTIVELY ENGINEERED

Whatever your application calls for in indicator lights, Dialight has your number. Over 1,500,000 to be exact. That's how many different types of indicator lights we offer. One is bound to meet your specs and needs perfectly.

Take our ultraminiature incandescents with plug-in cartridges for example. They come in enough colors to simplify even the most complex front panels. And they make changing lamps a snap. Dialight LEDs, on the other hand, have a service life of over 100,000 hours. We also offer indicators with built-in RFI/EMI shields, open types, as well as watertight, oil-tight and press-to-test models. You'll also be happy to know that all our indicator lights meet or exceed military specs.

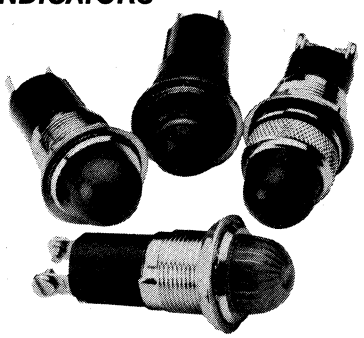
ULTRAMINIATURE LED, INCANDESCENT OR NEON INDICATORS—DATALITES®

Replaceable plug-in cartridges for 1.35-125V operation. U.L. listed and CSA approved. Indicators mount in 9/32″, 3/8″ and 3/4″ (twin lamp) clearance holes. Meet or exceed MIL-L-3661. Available with red, green, amber, blue, white translucent, light yellow or colorless lenses. Wide range of lens shapes. Custom legends.

SUBMINIATURE INCANDESCENT OR NEON INDICATORS

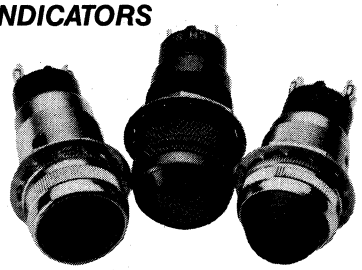
Meet or exceed MIL-L-3661. U.L. listed and CSA approved. Mount in 15/32″, 1/2″ or 17/32″ clearance holes. Incandescent for 1.35 to 28V; neon has built-in current-limiting resistor. Choice of cylindrical, faceted, convex, flat, square and round lens shapes. Custom legends.

MINIATURE INCANDESCENT OR NEON INDICATORS



U.L. listed and CSA approved. Meet or exceed MIL-L-3661. Mount in 9/16″ and 11/16″ clearance holes. Voltages range from 2 to 120V. Available in red, green, amber, blue, white, yellow or colorless lenses. Full range of finishes.

LARGE INCANDESCENT OR NEON INDICATORS



DIALIGHT CORPORATION
A Cambridge Electronic Industries Company

(201) 223-9400

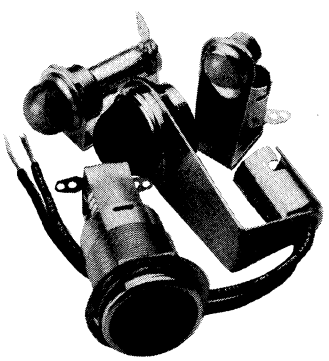
Engineering is the only commodity we sell.

DIALIGHT INDICATOR LIGHTS

PASSIVE COMPONENTS, ACTIVELY ENGINEERED

Mount in 1″ clearance hole. U.L. listed and CSA approved. Meet or exceed MIL-L-3661. Incandescent for 2 to 250V; neon has built-in current-limiting resistor. Screw-on or friction-fit lens caps. Bayonet lock caps also available. Mechanical dimmer caps or light shield lens cap available on some models. Choice of flat, convex, torpedo, large torpedo, faceted, torpedo faceted or dome lens shapes.

OPEN TYPE INDICATORS



Mount in 7/16″, 11/16″ or 1″ clearance holes. 2 to 250V models available depending upon series. Tamper-proof construction is available. Choice of flat, convex, faceted, stove-pipe or cylindrical lens shapes.

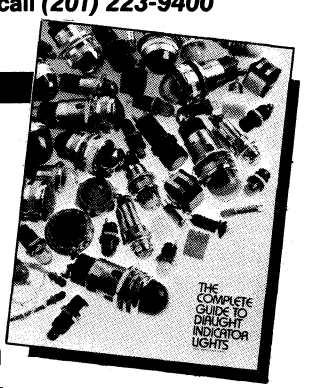
OIL-TIGHT INDICATORS

U.L. listed and CSA approved. Three retained elastomer seals of inert material, consisting of a gasket and two "O" rings, make these indicator lights resistant to permeation by oil, water, dust or fumes. Thus, assuring high reliability in harsh environments. Subminiature and miniature incandescent and neon lamps mount in 15/32″ and 11/16″ clearance holes. Large incandescent and neon lamps mount in 1″ or 1-3/16″ clearance holes. Available in red, green, yellow, blue, white translucent, light yellow and clear colorless. Positive or negative film discs with words, numerals or letters may be ordered for use with some models. Wide range of voltages and specifications available.

PRESS-TO-TEST INDICATORS

Positive safety factors are provided by patented built-in Press-To-Test indicators. Lamps can be checked instantly and accurately without removing them from their assembly. 4-terminal assemblies are available with all indicators and are particularly useful for remote applications. Subminiature, miniature and large Press-To-Test indicators are available for mounting in 15/32″, 5/8″ and 1″ clearance holes respectively. Choice of red, green, yellow, blue, white translucent, light yellow and clear colorless lens colors. Patented shutter-dimming device available on most models. Hot-stamped or engraved legend can be supplied on flat lenses. Meet or exceed QPL approval. NVIS and secure lighting compatible assemblies also available.

For complete specifications, mounting diagrams, ordering information, etc., send for our free product catalog. **Dialight Corp., 1913 Atlantic Avenue, Manasquan, NJ 08736. Or call *(201) 223-9400***



DIALIGHT CORPORATION
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Engineering is the only commodity we sell.

ERG Smart Force™ DC-AC Inverters compensate for the aging characteristics (brightness loss over time) of electroluminescent (EL) phosphors to improve EL lamp useful life. Smart Force™ Inverters automatically adjust operting voltage and frequency as the impedence of the EL lamp changes. Thus, providing an almost constant brightness throughout the life of the lamp. (See Typical Relative Brightness VS Time Performance Curve below.)

TAILORED INVERTERS:

Because all EL lamps are not electrically the same, ERG offers a Dedicated Series for different EL lamp brands. As a result of working jointly with the various manufacturers of EL to define each lamp brand's characteristics, ERG can offer the best matched inverter for ANY MANUFACTURERS EL LAMP!

Each DEDICATED inverter series is tailored specifically to the required voltages, frequency and load characteristics of the specific area of selected manufacturers EL lamp. Each Series offers four different output voltage configurations (providing different brightness levels), 3 different package sizes with a wide range of input voltages available providing maximum flexibility!

SOME OF OUR DEDICATED SERIES INVERTERS:

JLA Series ... Imported EL Backlit Displays
LPS Series ... Loctite Luminescent Systems, EL Products
ROG Series ... Durel/Rogers Corp.
BKL Series ... Bonar Kard-O-Lite
DUN Series ... Dunmore/ELTECH

SMART FORCE™ DC-AC INVERTER SPECIFICALLY DESIGNED FOR IMPORTED LCD BACKLIGHTS!

Endicott Research Group's JLA Series Smart Force™ DC-AC Inverter is tailored specifically to match the power requirements of EL backlites which are incorporated into imported LCD display modules. Designed to match the load characteristics of these imported EL lamps, the JLA series provides maximum performance and increased useful life.

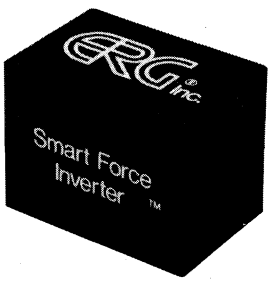
The JLA Series Inverters offer the exclusive ERG Smart Force™ feature, which automatically adjust the operating voltage and frequency as the impedence of the EL lamp varies overtime. The low power consumption (typically less than 200 milliwatts per unit load, Brightness Code 2) allows the electroluminescent lamp to become an ideal light source in many battery operated devices.

JLA Series inverters are ideal for powering EL backlit modules from Densitron, Hitachi, Epson, NEC, Optrex, Satori, Seiko, Sharp, Toshiba and others...It is available in 4 different output voltage configurations and in 3 different package sizes (depending on output) for maximum, design flexibility.

CONTACT THE FACTORY FOR MORE INFORMATION!

SMART FORCE™ INVERTERS

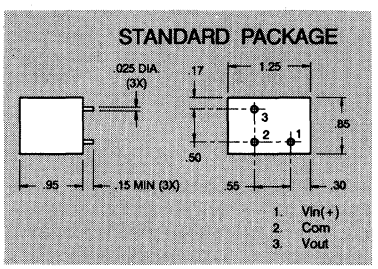
FOR ELECTROLUMINESCENT LAMPS

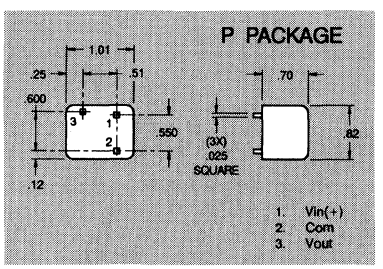


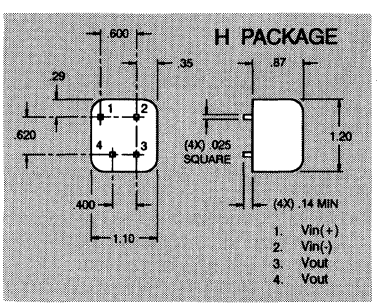
GENERAL SPECIFICATIONS:

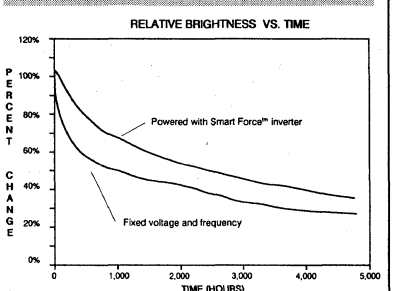
Input: 3, 5, 6, 9, 12, 15, 18, 24, 28 VDC (your choice)
Output: 60-130 V RMS @ 400-700 Hz. nom.
Package: Nylon, epoxy filled
Mounting: PCB Mount standard
Temperature Range:
Operating: -25° C to + 85°C
Storage: -40° C to + 100°C

STANDARD PACKAGE
MINIATURIZED "P" PACKAGE
"H" PACKAGE SERIES IDEAL FOR LARGER EL LAMPS









NO MATTER WHOSE EL LAMP...ERG HAS THE RIGHT INVERTER!!!

NO OTHER COMPANY IN THE WORLD OFFERS A WIDER RANGE OF DC-AC INVERTERS FOR EL LAMP APPLICATIONS!

AND NO OTHER COMPANY OFFERS THE SMART FORCE™ FEATURE!

ASK ABOUT OUR E200 SERIES DC-AC INVERTER FOR COLD CATHODE TUBE BACKLIGHT APPLICATIONS!

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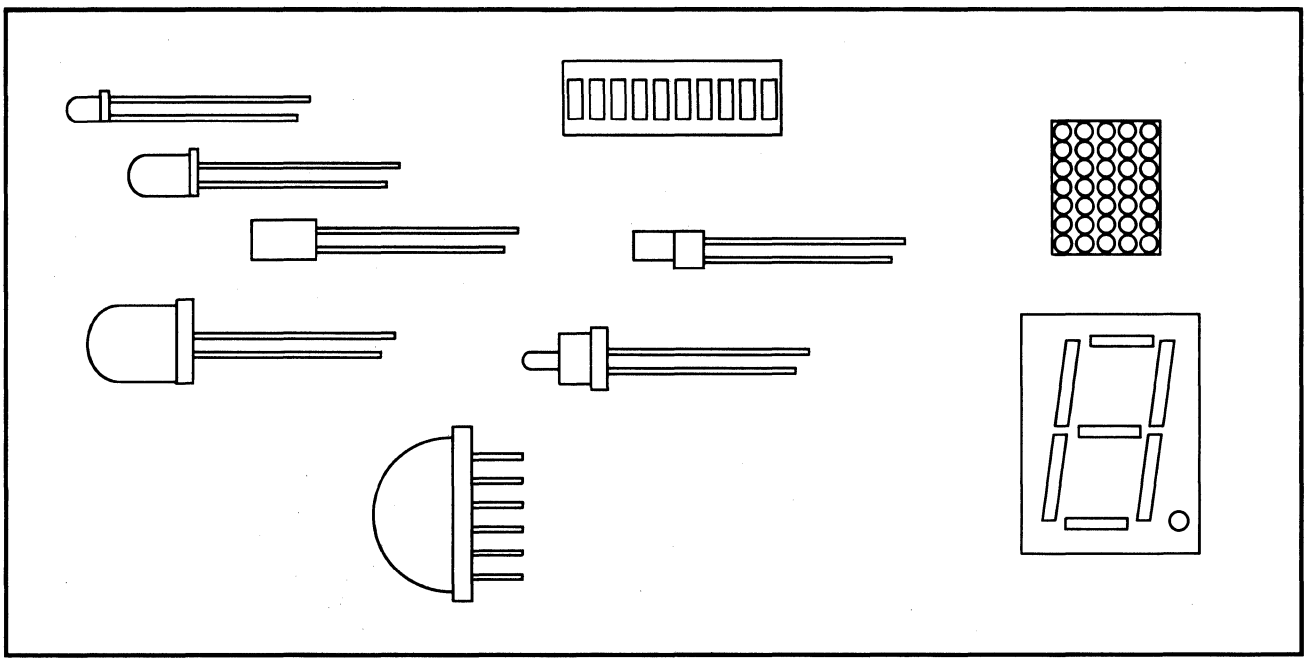

LEDs from 1.6mm dia to 20mm dia:
EL90-21 series
EL202, 204, 264 series
EL331, 332, 333, 313, 323, 383 series
EL363, 1363 series
EL811, 1101 series.

Rectangular LEDs:
EL523 series, 2 x 5mm flangeless
EL533 series, 2.5 x 5mm tombstone
EL573 series, 2.4 x 7.1 flangeless
EL723 series, 1 x 5mm
EL743 series, 2 x 5mm
EL1003 series, legend lamp.

LED displays:
ELM2157/2057 series 5 x 7 dot matrix
ELS313/312 series 0.3-inch single digit
ELS6X80/6X60 series .56-inch single digit
ELD6X40/6X10 series .56-inch dual digit
ELB1000 series 10-element bargraph
ELB57173 and B1020 series light bars.

Minimum order size:
LED lamps—100,000 pcs.
Displays—5,000 pcs.

For further information on any or all of your LED needs, contact our agent listed below for details. Our offerings encompass the entire spectrum of LED size, shape, brightness and combinations.

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TAIWAN, R.O.C.

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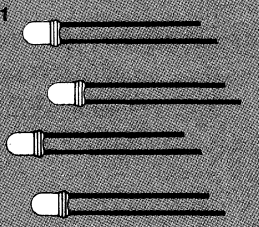
Fax: (213) 690-8067

T-1 Visible LEDs (Very Bright)

	LED No.	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E100	Clear	90mcd	**200mcd**	32°	2.1V	3.0V	650nm	1
ORANGE	E102	Clear	90mcd	**200mcd**	32°	2.1V	3.0V	610nm	1
YELLOW	E104	Clear	90mcd	**200mcd**	32°	2.2V	3.0V	585nm	1
GREEN	E106	Clear	90mcd	**200mcd**	32°	2.2V	3.0V	563nm	1
RED	E112	Diffused	36mcd	**100mcd**	55°	2.1V	3.0V	650nm	1
ORANGE	E113	Diffused	36mcd	**100mcd**	55°	2.1V	3.0V	610nm	1
YELLOW	E114	Diffused	36mcd	**100mcd**	55°	2.2V	3.0V	585nm	1
GREEN	E116	Diffused	36mcd	**100mcd**	55°	2.2V	3.0V	563nm	1

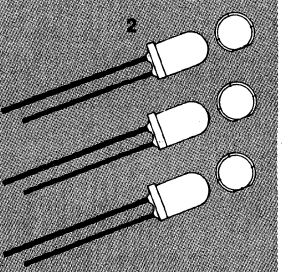
1



T-1¾ Diffused LEDs (Very Bright)

	LED No.	Lens	Luminous Intensity at 20mA Minimum	Luminous Intensity at 20mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E118	Diffused	36mcd	**100mcd**	55°	2.1V	3.0V	650nm	2
ORANGE	E119	Diffused	36mcd	**100mcd**	55°	2.1V	3.0V	610nm	2
YELLOW	E120	Diffused	36mcd	**100mcd**	55°	2.2V	3.0V	585nm	2
GREEN	E121	Diffused	36mcd	**100mcd**	55°	2.2V	3.0V	563nm	2
RED	E280	Clear	300mcd	**500mcd**	25°	1.8V	2.5V	660nm	2
RED	E281	Clear	500mcd	**700mcd**	25°	1.8V	2.5V	660nm	2
RED	E282	Clear	700mcd	**1000mcd**	25°	1.8V	2.5V	660nm	2
RED	E283	Clear	1400mcd	**2000mcd**	25°	1.8V	2.5V	660nm	2
RED	E284	Clear	2000mcd	**3000mcd**	25°	1.8V	2.5V	660nm	2

2

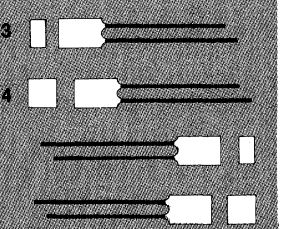


Rectangular and Square LEDs

	LED No.	Lens	Luminous Intensity at 10mA Min.	Luminous Intensity at 10mA Typical	Luminous Intensity at 10mA Max.	Forward Voltage at 10mA Typical	Forward Voltage at 10mA Maximum	Peak Wave Length at 10mA	Drawing
RED	E122	Diffused	.40mcd	**.80mcd**	—	2.0V	3.0V	650nm	3
ORANGE	E123	Diffused	.40mcd	**.80mcd**	—	2.0V	3.0V	610nm	3
YELLOW	E124	Diffused	.40mcd	**.80mcd**	—	2.1V	3.0V	585nm	3
GREEN	E125	Diffused	.40mcd	**1.0mcd**	—	2.1V	3.0V	562nm	3
RED	E126	Diffused	.40mcd	**1.0mcd**	—	2.0V	3.0V	650nm	4
ORANGE	E127	Diffused	.40mcd	**1.0mcd**	—	2.0V	3.0V	610nm	4
YELLOW	E128	Diffused	.40mcd	**1.0mcd**	—	2.1V	3.0V	585nm	4
GREEN	E129	Diffused	.40mcd	**1.0mcd**	—	2.1V	3.0V	562nm	4

3

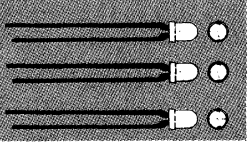
4



T-1 Low Current LEDs (2mA)

	LED No.	Lens	Luminous Intensity at 2mA Minimum	Luminous Intensity at 2mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E130	Diffused	1.0mcd	**2.0mcd**	40°	2.1V	2.8V	697nm	5
YELLOW	E131	Diffused	1.0mcd	**2.0mcd**	40°	2.0V	2.8V	570nm	5
GREEN	E132	Diffused	1.0mcd	**2.0mcd**	40°	2.1V	2.8V	565nm	5

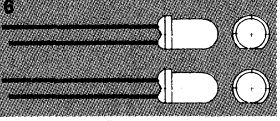
5



T-1¾ Low Current LEDs (2mA)

	LED No.	Lens	Luminous Intensity at 2mA Minimum	Luminous Intensity at 2mA Typical	Viewing Angle	Forward Voltage at 20mA Typical	Forward Voltage at 20mA Maximum	Peak Wave Length at 20mA	Drawing
RED	E133	Diffused	1.0mcd	**2.0mcd**	38°	2.1V	2.8V	697nm	6
YELLOW	E134	Diffused	1.0mcd	**2.0mcd**	38°	2.0V	2.8V	570nm	6
GREEN	E135	Diffused	1.0mcd	**2.0mcd**	38°	2.1V	2.8V	565nm	6

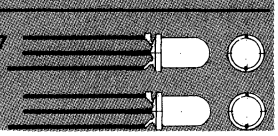
6



T-1¾ Bi-Color LED (Very Bright)

	LED No.	Lens	Luminous Intensity at 10mA Minimum	Luminous Intensity at 10mA Typical	Viewing Angle	Forward Voltage at 10mA Typical	Forward Voltage at 10mA Maximum	Peak Wave Length at 20mA	Drawing
RED &	E202	Milky White	3.6mcd	**10mcd**	50°	2.0V	3.0V	650nm	7
GREEN			3.6mcd	**10mcd**	50°	2.1V	3.0V	563nm	

7



Gilway Technical Lamp

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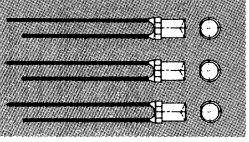
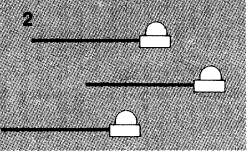
T-1 Wide Angle LEDs

	LED No.	Lens	Luminous Intensity at 10mA Minimum	Typical	Viewing Angle	Forward Voltage at 10mA Typical	Maximum	Peak Wave Length at 20mA	Drawing
RED	E136	Transparent	.6mcd	**1.6mcd**	140°	2.0V	3.0V	650nm	1
YELLOW	E137	Transparent	.9mcd	**2.5mcd**	140°	2.1V	3.0V	585nm	1
GREEN	E138	Transparent	1.4mcd	**4.0mcd**	140°	2.1V	3.0V	563nm	1



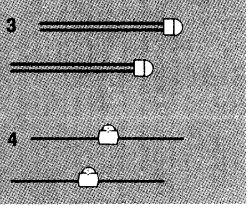
Right Angle LEDs

	LED No.	Lens	Luminous Intensity at 15mA Min.	Typical	Max.	Viewing Angle	Forward Voltage at 20mA Typical	Maximum	Peak Wave Length at 15mA	Drawing
RED	E108	Transparent	—	**2.5mcd**	—	60°	2.1V	2.8V	700nm	2
ORANGE	E109	Transparent	—	**4.0mcd**	—	60°	2.1V	2.8V	610nm	2
YELLOW	E110	Transparent	—	**4.0mcd**	—	60°	2.1V	2.8V	585nm	2
GREEN	E111	Transparent	—	**4.0mcd**	—	60°	2.1V	2.8V	565nm	2



Micro Miniature LEDs (2.0mm Diameter)

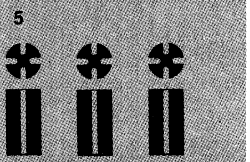
	LED No.	Lens	Luminous Intensity at 20mA Minimum	Typical	Viewing Angle	Forward Voltage at 20mA Typical	Maximum	Peak Wave Length at 20mA	Drawing
RED	E3	Transparent	1.5mcd	**3.0mcd**	45°	2.1V	2.7V	630nm	3
YELLOW	E4	Transparent	1.5mcd	**3.0mcd**	45°	2.1V	2.7V	585nm	3
GREEN	E5	Transparent	.6mcd	**1.2mcd**	45°	2.1V	2.7V	560nm	3
RED	E6	Transparent	1.4mcd	**4.0mcd**	40°	2.0V	2.8V	650nm	4
YELLOW	E7	Transparent	1.4mcd	**4.0mcd**	40°	2.1V	2.8V	585nm	4
GREEN	E8	Transparent	2.2mcd	**6.3mcd**	40°	2.1V	2.8V	560nm	4



Spacers for T-1, T-1¾, Right Angle, Square & Rectangular LEDs

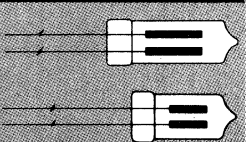
Spacer No. (1)	Spacer No. (2)	Length	Material	Drawing
SP3T	SP3L	3 mm (.118)	Black PVC	5
SP4T	SP4L	4 mm (.157)	Black PVC	5
SP5T	SP5L	5 mm (.197)	Black PVC	5
SP6T	SP6L	6 mm (.236)	Black PVC	5
SP7T	SP7L	7 mm (.276)	Black PVC	5
SP9T	SP9L	9 mm (.354)	Black PVC	5
SP12T	SP12L	12 mm (.472)	Black PVC	5
SP15T	SP15L	15 mm (.590)	Black PVC	5

(1) Spacer numbers ending in "T" provide a tight fit on the LED leads.
(2) Spacer numbers ending in "L" provide a loose fit on the LED leads.



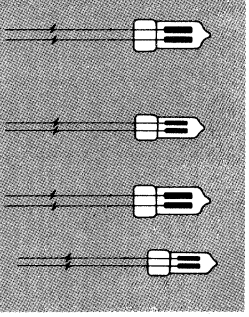
Neon Glow Lamps

Lamp No.	Color Off	Color On	Circuit Voltage	Starting Max. VAC	Current mA	Series Resistor 115V	220V	Average Life (hours)	mcd	Drawing
N512	Clear	Red	90-115/220	85	5.0	8.2KΩ	33KΩ	10,000	40.0	6
N501	Clear	Red	90-115/220	85	1.1	33KΩ	150KΩ	20,000	8.0	7
N502	Clear	Red	85-115/220	65	.9	47KΩ	180KΩ	20,000	4.0	8
N503	Clear	Red	85-115/220	75	1.4	33KΩ	120KΩ	20,000	4.0	9



Fluorescent Glow Lamps (Green, Yellow, Blue)

Lamp No.	Color Off	Color On	Circuit Voltage	Starting Max. VAC	Current mA	Series Resistor 115V	220V	Average Life (hours)	mcd	Drawing
N504	White	Green	90-115/220	80	.8	51KΩ	200KΩ	20,000	4.0	7
N505	White	Green	90-115/220	80	1.4	33KΩ	120KΩ	20,000	6.0	7
N506	White	Green	90-115/220	80	.6	75KΩ	220KΩ	20,000	1.1	8
N507	White	Green	90-115/220	80	.6	75KΩ	270KΩ	20,000	.8	9
N508	White	Yellow	90-115/220	80	.8	51KΩ	200KΩ	20,000	4.0	7
N509	White	Yellow	90-115/220	80	1.4	33KΩ	120KΩ	20,000	6.0	7
N510	White	Blue	90-115/220	80	.8	51KΩ	200KΩ	20,000	1.5	7
N511	White	Blue	90-115/220	80	1.4	33KΩ	120KΩ	20,000	3.2	7



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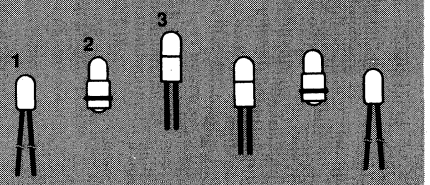
Gilway
Technical Lamp

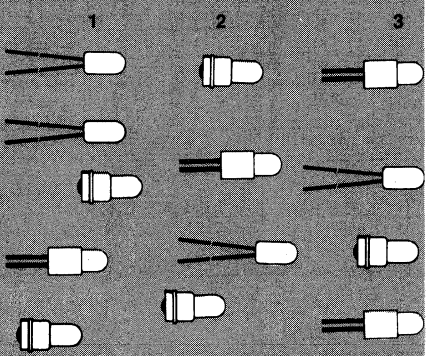
T-3/4 Subminiature Lamps

Volts	Amps	M.S.C.P.	Hours	Wire 1	Flanged 2	Bi-Pin 3
5.0	.060	.05	100,000	6833	8913	7114
5.0	.060	.15	3,000	6153	6183	7115
5.0	.075	.09	25,000	7133	8828	7116
5.0	.115	.15	40,000	7153	8270	7118
5.0	.115	.20	5,000	7102	7123	7119
12.0	.060	.15	16,000	L51	L52	L53
14.0	.050	.13	16,000	L54	L55	L56
28.0	.024	.15	16,000	L57	L58	L59



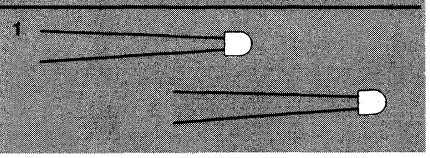
T-1 Subminiature Lamps

Volts	Amps	M.S.C.P.	Hours	Wire 1	Flanged 2	Bi-Pin 3
5.0	.021	.034	10,000	6022	8022	7022
5.0	.060	.15	5,000	6150	6180	7265
5.0	.075	.09	25,000	713	714	7714
5.0	.115	.15	40,000	715	718	7715
5.0	.115	.20	5,000	7213	7236	7267
5.0	.125	.22	5,000	7216	7239	7268
5.0	.145	.16	10,000	8096	7251	7269
10.0	.027	.10	10,000	7218	7240	8095
12.0	.060	.15	16,000	7219	32	8097
14.0	.065	.15	16,000	8111	8112	8098
18.0	.026	.15	16,000	7220	7241	8099
28.0	.024	.15	16,000	6838	6839	7839



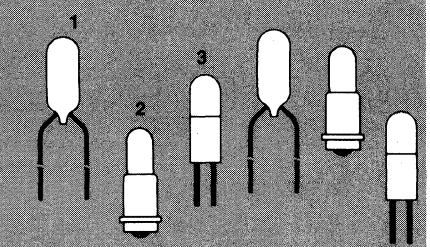
T-1 Subminiature Short Type Lamps

Volts	Amps	M.S.C.P.	Hours	Wire 1
5.0	.06	.05	100,000	6832AS15
5.0	.075	.09	40,000	7132AS15
5.0	.115	.15	40,000	7152AS15
28.0	.024	.15	16,000	7009



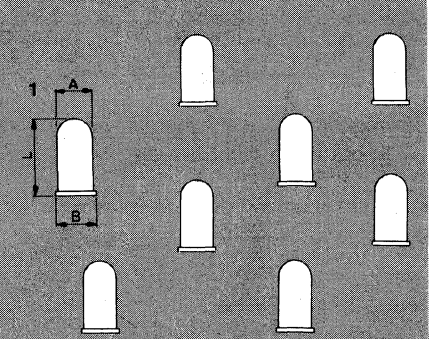
T-1 1/4 Subminiature Lamps

Volts	Amps	M.S.C.P.	Hours	Wire 1	Flanged 2	Bi-Pin 3
2.5	.40	.55	30	8655	8656	7307
3.0	.19	.25	350	324	8637	7637
5.0	.06	.03	100,000	580	3582	7580
5.0	.06	.05	100,000	583	3585	7583
5.0	.115	.15	40,000	515	3518	7515
6.0	.06	.13	3,000	2114	8541	7309
6.0	.20	.63	1,000	634	8628	7628
6.3	.20	.55	5,000	8610	8551	7310
14.0	.08	.50	1,000	8640	8646	7646
28.0	.04	.32	1,000	8627	8632	7632



Silicone Boots for T-1, T-1 3/4 + T-5mm Lamps

Boot No.	Color	Lamp Size	A	B	L	Drawing
BT301	Red	T-1	3.7	3.9	6.7	1
BT302	Green	T-1	3.7	3.9	6.7	1
BT303	Yellow	T-1	3.7	3.9	6.7	1
BT304	Blue	T-1	3.7	3.9	6.7	1
BT305	White	T-1	3.7	3.9	6.7	1
BT306	Blue/White	T-1	3.7	3.9	6.7	1
BT321	Red	T-1 3/4 + T-5mm	5.5	5.6	10.0	1
BT322	Green	T-1 3/4 + T-5mm	5.5	5.6	10.0	1
BT323	Yellow	T-1 3/4 + T-5mm	5.5	5.6	10.0	1
BT324	Blue	T-1 3/4 + T-5mm	5.5	5.6	10.0	1
BT325	White	T-1 3/4 + T-5mm	5.5	5.6	10.0	1
BT326	Blue/White	T-1 3/4 + T-5mm	5.5	5.6	10.0	1



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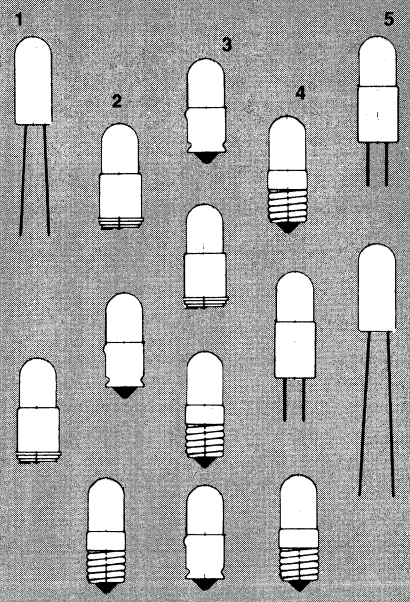
T-1¾ Subminiature Lamps

Volts	Amps	M.S.C.P	Hours	Wire 1	Flanged 2	Grooved 3	Screw 4	Bi-Pin 5
3.0	.03	.02	1,800	2156	7329	7343	7314	7358
5.0	.06	.15	5,000	3151	3150	3152	3153	3149
5.0	.115	.15	40,000	2203	7335	7348	7319	7362
5.0	.19	.45	1,000	8784	7334	7350	7317	7363
6.0	.04	.03	10,000	1730	345	8705	342	7945
6.0	.20	.60	1,000	1784	328	337	1768	7328
6.0	.22	.63	3,000	1784L	7337	337L	1768L	7365
6.3	.04	.02	50,000	2180	380	7351	7320	7380
6.3	.20	.40	50,000	2181	381	379	378	7381
6.3	.20	.55	3,000	2112	349	398	7323	7349
10.0	.014	.002	10,000	1869	344	709	8691	7344
10.0	.04	.08	5,000	2107	367	397	389	7367
11.0	.022	.03	10,000	8946	7338	7353	7325	7369
12.0	.04	.12	10,000	2174	394	7354	7326	7394
14.0	.08	.30	50,000	2182	382	386	8362	7382
14.0	.08	.50	750	1705	330	336	373	7330
14.0	.100	.50	10,000	2162	8918	393	8162	7373
18.0	.04	.15	10,000	2102	370	346	8536	7370
22.0	.04	.30	2,000	8425	459	457	8437	7459
28.0	.04	.20	50,000	2185	385	7355	8384	7374
28.0	.04	.30	25,000	2187	387	388	399	7387
28.0	.04	.34	7,000	1764	327	334	335	7327
28.0	.065	.65	5,000	8361	7341	7356	8369	7376



T-5mm Wedge Base Lamps

Lamp No.	Volts	Amps	M.S.C.P.	Hours	FilamentType	Base Type	Drawing
86	6.3	.200	.40	50,000	C-2F	Wedge	6
73	14.0	.080	.30	25,000	C-2F	Wedge	6
74	14.0	.100	.70	500	C-2F	Wedge	6
85	28.0	.040	.30	7,000	C-2F	Wedge	6
17	28.0	.065	.65	5,000	C-2F	Wedge	6

T-5mm Wedge Base Holders

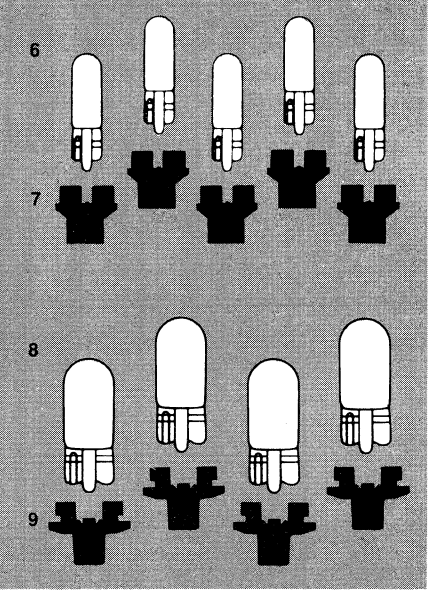
Holder No.	Lamp Type	Lamp Base Type	Drawing
H710	T-5mm	Wedge Base	7

T-10mm Wedge Base Lamps

Lamp No.	Volts	Amps	M.S.C.P.	Hours	Filament Type	Base Type	Drawing
159	6.3	.150	.38	5,000	C-2V	Wedge	8
259	6.3	.250	.50	5,000	C-2V	Wedge	8
555	6.3	.250	.90	3,000	C-2R	Wedge	8
161	14.0	.090	1.00	1,500	C-2F	Wedge	8
194	14.0	.270	2.00	1,500	C-2F	Wedge	8

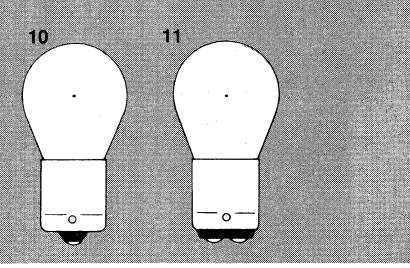
T-10mm Wedge Base Holders

Holder No.	Lamp Type	Lamp BaseType	Drawing
H711	T-10mm	Wedge Base	9



S-8 Miniature Lamps

Lamp No.	Volts	Amps	M.S.C.P.	Hours	Vacuum or Gas	Base Type	Drawing
6	6.4	3.0	23	500	G	D.C. Bayonet	11
6IF	6.4	3.0	23	500	G	D.C. Bayonet	11
8	8.0	2.2	20	500	G	D.C. Bayonet	11
88	6.8	1.91	15	300	G	D.C. Bayonet	11
94	12.8	1.04	15	700	G	D.C. Bayonet	11
1073	12.8	1.80	32	200	G	S.C. Bayonet	10
1142	12.8	1.44	21	1,000	G	D.C. Bayonet	11
305	28.0	.51	15	300	G	S.C. Bayonet	10
307	28.0	.67	21	300	G	S.C. Bayonet	10



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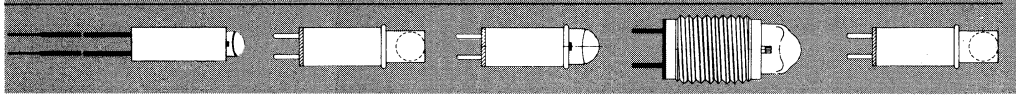
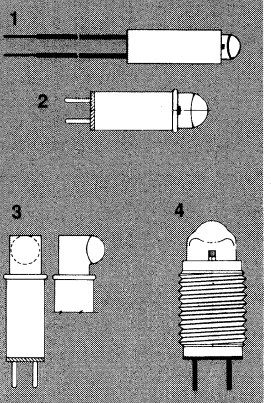
Focused Lens-End Lamps

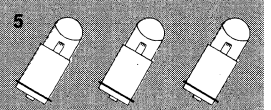
Lamp No.	Volts	Amps	Lux	Color Temp. (°Kelvin)	Hours	Vacuum or Gas	Filament Type	Base Type	Drawing
L1005	2.5	.350	1,200	2,170	30,000	V	C-6	Brass	1
L1005A	2.5	.350	1,550	2,170	30,000	V	C-6	Brass	1
L1026A	2.5	.350	2,000	2,250	10,000	V	C-2R	Brass	1
L1023	2.5	.350	2,100	2,240	15,000	V	C-6	Brass	1
L4038	2.5	.350	2,100	2,250	10,000	V	C-6	Cartridge	2
L4040	3.5	.370	4,000	2,550	1,000	V	C-2R	Cartridge	3
L1006	3.5	.450	1,600	2,230	30,000	G	C-6	Brass	1
L1024	3.5	.560	3,800	2,490	5,000	G	C-6	Brass	1
L1024A	3.5	.560	3,800	2,490	5,000	G	C-6	Brass	1
L1021	3.5	.600	12,000	2,930	100	Krypton	C-6	Brass	1
L1007	5.0	.160	800	2,300	15,000	V	C-2R	Brass	1
L1025	5.0	.240	1,200	2,450	10,000	V	C-2R	Brass	1
L8006	5.0	.775	7,000	2,370	30,000	G	C-6	1/2-20UNF-2A	4
L8008	5.0	.725	12,000	2,400	10,000	G	C-6	1/2-20UNF-2A	4





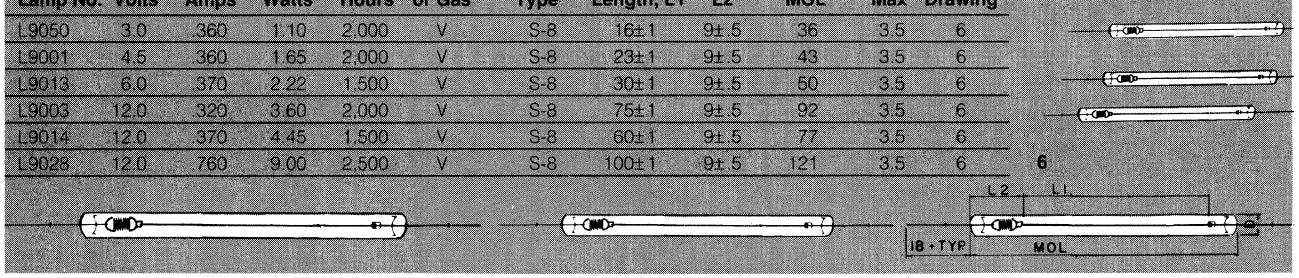
Midget Flanged Base Lens-End Lamps

Lamp No.	Volts	Amps	Lux	Color Temp. (° Kelvin)	Hours	Vacuum or Gas	Filament Type	Drawing
169-14	2.5	.340	1,000	2,170	30,000	V	C-6	5
180-14	2.5	.350	2,100	2,240	15,000	V	C-6	5
172-14	3.5	.450	1,600	2,230	30,000	G	C-6	5
173-14	3.5	.600	12,000	2,930	100	G	C-6	5
174-14	5.0	.170	880	2,300	15,000	V	C-2R	5



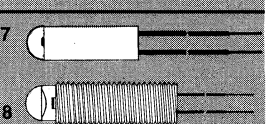
Line Filament Lamps

Lamp No.	Volts	Amps	Watts	Hours	Vacuum or Gas	Filament Type	Filament Length, L1	L2	Dimensions MOL	D Max	Drawing
L9050	3.0	.360	1.10	2,000	V	S-8	16±1	9±.5	36	3.5	6
L9001	4.5	.360	1.65	2,000	V	S-8	23±1	9±.5	43	3.5	6
L9013	6.0	.370	2.22	1,500	V	S-8	30±1	9±.5	50	3.5	6
L9003	12.0	.320	3.60	2,000	V	S-8	75±1	9±.5	92	3.5	6
L9014	12.0	.370	4.45	1,500	V	S-8	60±1	9±.5	77	3.5	6
L9028	12.0	.760	9.00	2,500	V	S-8	100±1	9±.5	121	3.5	6



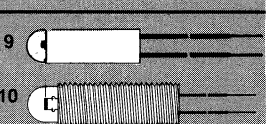
Lens-End Halogen Lamps

Lamp No.	Volts	Amps	Lux	Color Temp. (°Kelvin)	Hours	Filament Type	Base Type	Drawing
L1030	3.5	1.200	18,000	2,950	150	C-6	1/4 " Sleeve	7
L1041	5.0	1.430	30,000	2,800	3,000	C-6	1/4 " Sleeve	7
L1051	6.0	1.920	75,000	2,920	500	C-6	3/8 " 24 UNF-2A	8



Clear-End Halogen Lamps

Lamp No.	Volts	Amps	Lumens	Color Temp. (° Kelvin)	Hours	Filament Type	Base Type	Drawing
L1031	3.5	1.200	40	2,950	150	C-6	1/4 " Sleeve	9
L1040	5.0	1.430	70	2.800	3,000	C-6	1/4 " Sleeve	9
L1050	6.0	1.920	170	2.920	500	C-6	3/8 " 24 UNF-2A	10



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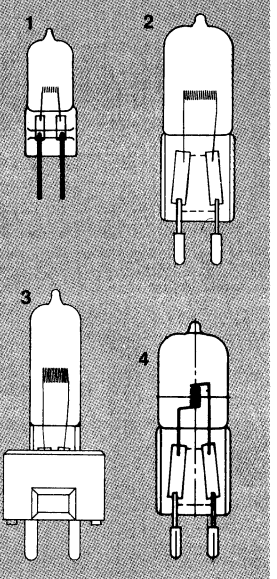
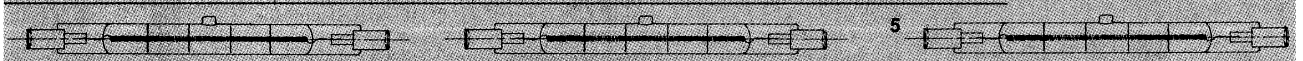
Quartz Halogen Lamps

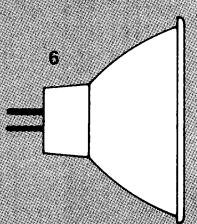
Lamp No.	Volts	Watts	Lumens	Color Temp. (°Kelvin)	Hours	Filament Type	Dimensions D	Dimensions MOL	Dimensions LCL	Base Type	Drawing
L7387	6.0	10	200	3,200	100	C-6	8.5	30.0	19.5 ± .25	G-4	1
L6402	6.0	10	150	2,900	2,000	C-6	8.5	30.0	19.5 ± .25	G-4	1
L7388	6.0	20	420	3,200	100	C-6	8.5	30.0	19.5 ± .25	G-4	1
L7394	6.0	20	350	3,000	2,000	C-6	8.5	30.0	19.5 ± .25	G-4	1
L7401	12.0	20	420	3,150	250	C-6	8.5	30.0	19.5 ± .25	G-4	1
L7404	12.0	20	350	3,000	2,000	C-6	8.5	30.0	19.5 ± .25	G-4	1
L7389	12.0	50	900	3,000	2,500	C-6	12.0	44.0	30.0 ± .25	GY6.35	2
L7390	12.0	100	2,400	3,000	2,000	C-Bar	11.0	44.0	30.0 ± .25	GY6.35	2
L7407	12.0	100	3,000	3,400	50	C-Bar	11.0	44.0	30.0 ± .25	G6.35	2
L6405	24.0	150	4,700	3,400	50	C-Bar	13.5	50.0	32.0 ± .50	G6.35	2
L7391	24.0	250	5,750	3,000	2,000	C-Bar	15.0	58.0	37.0	GY6.35	2
L9404	12.0	20	350	3,000	2,000	C-6	10.0	55.0	30.3 ± .25	*Snaplock*	3
L9389	12.0	50	900	3,000	2,500	C-6	12.0	60.0	33.3 ± .25	*Snaplock*	3
L9390	12.0	100	2,400	3,000	2,000	C-Bar	11.0	60.0	33.3 ± .25	*Snaplock*	3
L7409	12.0	20	300	3,000	2,000	C-8I	12.0	42.0	28.5 ± .25	GY6.35	4
L7410	12.0	35	600	3,000	3,000	C-8I	12.0	42.0	28.5 ± .25	GY6.35	4
L7411	12.0	50	900	3,000	3,000	C-8I	12.0	42.0	28.5 ± .25	GY6.35	4
L9110	120.0	150	2,400	2,900	1,500	C-8	12.0	78.0	—	R7s	5
L9111	120.0	150	3,600	2,900	2,000	C-8	9.4	114.2	—	R7s	5
L9112	120.0	250	4,000	2,900	2,000	C-8	9.4	114.2	—	R7s	5





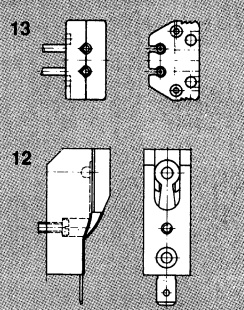
Dichroic Reflector Halogen Lamps

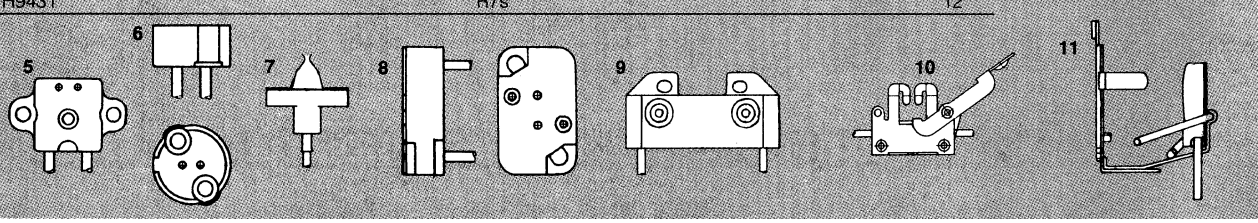
Lamp No.	Volts	Watts	Color Temp. (°Kelvin)	Hours	Dimensions MD	Dimensions MOL	Base	Drawing
L510	12.0	28	3,050	1,000	36.0	35.0	GZ4	6
L512	13.8	25	3,125	500	36.0	35.0	GZ4	6
L513	12.0	20	2,900	2,000	36.0	35.0	GZ4	6
L514	12.0	35	2,900	2,000	36.0	35.0	GZ4	6
L6408	12.0	75	3,000	1,500	50.0	42.0	GZ6.35	6
L7405	12.0	100	3,400	50	50.0	42.0	GZ6.35	6
L7406	21.0	150	3,350	40	50.5	45.0	GX5.3	6



Halogen Lamp Holders

Holder No.	Halogen Lamp Base Types	Drawing
H9901	G-4, GZ4	5
H9941	G-4, GZ4	6
H997	G-4, GZ4	7
H912	GY6.35, G6.35	6
H701	GY6.35, G6.35	8
H910	G6.35	9
H881	G6.35, GZ6.35	13
H9971	GY9.5, *Snaplock*	10
H705	GZ6.35	11
H706	GX5.3	11
H867	GY5.3	11
H989	GX5.3	6
H9431	R7s	12





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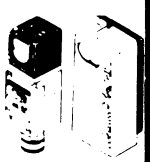
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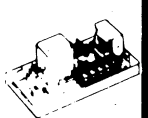
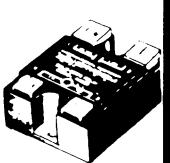
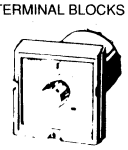

LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS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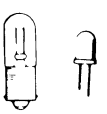
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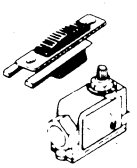
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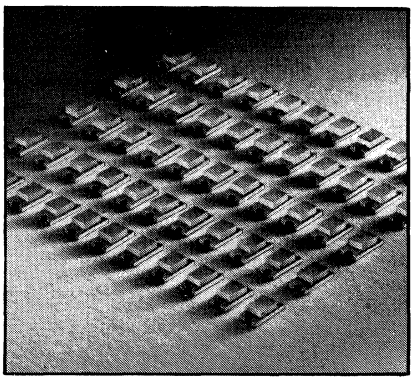


■ FEATURES

1. **It is an SMD (surface mount device).**
2. **Extra small and thin**
3. **Can have a current limiting resistor built in (except for the CL-70 series).**
4. **Automated chip machine mounting allows for efficient mounting.**
5. **Dip and reflow soldering are applicable.**
6. **Can be sorted into different luminous intensities by automatic sorting machine upon request.**
7. **Shippable in bulk, on tape and mounted as an assembly.**
8. **CL-70 series is even much smaller.**

CL-55, CL-65 SERIES

Super Brightness Type, Ultra Brightness Type

1. Two-color lighting (orange/green, red/green).
2. Orange/green for super brightness type and red/green for ultra brightness type are standard.
3. Dimensions: 3.2(L) × 2.7(W) × 1.1(H) mm
4. CL-65 series has built-in resistors.

CL-50, CL-61 SERIES

Standard Brightness Type

1. Dimensions: 3.2(L) × 1.6(W) × 1.1(H) mm
2. Six colors such as red, orange, yellow, green, fresh green and pure green
3. CL-61 series has built-in resistor.

Super Brightness Type, Ultra Brightness Type

1. Dimensions: 3.2(L) × 1.6(W) × 1.1(H) mm
2. Two colors of red and orange for super brightness type and one color of red for ultra brightness type.
3. CL-61 series has a built-in resistor.

CL-70 SERIES

Super Brightness Type, Ultra Brightness Type

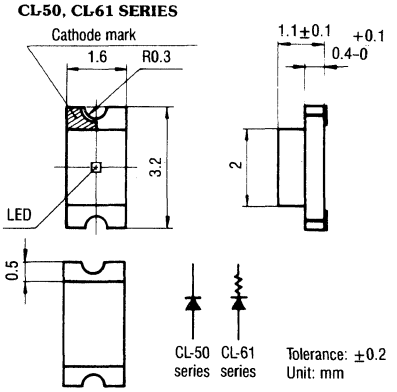
1. Dimensions: 2.0(L) × 1.25(W) × 1.1(H) mm
2. Two colors of red and orange for super brightness type and one color of red for ultra brightness type
3. Soldering by reflow available

Standard Brightness Type

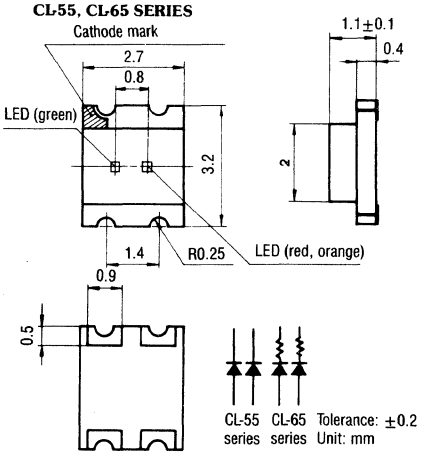
1. Dimensions: 2.0(L) × 1.25(W) × 1.1(H) mm
2. Six colors such as red, orange, yellow, green, fresh green and pure green
3. Soldering by reflow available

■ OUTLINE DRAWINGS

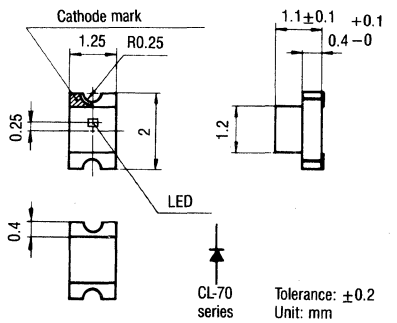
CL-50, CL-61 SERIES



CL-55, CL-65 SERIES



CL-70 SERIES



■ ABSOLUTE MAXIMUM RATINGS

Series	P*1 (mW)	Pd (mW)	I_F (mA)	I_{FP} (mA)	V_R (V)	Top (°C)	Tst (°C)
CL-55	90	65	25	100*3	5	−25 ~ +80	−30 ~ +85
CL-65	70	50(40)*2	20				

*1: P means total value of power dissipation when both colors are on. *2: Figure in ( ) means value of power dissipation of resistor. *3: Condition for I_{FP} is pulse of 1/10 duty and 0.1m sec. width.

Series	Pd (mW)	I_F (mA)	I_{FP} (mA)	V_R (V)	Top (°C)	Tst (°C)
CL-50	65	25	100*2	5	−25 ~ +80	−30 ~ +85
CL-61	50(40)*1	20				
CL-50	65	25	100*2	5	−25 ~ +80	−30 ~ +85
CL-61	50(40)*1	20				
CL-70	50	20	100*2	5	−25 ~ +80	−30 ~ +85
CL-70	50	20	100*2	5	−25 ~ +80	−30 ~ +85

*1 Figure in ( ) means value of power dissipation of resistor. *2 Condition for I_{FP} is pulse of 1/10 duty and 0.1m sec. width.

■ ELECTRO-OPTICAL CHARACTERISTICS

Code for parts	Lighting color	V_F I_F (mA)	V_F typ. (V)	V_F max. (V)	λp typ. (nm)	Δλ typ. (nm)	I_V I_F (mA)	I_V min. (mcd)	I_V typ. (mcd)	I_R V_R (V)	I_R max. (μA)
CL-50R, -61R	Red	20	2.2	2.6	700	100	20	1.0	2.4	5	100
CL-50D, -61D	Orange	20	2.2	2.6	605	40	20	4.5	13.0	5	100
CL-50Y, -61Y	Yellow	20	2.1	2.6	589	40	20	5.0	12.0	5	100
CL-50G, -61G	Green	20	2.2	2.6	567	26	20	5.0	20.0	5	100
CL-50FG, -61FG	Fresh green	20	2.2	2.6	560	26	20	4.5	13.0	5	100
CL-50PG, -61PG	Pure green	20	2.2	2.6	557	24	20	2.0	6.0	5	100
CL-50SR, -61SR	Red	20	2.0	2.6	650	40	20	3.2	9.0	5	100
CL-50SD, -61SD	Orange	20	2.0	2.6	630	40	20	4.5	13.0	5	100
CL-50UR, -61UR	Red	20	1.8	2.6	660	20	20	7.0	25.0	5	100
CL-55SD/G	Orange	20	20	2.6	630	40	20	4.5	13.0	5	100
CL-65SD/G	Green	20	2.2	2.6	567	26	20	5.0	20.0	5	100
CL-55UR/G	Red	20	1.8	2.6	660	20	20	7.0	25.0	5	100
CL-65UR/G	Green	20	2.2	2.6	567	26	20	5.0	20.0	5	100
CL-70SR	Red	20	2.0	2.6	650	40	20	3.2	9.0	5	100
CL-70SD	Orange	20	2.0	2.6	630	40	20	4.5	13.0	5	100
CL-70UR	Red	20	1.8	2.6	660	20	20	7.0	25.0	5	100
CL-70-R	Red	20	2.2	2.6	700	100	20	1.0	2.4	5	100
CL-70D	Orange	20	2.2	2.6	605	40	20	4.5	13.0	5	100
CL-70Y	Yellow	20	2.1	2.6	589	40	20	5.0	12.0	5	100
CL-70G	Green	20	2.2	2.6	567	26	20	5.0	20.0	5	100
CL-70FG	Fresh green	20	2.2	2.6	560	26	20	4.5	13.0	5	100
CL-70PG	Pure green	20	2.2	2.6	557	24	20	2.0	6.0	5	100

■ LED ASSEMBLIES

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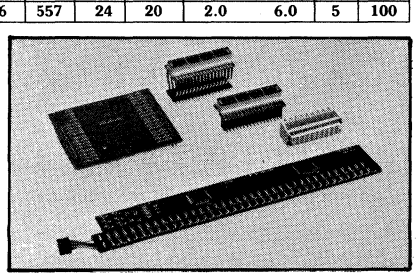
Application

A variety of CITILEDs are available with a color assortment of red, orange, yellow, green, fresh green and pure green to satisfy a multiplicity of requirements from audio equipment to home appliances such as radios, TVs, VCRs, electronic musical instruments, printers, telephones, desk-top computers, cameras, solar cell calculators (for clamping voltage) and any apparatus with signal or switch display.



Commercial applications (Car audio and office automation equipment)

SYLVANIA Miniature Lighting

GTE Products Corporation
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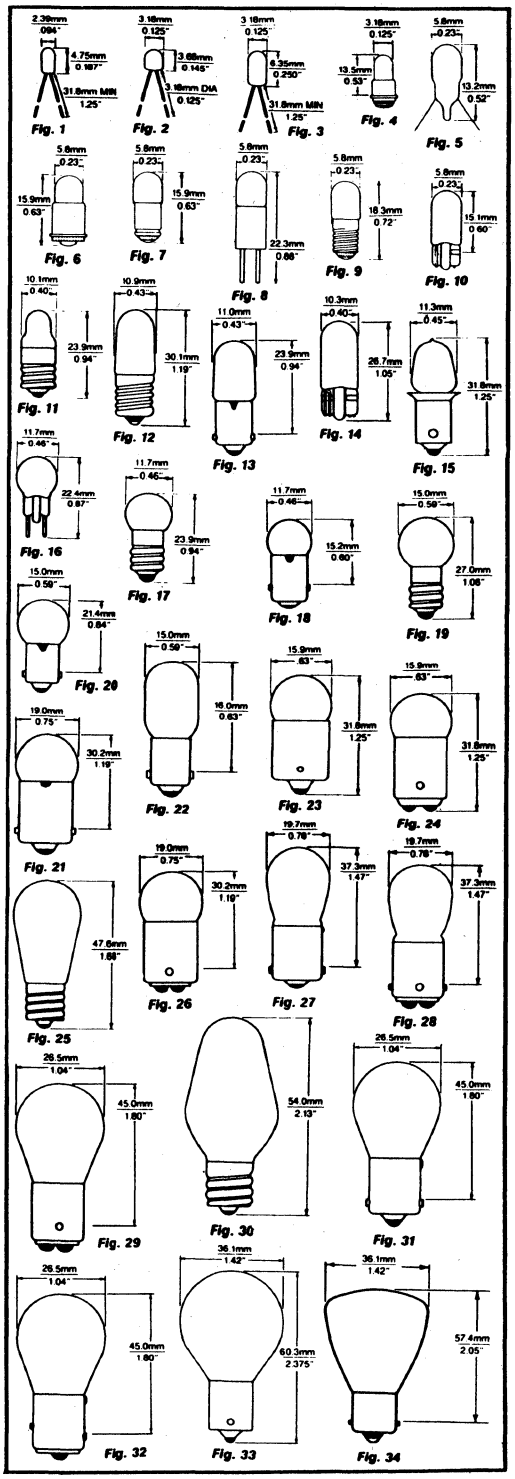
Lamp No.	Bulb	Volts	Amps	M.S. C.P.	Fig.	Net Each, Lots of 1-9	10-99	100-499
PR2	B-3½	2.38	.50	.80	15	$0.82	$0.653	$0.571
PR3	B-3½	3.57	.50	1.50	15	.84	.674	.589
PR4	B-3½	2.33	.27	.40	15	.84	.674	.589
PR6	B-3½	2.47	.30	.45	15	.84	.674	.589
PR7	B-3½	3.7	.30	.90	15	.95	.758	.664
PR12	B-3½	5.95	.50	3.10	15	.84	.674	.589
PR13	B-3½	4.75	.50	2.20	15	.84	.674	.589
PR18	B-3½	7.2	.55	5.5	15	1.03	.821	.718
6S6	S-6	120	6W	.....	25	1.12	.982	.912
7C7	C7	115-125	7W	.....	30	1.08	.943	.876
12	G-3½	6.3	.15	.35	16	1.18	.947	.829
13	G-3½	3.7	.30	.98	17	.87	.695	.608
14	G-3½	2.47	.30	.50	17	.87	.695	.608
19	G-3½	14.4	.10	.90	16	1.68	1.347	1.179
27	G-4½	4.9	.30	1.4	19	1.29	1.032	.903
31	G-4½	6.15	.30	2.0	19	1.76	1.412	1.235
41	T-3¼	2.5	.50	.50	12	.85	.681	.596
43	T-3¼	2.5	.50	.50	13	1.05	.842	.736
44	T-3¼	6.3	.25	.90	13	.53	.421	.368
45	T-3¼	3.2	.35	.50	13	1.49	1.193	1.044
46	T-3¼	6.3	.25	.90	12	.75	.597	.522
47	T-3¼	6.3	.15	.52	13	.53	.421	.368
48	T-3¼	2.0	.06	.04	12	1.14	.912	.798
49	T-3¼	2.0	.06	.04	13	1.21	.968	.847
51	G-3½	7.5	.22	1.0	18	.71	.568	.497
53	G-3½	14.4	.12	1.0	18	.74	.589	.515
53X	G-3½	14.4	.12	1.0	18	1.00	.800	.700
55	G-4½	7.0	.41	2.0	20	.95	.758	.664
57	G-4½	14.0	.24	2.0	20	.66	.526	.461
57X	G-4½	14.0	.24	2.0	20	.97	.779	.682
63	G-6	7.0	.63	3.0	21	.89	.715	.626
67	G-6	13.5	.59	4.0	21	.76	.611	.535
81	G-6	6.5	1.02	6.0	21	1.21	.968	.847
82	G-6	6.5	1.02	6.0	26	.97	.779	.682
87	S-8	6.8	1.91	15.0	31	1.66	1.331	1.165
88	S-8	6.8	1.91	15.0	29	1.61	1.285	1.124
89	G-6	13.0	.58	6.0	21	.87	.694	.608
93	S-8	12.8	1.04	15.0	31	1.32	1.053	.921
112	TL-3	1.2	.22	.....	11	1.50	1.200	1.050
123	G-3½	1.25	.30	.10	17	.65	.521	.456
136	G-4½	1.25	.60	.20	19	1.76	1.412	1.235
158	T-3¼	14.0	.24	2.0	14	.95	.758	.664
161	T-3¼	14.0	.19	1.0	14	.84	.674	.589
168	T-3¼	14.0	.35	3.0	14	.84	.674	.589
194	T-3¼	14.0	.27	2.0	14	.63	.506	.442
222	TL-3	2.25	.25	.....	11	1.05	.842	.736
301	G-5	28.0	.17	3.0	23	2.39	1.915	1.676
302	G-5	28.0	.17	3.0	24	2.53	2.030	1.776
303	G-6	28.0	.30	6.0	21	2.53	2.030	1.776
305	S-8	28.0	.51	15.0	31	2.37	1.894	1.658
307	S-8	28.0	.67	21.0	31	2.37	1.894	1.658
308	S-8	28.0	.67	21.0	29	3.00	2.400	2.100
309	S-11	28.0	.9	32.0	33	3.42	2.738	2.395
313	T-3¼	28.0	.17	3.5	13	1.11	.885	.774
327	T-1¾	28.0	.04	.34	6	.92	.737	.645
328	T-1¾	6.0	.20	.34*	6	.95	.758	.664
330	T-1¾	14.0	.08	.5	6	.97	.779	.682
331	T-1¾	1.35	.06	.006	6	1.22	.977	.855
334	T-1¾	28.0	.04	.34	7	1.26	1.011	.885
344	T-1¾	10.0	.014	.004	6	1.18	.947	.829
382	T-1¾	14.0	.08	.30	6	1.18	.947	.829
387	T-1¾	28.0	.04	.30	6	.95	.758	.664
388	T-1¾	28.0	.04	.30	6	1.39	1.115	.976
680	T-1	5.0	.06	.03	3	1.81	1.450	1.269
682	T-1	5.0	.06	.029	4	2.45	1.960	1.715
683	T-1	5.0	.06	.05	3	1.37	1.097	.960
685	T-1	5.0	.06	.048	4	2.84	2.275	1.990
713	T-1	5.0	.075	.09	3	1.46	1.167	1.020
714	T-1	5.0	.075	.08	4	2.45	1.964	1.718
715	T-1	5.0	.115	.15	3	1.50	1.200	1.050
718	T-1	5.0	.115	.132	4	2.59	2.069	1.810
1003	B-6	12.8	.94	15.0	27	1.24	.989	.865
1004	B-6	12.8	.94	15.0	28	1.24	.989	.865
1034	S-8	12.8	1.80	32.0	32	1.26	1.011	.885
		14.0	.59	3.0				
1076	S-8	12.8	1.80	32.0	29	2.05	1.642	1.436
1133	RP-11	6.2	3.91	32.0	34	2.87	2.294	2.008
1156	S-8	12.8	2.10	32.0	31	1.26	1.011	.885
1157	S-8	12.8	2.10	32.0	32	.61	.485	.424
		14.0	.59	3.0				
1176	S-8	12.8	1.34	21.0	29	1.89	1.515	1.326
		14.0	.59	6.0				
1183	RP-11	5.5	6.25	50.0	34	4.61	3.690	3.229
1195	RP-11	12.5	3.0	50.0	34	6.29	5.032	4.403
1445	G-3½	14.4	.135	.7	18	.66	.526	.461
1447	G-3½	18.0	.15	1.5	17	.92	.738	.645
1495	T-4½	28.0	.30	6.0	22	2.05	1.642	1.436
1764	T-1¾	28.0	.04	.34	5	.81	.650	.568
1784	T-1¾	6.0	.20	.60	5	.81	.652	.570
1813	T-3¼	14.4	.10	.86	13	.84	.674	.589
1816	T-3¼	13.0	.33	3.0	13	1.03	.821	.718
1819	T-3¼	28.0	.04	.34	13	1.00	.800	.700
1820	T-3¼	28.0	.10	1.6	13	1.00	.800	.700
1829	T-3¼	28.0	.07	1.0	13	.92	.738	.645
1847	T-3¼	6.3	.15	.38	13	.61	.485	.424

*At 5 volts.

INDUSTRY STANDARD LAMPS
CONTINUED ON FOLLOWING PAGE



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INDUSTRY STANDARD LAMPS (CONT'D)

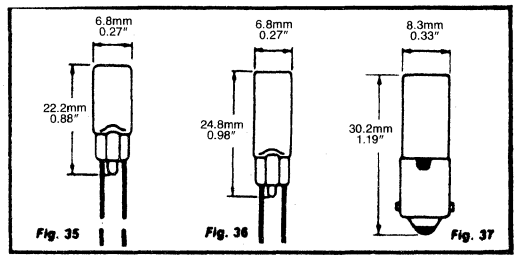
See previous page for illustrations.

Lamp No.	Bulb	Volts	Amps	M.S. C.P.	Fig.	Net Each, Lots of 1-9	10-99	100-499
1850	T-3¼	5.0	.09	.25	13	$1.68	$1.347	$1.179
1864	T-3¼	28.0	.17	3.0	13	1.11	.885	.774
1869	T-1¾	10.0	.014	.004	5	1.17	.938	.821
1889	T-3¼	14.0	.27	2.0	13	.92	.738	.645
1891	T-3¼	14.0	.24	2.0	13	.79	.632	.553
1893	T-3¼	14.0	.33	2.0	13	.82	.653	.571
1895	G-4½	14.0	.27	2.0	20	.66	.526	.461
2162	T-1¾	14.0	.10	.5	5	.90	.723	.633
2182	T-1¾	14.0	.08	.30	5	.68	.543	.475
2187	T-1¾	28.0	.04	.30	5	.68	.543	.475

Lamp No.	Bulb	Volts	Amps	M.S. C.P.	Fig.	Net Each, Lots of 1-9	10-99	100-499
6832	T-1	5.0	.06	.05	2	$1.79	$1.431	$1.252
6833	T-¾	5.0	.06	.05	1	1.86	1.490	1.304
6838	T-1	28.0	.024	.15	3	2.33	1.863	1.630
6839	T-1	28.0	.024	.15	4	2.45	1.964	1.718
7152	T-1	5.0	.115	.15	2	1.55	1.241	1.085
7327	T-1¾	28.0	.04	.34	8	1.05	.844	.738
7328	T-1¾	6.0	.20	.6	8	1.22	.973	.852
7344	T-1¾	10.0	.014	.004	8	1.22	.977	.855
7382	T-1¾	14.0	.08	.30	8	1.33	1.064	.931
7387	T-1¾	28.0	.04	.30	8	1.06	.847	.741
7931	T-1¾	1.35	.06	.006	8	1.52	1.216	1.064

WIRE LEAD INDICATOR LAMPS (T-2 BULB) (FIG. 35)

Lamp No.	Volts	Amps.	M.S. C.P.	Net Each, Lots of 1-9	10-99	100-499
4ES	4	.04	.03	$1.29	$1.031	$0.902
5ES	5	.04	.04	1.29	1.031	.902
6ES	6	.04	.025	1.29	1.031	.902
10AS	10	.01	.001	1.63	1.302	1.139
10CS	10	.017	.01	1.36	1.085	.949
10ES	10	.04	.07	1.09	.868	.760
12ES	12	.04	.09	1.28	1.026	.897
16CS	16	.017	.016	1.28	1.020	.893
16ES	16	.04	.17	1.25	.999	.874
18ES	18	.04	.14	1.25	.999	.874
24CS	24	.017	.02	1.36	1.085	.949
24ES	24	.04	.12	1.25	.999	.874
28ES	28	.04	.25	1.25	.998	.873
48ES	28	.04	.44	1.52	1.216	1.064



WIRE LEAD PILOT LAMPS (T-2 BULB) (FIG. 36)

Lamp No.	Volts	Amps	M.S. C.P.	Net Each, Lots of 1-9	10-99	100-499
6PS	6	.14	.12	$1.29	$1.031	$0.902
12PS	12	.17	.35	1.25	.999	.874
24PS	24	.073	.5	1.25	.999	.874
28PS	28	.04	.29	1.25	.999	.874
48PS	48	.053	.7	1.25	.999	.874
60PS	60	.05	.73	1.57	1.260	1.102
120PS	120	.025	.36	1.41	1.129	.988
120PS/6	120	.052	1.43	1.41	1.129	.988

MINIATURE BAYONET PILOT LAMPS (T2½ BULB) (FIG. 37)

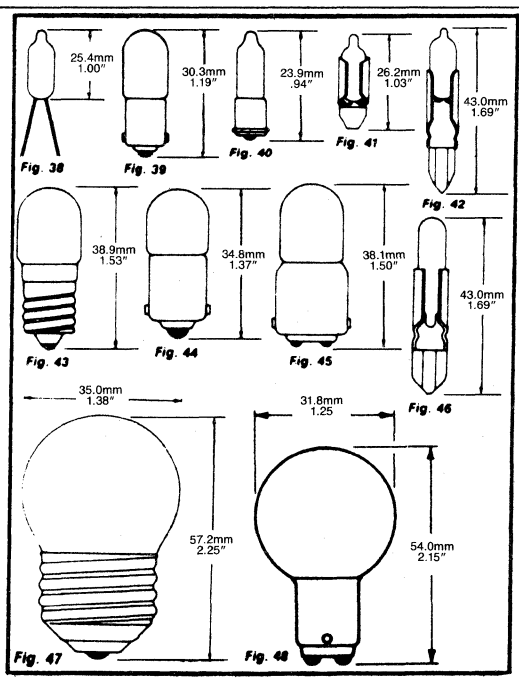
Lamp No.	Volts	Amps	M.S. C.P.	Net Each, Lots of 1-9	10-99	100-499
6MB	6	.140	.12	$1.97	$1.579	$1.382
12MB	12	.170	.35	1.86	1.485	1.299
24MB	24	.073	.50	1.86	1.485	1.299
28MB	28	.040	.29	1.86	1.485	1.299
48MB	48	.053	.70	1.94	1.555	1.361
60MB	60	.050	.73	2.03	1.627	1.423
90MB	90	.033	.37	1.86	1.485	1.299
120MB	120	.025	.36	1.83	1.466	1.283
120MB/6	120	.052	1.43	1.90	1.524	1.333

NEON GLOW INDICATOR LAMPS

Lamp No.	Bulb	Circuit Volts	Ext. Res. (K-ohms)	Fig.	Net Each, Lots of 1-9	10-99	100-499
NE-2 (A1A)	T-2	105-125	150	38	$0.50	$0.402	$0.352
NE-2A (A2A)	T-2	105-125	220	38	.50	.402	.352
NE-2V (A2B)	T-2	105-125	100	38	.50	.402	.352
NE-2E (A9A)	T-2	105-125	100	38	.65	.517	.453
NE-51 (B1A)	T-3¼	105-125	220	39	1.06	.851	.745
NE-51H (B2A)	T-3¼	105-125	27	39	1.06	.851	.745
NE-2H (C2A)	T-2	105-125	30	38	.50	.402	.352
NE-2D (C7A)	T-2	105-125	100	40	2.90	2.317	2.027
NE-2J (C9A)	T-2	105-125	30	40	2.66	2.132	1.865
NE-84 (K1A5)	T-2	105-125	30	41	.98	.788	.689

NEON GLOW CIRCUIT COMPONENT LAMPS

Lamp No.	Bulb	Start. Volts (DC)	Nom. Cur. (mA)	Fig.	Net Each, Lots of 1-9	10-99	100-499
NE-96 (4AB)	T-2	120-150	0.5	38	$4.56	$3.650	$3.194
NE-68 (5AC)	T-2	60-90	0.3	38	1.66	1.328	1.162
NE-81 (5AG)	T-2	64-80	0.3	38	1.91	1.531	1.339
NE-76 (5AG-A)	T-2	68-76	0.4	38	3.25	2.602	2.276
NE-83 (5AH)	T-2	60-100	5.0	38	1.53	1.227	1.073
NE-86 (5AJ)	T-2	55-90	1.5	38	3.15	2.523	2.208
NE-4 (8AB)	T-2	60-90	0.3	42	4.91	3.931	3.440



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SYLVANIA Miniature Lighting

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INDICATOR CARTRIDGE LAMPS (T-2 BULB) (FIG. 50)

Lamp No.	Volts	Amps.	Average End F.C.	Net Each, Lots of 1-9	10-99	100-499
901	4	.04	145	$2.84	$2.271	$1.987
905	5	.04	225	2.84	2.271	1.987
909	6	.04	160	2.84	2.271	1.987
913	10	.01	—	2.84	2.271	1.987
914	10	.017	10	2.84	2.271	1.987
915	10	.04	540	2.84	2.271	1.987
918	12	.04	550	2.84	2.271	1.987
925	16	.017	75	2.84	2.271	1.987
926	16	.04	750	.87	.694	.608
930	18	.04	800	2.84	2.271	1.987
933	24	.017	200	2.84	2.271	1.987
934	24	.04	650	2.84	2.271	1.987
938	28	.04	1500	2.84	2.271	1.987
941	48	.04	3000	2.84	2.271	1.987

SOCKETS FOR INDICATOR CARTRIDGE LAMPS (FIG. 51)

Part No.	Overall Length	Mtg. Hole Dia.	Terminals	Net Each, Lots of 1-9	10-99	100-499
SM1	1 11/64"	.375"	Turret	$5.17	$4.136	$3.619
SM1A	1 11/64"	.375"	Solder	5.17	4.136	3.619

PILOT CARTRIDGE LAMPS (T-2 BULB) (FIG. 52)

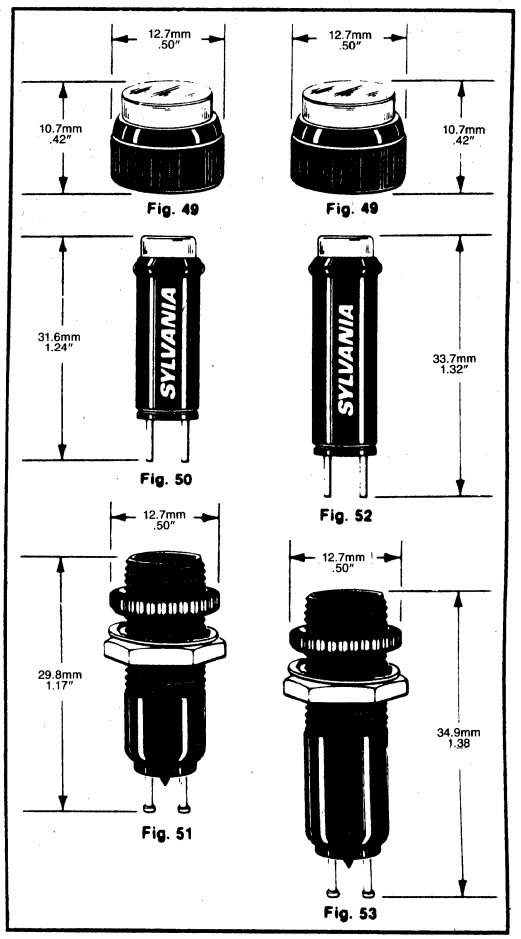
Lamp No.	Volts	Amps	Avg. End F.C.	Net Each, Lots of 1-9	10-99	100-499
6PC	6	.8	550	$2.39	$1.911	$1.673
12PC	12	2	2400	2.39	1.911	1.673
24PC	24	1.7	3000	2.39	1.911	1.673
28PC	48	1.1	1500	2.39	1.910	1.671
48PC	48	2.5	1500	2.39	1.911	1.673
60PC	60	3	1800	2.39	1.910	1.671
120PC	120	3	1000	2.44	1.955	1.711

SOCKETS FOR PILOT CARTRIDGE LAMPS (FIG. 53)

Part No.	Overall Length	Mtg. Hole Dia.	Terminals	Net Each, Lots of 1-9	10-99	100-499
SM2	1 3/8"	.375"	Turret	$5.17	$4.136	$3.619
SM2A	1 3/8"	.375"	Solder	5.17	4.136	3.619

LENSES FOR ABOVE SOCKETS (FIG. 49)

Lens Color	Lens No. Transparent	Lens No. Translucent	Net Each, Lots of 1-9	10-99	100-499
Amber	30140	.....	$1.14	$0.912	$0.798
Clear	30141	.....	1.14	.912	.798
Red	30142	30147	1.14	.912	.798
Blue	30143	30148	1.14	.912	.798
Green	30144	30149	1.14	.912	.798
Yellow	.....	30145	1.14	.912	.798
White	.....	30146	1.14	.912	.798

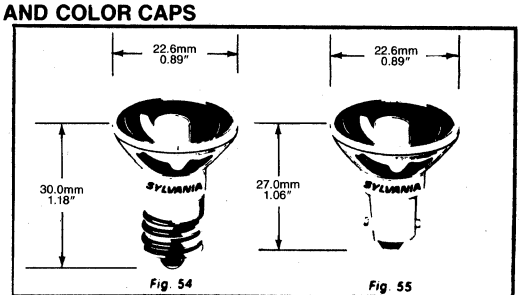


ANNUNCIATOR LAMPS AND COLOR CAPS

Long life annunciator lamps are designed for use in elevator panels, pushbutton stations, indirect decorative lighting and general signalling applications where a relatively high candlepower miniature light source is necessary. A high degree of light control is made possible by a self-contained aluminized reflector. Unique lighting and signalling effects are attainable using pyrex color caps shown in the chart. Ordering Data: For clear lamps, specify lamp number. For colored lamps, specify color as follows: 6RB/Red, etc. Caps are cemented to lamps when ordered in this manner. Caps may also be ordered separately.

ANNUNCIATOR LAMPS (FIGS. 54 AND 55)

Lamp No.	Base	Volts	Amps	Watts	Net Each, Lots of 1-9	10-99	100-499
6RC	Cand. Screw	6	.14	.8	$2.99	$2.388	$2.090
12RC	Cand. Screw	12	.17	2	2.99	2.388	2.090
24RC	Cand. Screw	24	.073	1.7	2.99	2.388	2.090
28RC	Cand. Screw	28	.04	1.1	2.99	2.388	2.090
60RC	Cand. Screw	60	.050	3	2.99	2.388	2.090
120RC	Cand. Screw	120	.025	3	2.99	2.388	2.090
6RB	Min. Bay	6	.140	.8	2.99	2.388	2.090
12RB	Min. Bay	12	.17	2	2.99	2.388	2.090
24RB	Min. Bay	24	.073	1.7	2.99	2.388	2.090
28RB	Min. Bay	28	.04	1.1	2.99	2.388	2.090
60RB	Min. Bay	60	.05	3	2.99	2.388	2.090
120RB	Min. Bay	120	.025	3	2.99	2.388	2.090



COLOR CAPS FOR ANNUNCIATOR LAMPS

Cap Color	Cap No.	Net Each, Lots of 1-9	10-99	100-499
Red	38071	$1.40	$1.116	$0.977
Yellow	38072	.65	.521	.456
White	38073	.65	.521	.456
Green	38074	.65	.521	.456
Blue	38075	.65	.521	.456

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SYLVANIA Miniature Lighting

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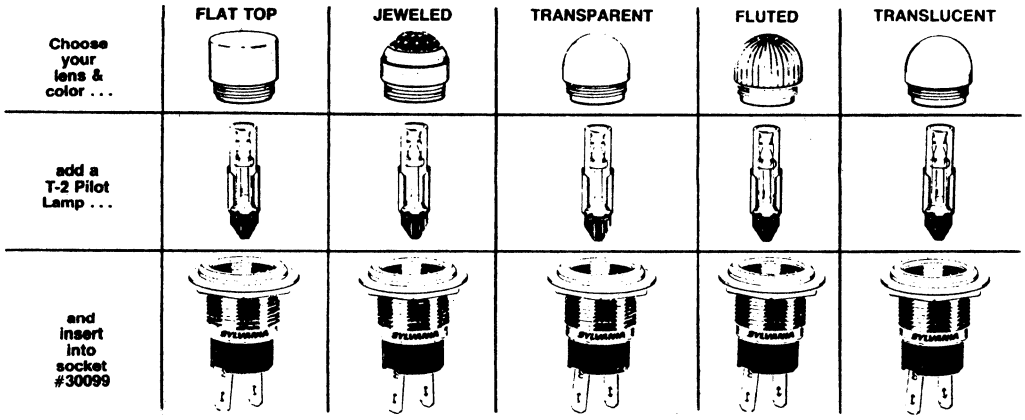
UNIVERSAL PILOT LAMP HOUSING

A variety of lens styles, each available in a choice of colors, plus a standard socket (P/N 30099) provide a wide choice of configurations for virtually every application when used with T-2 slide base pilot lamps rated at 5, 6, 12, 24, 28, 48, 60 or 120 volts. **Dimensions: Lenses**—Height, .38"; diameter, .63". **Socket**—Front of panel to end of terminals, .91"; mounting hole, .75" dia.



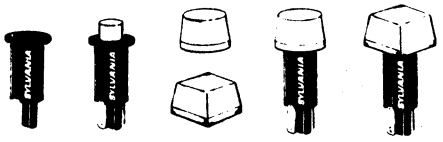
SOCKET AND LENSES

Part No.	Lens Type	Net Each, Lots of 1-9	10-99	100-499
30200	Flat Top Translucent—Red	$1.11	$0.891	$0.780
30212	Flat Top Translucent—Green	1.11	.891	.780
30213	Flat Top Translucent—Blue	1.11	.891	.780
30214	Flat Top Translucent—Yellow	1.11	.891	.780
30100	Jeweled—Red	1.28	1.020	.893
30102	Jeweled—Green	1.28	1.020	.893
30103	Jeweled—Blue	1.28	1.020	.893
30106	Jeweled—Amber	1.28	1.020	.893
30110	Transparent—Red	.73	.587	.514
30112	Transparent—Green	.73	.587	.514
30113	Transparent—Blue	.73	.587	.514
30111	Transparent—Amber	.73	.587	.514

Part No.	Lens Type	Net Each, Lots of 1-9	10-99	100-499
30114	Transparent—Yellow	$0.73	$0.587	$0.514
30116	Transparent—Clear	.73	.587	.514
30120	Fluted—Red	.57	.456	.399
30122	Fluted—Green	.57	.456	.399
30124	Fluted—Blue	.57	.456	.399
30126	Fluted—Amber	.57	.456	.399
30125	Fluted—Clear	.57	.456	.399
30130	Dome Translucent—Red	.57	.456	.399
30132	Dome Translucent—Green	.57	.456	.399
30131	Dome Translucent—Yellow	.57	.456	.399
30133	Dome Translucent—White	.57	.456	.399
30099	Pilot Lamp Socket	2.66	2.128	1.862

PILOT LAMP ASSEMBLIES

Socket P/N 30152 plug round (.70" dia. × .48" high) or square (.70" × .70" × .48" high) lens also uses T-2 slide base Pilot Lamps rated at 5, 6, 12, 24, 28, 48, 60 or 120 volts. Sockets can also be used without lens, with or without colored end cap covering end of bulb which extends .18" beyond .09" socket flange. **Dimensions:** Socket—1.31" M.O.L.; mounting hole—.50" dia.



LENSES

Color	Ordering Number: Round Lens	Square Lens
Red	30160	30170
Clear	30161	30171
Amber	30162	30172
White	30163	30173
Green	30164	30174
Blue	30165	30175

POLYPROPYLENE END CAPS*

Color	Ordering Number
Red	38001
Yellow	38002
White	38003
Green	38004
Blue	38005
Orange	38007

PYREX END CAPS#

Color	Ordering Number
Red	38071
Yellow	38072
White	38073
Green	38074
Blue	38075

*Polycarbonate end caps are press fit to the lamp; cannot be used with lamps rated over 1.1 watts.

#Pyrex end caps must be cemented to the lamp with a translucent silicon rubber adhesive.

PRICES FOR SOCKETS, LENSES AND END CAPS

Description	Net Each, Lots of 1-9	10-99	100-499
Pilot Lamp socket P/N 30152	$1.03	$0.825	$0.722
Lenses (round or square)	.49	.391	.342

Description	Net Each, Lots of 1-9	10-99	100-499
Pyrex end cap, red	$1.40	$1.116	$0.977
Polypropylene end caps	.46	.370	.324

PILOT LAMPS FOR ABOVE HOUSING AND ASSEMBLIES

Lamp No.	Design: Volts	Amps	Watts	Fila-ment	M.S. C.D.	Average End Foot Candles	Rated Average Life (Hours)	Net Each, Lots of 1-9	10-99	100-499
5SLB	5	.12	.6	C-2V	...	1,600	2,500	$1.63	$1.305	$1.142
6PSB	6	.14	.8	C-2F	.12	500	20,000	1.73	1.380	1.208
6SLB	6	.144	.6	C-2V	...	1,700	2,500	1.57	1.260	1.102
12PSB	12	.17	2.0	C-2F	.35	2,000	12,000	1.66	1.326	1.160
24PSB	24	.073	1.7	C-2F	.50	3,000	10,000	1.62	1.295	1.133
28PSB	28	.04	1.1	C-2F	.29	1,600	5,000	1.56	1.244	1.089
48PSB	48	.053	2.5	C-7A	.7	1,800	7,500	1.56	1.244	1.089
60PSB	60	.05	3.0	C-7A	.73	2,600	7,500	1.78	1.427	1.249
120PSB	120	.025	3.0	CC-7A	.36	1,200	10,000	1.67	1.337	1.170

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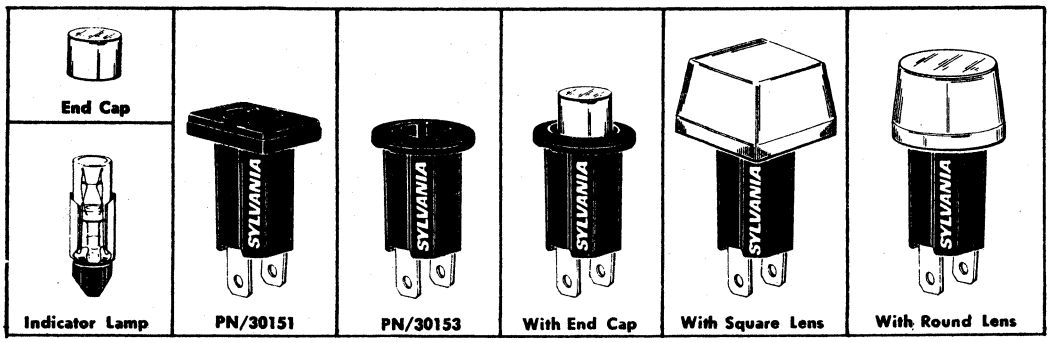
SINGLE SOCKET INDICATOR LAMP ASSEMBLIES

Available sockets include P/N 30153 (round flange) and P/N 30151 (rectangular flange). Sockets may be used with or without colored lens cap covering end of bulb which extends .18" beyond .09" flange. Socket P/N 30153 (round flange) can also be used with round (.70" dia. × .48" high) or square (.70" × .70" × .48" high) lenses. Both sockets 1.14" M.O.L. Mounting hole, .50" dia. Sockets accept T-2 lamps rated 4, 5, 6, 10, 12, 14, 16, 18, 24, 28 or 48 volts.



PRICING

Part Number	Description	Net Each, Lots of 1-9	10-99	100-499
30151	Socket, rectangular flange	$0.79	$0.629	$0.550
30153	Socket, round flange	.81	.652	.570
38001	End cap, (*), red	.46	.370	.324
38002	End cap, (*), yellow	.46	.370	.324
38003	End cap, (*), white	.46	.370	.324
38004	End cap, (*), green	.46	.370	.324
38005	End cap, (*), blue	.46	.370	.324
38007	End cap, (*), orange	.46	.370	.324
38071	End cap, Pyrex, red	1.40	1.116	.977
38072	End cap, Pyrex, yellow	.65	.521	.456
38073	End cap, Pyrex, white	.65	.521	.456
38074	End cap, Pyrex, green	.65	.521	.456

*Polypopylene and caps are press fit to the lamp; cannot be used with lamps rated over 1.1 watts.

Part Number	Description	Net Each, Lots of 1-9	10-99	100-499
38075	End cap, Pyrex, blue	$0.65	$0.521	$0.456
30160	Lens, round, red	.49	.391	.342
30161	Lens, round, clear	.49	.391	.342
30162	Lens, round, amber	.49	.391	.342
30163	Lens, round, white	.49	.391	.342
30164	Lens, round, green	.49	.391	.342
30165	Lens, round, blue	.49	.391	.342
30170	Lens, square, red	.49	.391	.342
30171	Lens, square, clear	.49	.391	.342
30172	Lens, square, amber	.49	.391	.342
30173	Lens, square, white	.49	.391	.342
30174	Lens, square, green	.49	.391	.342
30175	Lens, square, blue	.49	.391	.342

Pyrex end caps must be cemented to the lamp with a translucent silicone rubber adhesive.

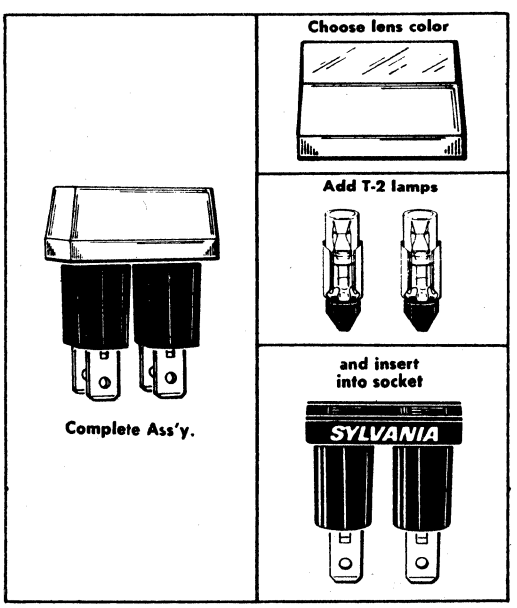
TWIN LIGHT INDICATOR LAMP ASSEMBLIES

TWIN LIGHT LENSES

Ordering Number	Color	Net Each, Lots of 1-9	10-99	100-499
30180	Red	$1.02	$0.812	$0.711
30182	Amber	1.02	.812	.711
30183	White	1.02	.812	.711
30184	Green	1.02	.812	.711
30185	Blue	1.02	.812	.711

TWIN LIGHT SOCKETS

Ordering Number	Description	No. of Contacts	Net Each, Lots of 1-9	10-99	100-499
31351	Both sides common	2	$2.26	$1.807	$1.581
31352	One side common	3	2.26	1.807	1.581
31353	Individual contacts	4	2.26	1.807	1.581



INDICATOR LAMPS FOR ABOVE ASSEMBLIES WILL BE FOUND ON FOLLOWING PAGE.

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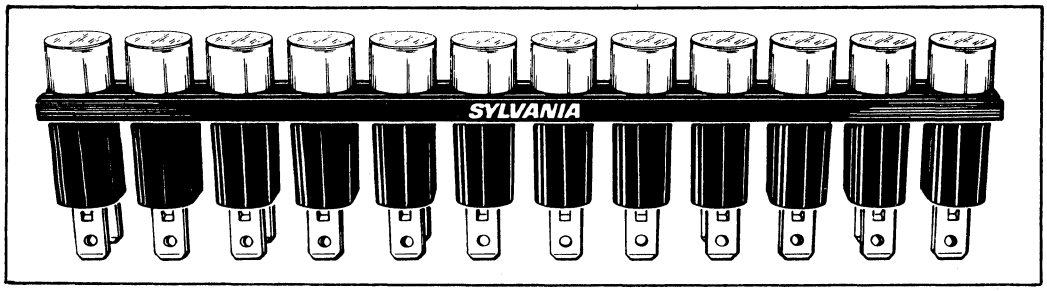
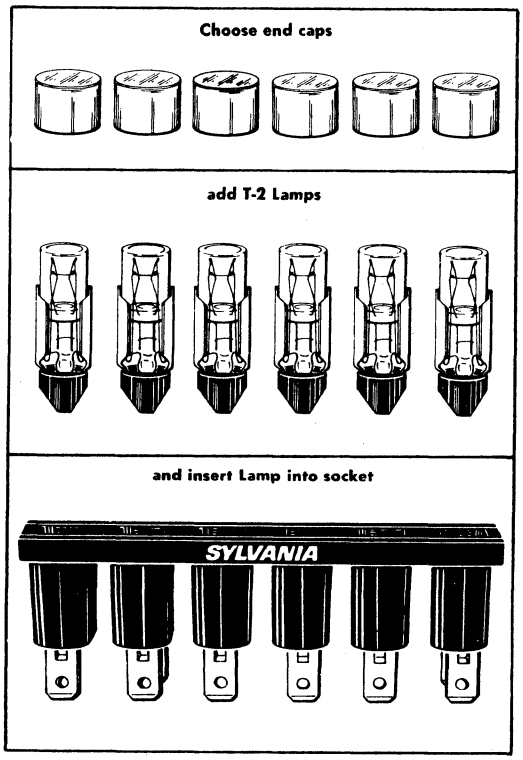
STRIP SOCKET ASSEMBLIES





Strip socket assemblies may be used with or without end caps. Polypropylene caps are press fit to the lamp; cannot be used with lamps rated over 1.1 watts. Pyrex caps must be cemented to the lamp with a translucent silicone rubber adhesive. Strip socket assemblies are available with 2 thru 12 sockets on ½" or ¾" centers; common ground or individual contacts. Sockets accept T-2 lamps rated at 4, 5, 6, 10, 12, 14, 16, 18, 24, 28 or 48 volts.

INDICATOR LAMP STRIP SOCKETS

Number of Sockets	Ordering Number			
	½" Centers		¾" Centers	
	Common Ground	Individual Contacts	Common Ground	Individual Contacts
2	31301	31311	31321	31337
3	31302	31312	31322	31338
4	31303	31313	31323	.....
5	31304	31314	31324	31339
6	31305	31315	31325	31333
7	31306	31316	31326	31334
8	31307	31317	31327	31341
9	31308	31318	31328	31342
10	31309	31319	31329	31343
11	31310	.....	.....	.....
12	31250	33250	31275	33275

SOCKET STRIP PRICING

Number of Sockets	Net Each, Lots of		
	1-9	10-99	100-499
2	$2.26	$1.807	$1.581
3	3.37	2.694	2.357
4	4.48	3.580	3.133
5	5.58	4.466	3.908
6	6.69	5.350	4.681
7	7.79	6.236	5.456
8	8.90	7.123	6.233
9	10.01	8.009	7.008
10	11.12	8.895	7.783
11	12.22	9.779	8.557
12	6.97	5.574	4.877

INDICATOR LAMPS FOR SINGLE SOCKET, TWIN LIGHT AND STRIP SOCKET ASSEMBLIES

Lamp Number	Design			Filament	M.S.C.D.	Average End Foot Candles	Rated Average Life (Hrs.)	Net Each, Lots of		
	Volts	Amperes	Watts					1-9	10-99	100-499
4ESB	4.0	.040	.16	C-6	.03	200	10,000	**$1.86**	**$1.487**	**$1.301**
5ESB	5.0	.040	.20	C-6	.04	225	8,000	**1.86**	**1.437**	**1.301**
6ESB	6.0	.040	.24	C-2V	.025	250	10,000	**1.55**	**1.242**	**1.087**
53B	6.0	.240	1.44	C-2V	.24	2,000	5,000	**1.68**	**1.347**	**1.179**
10ASB	10.0	.010	.10	C-2F	.001	.....	50,000	**2.04**	**1.628**	**1.425**
10CSB	10.0	.017	.17	C-2V	.01	60	20,000	**1.85**	**1.476**	**1.292**
10ESB	10.0	.040	.40	C-2V	.07	450	10,000	**1.27**	**1.015**	**.888**
12ESB	12.0	.040	.48	C-2V	.09	650	10,000	**1.64**	**1.316**	**1.151**
14FSB	14.0	.080	1.12	C-2F	.50	4,000	500	**1.76**	**1.412**	**1.235**
16CSB	16.0	.017	.27	C-2F	.016	80	15,000	**1.82**	**1.454**	**1.272**
16ESB	16.0	.040	.64	C-2F	.17	800	7,500	**1.62**	**1.295**	**1.133**
18ESB	18.0	.040	.72	C-2F	.14	850	5,000	**1.72**	**1.379**	**1.206**
24CSB	24.0	.017	.42	C-2F	.02	100	15,000	**1.68**	**1.345**	**1.177**
24ESB	24.0	.040	.96	C-2F	.12	850	8,000	**1.62**	**1.295**	**1.133**
28ESB	28.0	.040	1.12	C-2F	.25	1,500	6,000	**1.62**	**1.295**	**1.133**
48ESB	48.0	.040	1.92	CC-2F	.44	3,000	5,000	**1.81**	**1.452**	**1.270**

FOR OUR COMPLETE CATALOG #207, CALL GTE MARKETING SERVICES, 1-800-828-7280, IN NY STATE, 1-800-462-1075

Light Emitting Diodes

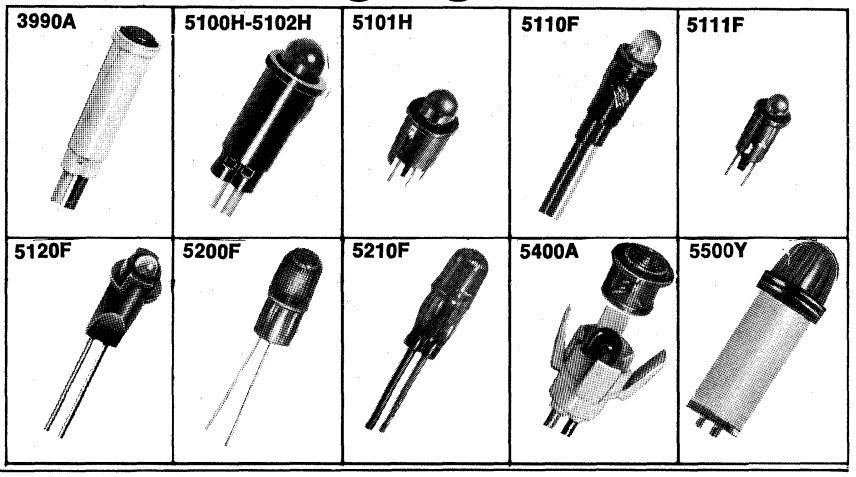
Industrial Devices Inc.
260 Railroad Ave., Hackensack, New Jersey 07601 • (201) 489-8989 • FAX: 201-489-6911

Panel Mounted LED Indicating Lights

Snap fit in panel

Model	Hole	LED Color(s)	Elec. Conn.
3990A	7/32	R, G, Y	24 AWG
5100H	1/4	R, G, Y, R/G	24 AWG
5102H	1/4	R, A, G	24 AWG
5101H	1/4	R, G, Y	Sq Pin
5110F	5/32	R, G, Y	26 AWG
5111F	5/32	R, G, Y	Sq Pin
5120F	Twst	R, G, Y	26 AWG
5200F	3/16	R, G, Y	26 AWG
5210F	3/16	R, G, Y	26 AWG
5400A	5/16	R, G, Y	24 AWG
5500Y	9/32	R, G, Y	Sq Pin
5502Y	9/32	R, A, Y	Sq Pin

ACTUAL SIZE



PC Board Mounted LED Assembly Blocks

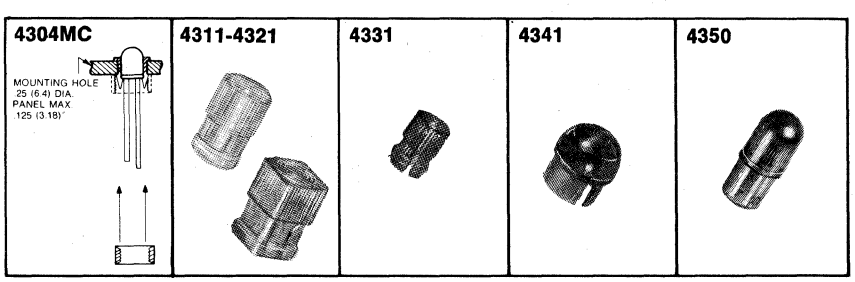
Mount directly to PC board

Model	LED Color
5300E	R, G, Y
5300H	R, G, Y, R/G
5302H	R, G, A
5390E	R, G, Y
5390H	R, G, Y
5390H	R, G, A
5306H	R, G, Y
5307H	R, G, Y
5310F	R, G, Y
5340H	R, G, Y
5350T	R, G, Y
5370T	R, G, Y
5360F	R, G, Y Quad
5380E	R, G, Y
5380H	R, G, Y
5381E	R, G, Y
5381H	R, G, Y
5610R	R, G, Y

ACTUAL SIZE

LED Clip and Lenses

4304MC is quick mounting clip to fit 1/4" hole for T-1 3/4 LEDs. 4311 is round 1/4" Fresnel antistatic lens, 4321 is square. 4331 is round 11/64" antistatic miniature lens for T-1 LED. 4341 is 9mm (23/64" antistatic lens with diffusing rings. 4350 is 3/16" wide angle snap in lens for T-1 LEDs.



Surface Mount LED

Designated the model 6200 series, these devices position the LED for easy visibility, particularly in applications where boards are mounted in parallel close to one another.

Model No.	Color	LED	Model No.	Color	LED
6200T1	Red	4307T1	6202T1-5V	Red	4302T1-5V
6200T5	Green	4307T5	6202T3-5V	Amber	4302T3-5V
6200T7	Yellow	4307T7	6202T5-5V	Green	4302T5-5V
6200T1LC	Red	4300T1LC	6202T1-5VLC	Red	4302T1-5VLC
6200T5LC	Green	43005LC	6202T3-5VLC	Amber	4302T3-5VLC
6200T7LC	Yellow	4300T7LC	6202T5-5VLC	Green	4302T5-5VLC

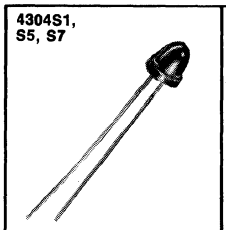
CALL FOR FREE CATALOG

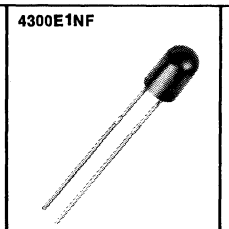
Solid State LED Lamps

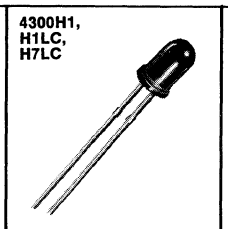
Industrial Devices Inc.
260 Railroad Ave., Hackensack, New Jersey 07601 • (201) 489-8989 • FAX: 201-489-6911

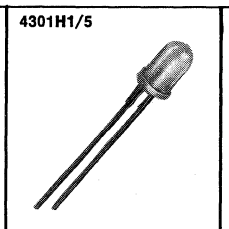
A wide variety of top-quality LEDs in a variety of sizes and package styles.

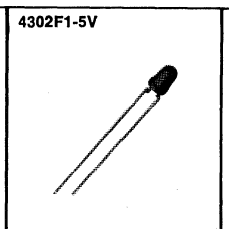
- All IDI LEDs provide bright, unmistakable indication **SUPER-BRITE** LEDs are GaAsP on GaP for red and yellow, **EXTRA-SUPER-BRITE** (series) are ultra bright LEDs utilizing GaA1As construction for red, GaAsP on GaP for amber, and high-efficiency GaP for yellow and green.
- New "LC" LEDs are high efficiency types available in red and yellow, require only 2 mA, ideal for battery-operated devices and limited-current power supplies.
- −5V LEDs have a current-limiting resistor on the chip, are TTL compatible — require no external current-limiting resistors.
- IDI LEDs are available as components, and also in a variety of panel-mounted and printed circuit-board mounted assemblies.

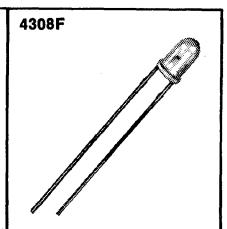


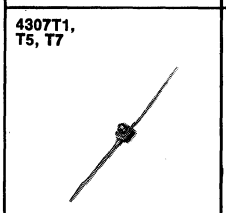


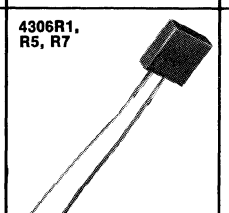


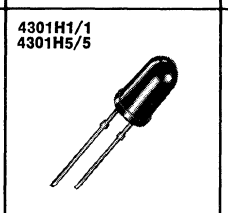


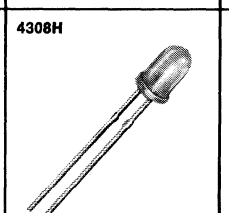


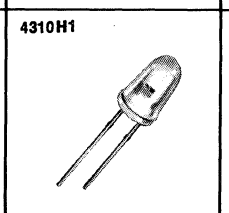


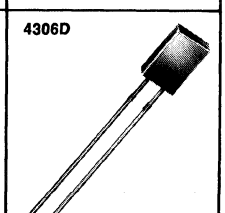












SPECIFICATIONS

* OUTPUT COLOR	* DIFFUSED-NON DIFFUSED	* PACKAGE COLOR	VIEWING ANGLE	MIN. LUM. INTENSITY AT RATED CURRENT	TYP. LUM. INTENSITY AT RATED CURRENT	RATED CURRENT	FORWARD VOLTAGE TYP.	FORWARD VOLTAGE MAX.	CONTINUOUS FORWARD CURRENT, MAX.	PEAK FORWARD CURRENT @ 1 μs-300 PPS.	REVERSE BREAKDOWN VOLTAGE (MIN.)	PEAK WAVELENGTH	POWER: DISSIPATION MAX. AT 25°C.	POWER: DERATE LINEARLY FROM 25°C.	CAPACITANCE @ V = 0	FORWARD CURRENT @ V_f = 5V TYP.	FORWARD CURRENT @ V_f = 5V MAX.	
	COLOR		DEG.	mcd	mcd	mA	V	V	mA	A	V	nm	mW	mW/C°	P.F.	mA	mA	MODEL NO.
R	D	R	70	0.5	2	20	1.7	2.2	100	1.0	5	660	105	1.14	25	—	—	4300E1NF
R	D	R	125	0.5	1.0	20	1.6	2.0	50	1.0	3	655	100	—	100	—	—	4300F1
R	D	R	50	1.0	1.8	2	1.8	2.2	7	.007	5	635	27	—	4	—	—	4300F1LC
Y	D	Y	50	1.0	1.8	2	1.9	2.7	7	.007	5	583	24	—	4	—	—	4300F7LC
R	D	R	80	0.5	1.6	20	1.7	2.2	100	1.0	5	670	180	2.0	30	—	—	4300H1
R	D	R	50	1.2	2.0	2	1.8	2.2	7	.007	5	635	27	—	4	—	—	4300H1LC
Y	D	Y	50	1.2	1.8	2	1.9	2.7	7	.007	5	583	24	—	4	—	—	4300H7LC
R	D	R	70	0.4	0.8	2	1.8	2.2	7	.007	5	635	27	—	4	—	—	4300T1LC
Y	D	Y	70	0.4	0.8	2	1.9	2.7	7	.007	5	583	24	—	4	—	—	4300T7LC
R/G	D	CLR	—	R-0.6 G-0.6	R-1.8 G-1.8	10	2.2	2.8	25	.06	—	R-697 G-565	115	1.5	100	—	—	4301H1/5
R	D	R	60	0.8	1.5	13	5	7.5	20	—	3	655	—	—	—	13	20	4302F1-5V
R	D	R	90	1.5	4.0	10	5	7.5	15	—	5	635	—	—	—	10	15	4302H1-5V
A	D	A	90	1.5	4.0	10	5	7.5	15	—	5	583	—	—	—	10	15	4302H3-5V
G	D	G	90	1.5	4.0	12	5	7.5	15	—	5	565	—	—	—	12	13	4302H5-5V
R	D	R	80	1.0	2.4	9.6	5	6	13	—	5	635	—	—	—	9.6	15	4302T1-5V
R	D	R	90	1.5	2.5	10	2.0	3.0	30	1.0	5	635	120	—	45	—	—	4303F1
G	D	G	90	2.0	5.0	20	2.2	3.0	30	.09	5	562	120	—	20	—	—	4303F5
Y	D	Y	90	1.5	3.0	20	2.1	3.0	30	1.0	5	585	120	—	45	—	—	4303F7
R	D	R	65	3.0	10	20	2.0	3.0	35	1.0	5	635	120	1.14	45	—	—	4304H1
G	D	G	75	3.0	12	20	2.2	3.0	30	.09	5	562	120	—	20	—	—	4304H5
Y	D	Y	65	2.5	11	20	2.1	3.0	35	1.0	5	585	120	1.14	45	—	—	4304H7
R	D	R	50	2.0	4.0	10	2.0	3.0	35	1.0	5	630	105	1.14	45	—	—	4304S1
G	D	G	50	.5	3.0	10	2.2	3.0	30	.09	5	562	180	—	20	—	—	4304S5
Y	D	A	50	1.5	3.0	10	2.1	3.0	35	1.0	5	585	105	1.14	45	—	—	4304S7
R	N	R	28	17	40	20	2.0	3.0	35	1.0	5	635	120	—	45	—	—	4305H1
G	N	G	35	12	25	20	2.3	3.0	30	.09	5	562	120	—	20	—	—	4305H5
Y	N	Y	28	10	45	20	2.1	3.0	35	1.0	5	585	120	—	45	—	—	4305H7
R	D	R	100	2.5	5.0	25	2.1	3.0	30	.09	5	635	135	—	17	—	—	4306R1
G	D	G	100	1.5	2.5	25	2.3	3.0	30	.09	5	565	135	—	18	—	—	4306R5
Y	D	Y	100	3.0	5.0	20	2.2	3.0	20	.06	5	583	85	—	17	—	—	4306R7
R	D	R	80	1.0	3.0	10	2.2	3.0	30	.06	5	635	120	—	11	—	—	4307T1
G	D	G	70	1.0	3.0	10	2.3	3.0	30	.06	5	565	120	—	18	—	—	4307T5
Y	D	Y	90	1.0	3.0	10	2.2	3.0	20	.06	5	583	120	—	15	—	—	4307T7
R	N	CLR	20	80	160	20	1.7	2.0	50	.3	4	660	100	—	50	—	—	4308H1
G	N	CLR	20	50	80	20	2.1	2.5	50	.1	4	555	125	—	50	—	—	4308H5
Y	N	CLR	20	80	160	20	2.1	2.5	50	.1	4	570	125	—	40	—	—	4308H7

* COLOR CODE: A - AMBER, CLR - CLEAR, G - GREEN, R - RED, Y - YELLOW, D - DIFFUSED, N - NON-DIFFUSED

CALL FOR FREE CATALOG

Relampable Indicator Lights

Industrial Devices Inc.
260 Railroad Ave., Hackensack, New Jersey 07601 • (201) 489-8989 • FAX: 201-489-6911

IDI supplies a complete series of relampable incandescent lights. They use the ultra-reliable T-1¾ and T-2 wedge and slide base lamps shown at the bottom of this page. The lamps are replaceable by removing the lens cap and pulling the lamp from the socket. New lamps press into place with little effort. For complete specifications and dimensions call or write for the new IDI technical data catalog.

Model	Mtg Hole	Lamp Type T-1¾	Lamp Type T-2 Pilot	Lamp Type T-2 Indctr	Lens Style	Lens Color	Mntg Type	Termi-nal
4610	3/8″	X			RF	RCAWGBY	Spdnut	Solder
4611	3/8″	X			RF	RCAWGBY	Spdnut	Solder
4100	5/16″	X			RF	See caps	Twist	22 AWG
4104	5/16″	X			RF	See caps	Twist	20 AWG
4110	5/16″	X			RF	See caps	Rivet	Solder
4111	5/16″	X			RF	See caps	Rivet	Solder
4112	5/16″	X			RF	See caps	Opt	Solder
4113	5/16″	X			RF	See caps	Opt	Solder
4120	5/16″	X			RF	See caps	Tab	
4130	Spcl	X			RF	See caps	P/C	P/C
4135	Spcl	X			RF	See caps	P/C	P/C
4136	Spcl	X			RF	See caps	P/C	P/C
4140	5/16″	X			RF	See caps	P/C	Pin
4141	5/16″	X			RF	See caps	P/C	Pin
4142	5/16″	X			RF	See caps	P/C	Pin
4144	5/16″	X			RF	See caps	P/C	Pin
4150	Spcl	X			RF	See caps	Hook	Solder
4151	Spcl	X			RF	RCAWGBY	Snap	Solder
2802	11/16″		X		RD	RCAWGBY	11/16-27	QD
2803	11/16″		X		RF	RCAWGBY	11/16-27	QD
3040	1/2″			X	SF	RCAWGBY	Spdnt	QD
3062	1/2″		X		SF	RCAWGBY	2Spdnt	QD
3001	1/2″			X	RF	See caps	Spdnt	QD
3002	1/2″			X	RF	See caps	Spdnt	QD
3062	1/2″		X		RF	See caps	Spdnt	QD
301–	Cap		>1.5W	>1.5W	Poly	RAWGBY	Snap	
320–	Cap		<1.5W	<1.5W	Pyrex	RWGBY	Push	

RF = Round Flat, RD = Round Dome, SF = Square Flat, R = Red, C = Clear, A = Amber, G = Green, B = Blue, Y = Yellow, QD = Quick Disconnect.

Codes

INCANDESCENT LAMPS

Lamp #	Design Volts	Design Amps	T-1¾	T-2 Pilot	T-2 Indicator
11	2.5	0.200	X		
4ESB	4.0	0.035			X
56	5.0	0.115	X		
5SLB	5.0	0.120		X	
5ESB	5.0	0.035			X
79	6.0	0.200	X		
6PSB	6.0	0.140		X	
6SLB	6.0	0.120		X	
51B	6.0	0.250			X
6ESB	6.0	0.035			X
84	6.3	0.040	X		
16	6.3	0.150	X		
86	6.3	0.200	X		
10ASB	10.0	0.009			X
10CSB	10.0	0.015			X
10ESB	10.0	0.035			X
12ESB	12.0	0.035			X
12PSB	12.0	0.170		X	
18	14.0	0.040	X		
73	14.0	0.080	X		
37	14.0	0.090	X		
74	14.0	0.100	X		
70	14.0	0.150	X		
14FSB	14.0	0.080			X
16CSB	16.0	0.015			X
16ESB	16.0	0.035			X
18ESB	18.0	0.035			X
24CSB	24.0	0.015			X
24ESB	24.0	0.035			X
85	28.0	0.040	X		
17	28.0	0.060	X		
28PSB	28.0	0.040		X	
28ESB	28.0	0.035			X
48ESB	48.0	0.035			X
48PSB	48.0	0.053		X	
60PSB	60.0	0.050		X	
120PSB	120.0	0.025		X	

Non-Relampable Lights

Industrial Devices Inc.
260 Railroad Ave., Hackensack, New Jersey 07601 • (201) 489-8989 • FAX: 201-489-6911

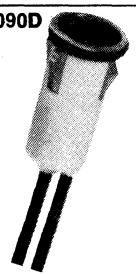
IDI nonrelampable indicator lights are available in a wide variety of models and styles. When properly specified, these lamps will outlast the life of the products they are installed in. For complete specifications and dimensions, ask for the IDI catalog.

Model #	Mtg Hole	Neon Vac	Incan Volts	LED Volts	Lens Type	Lens Color	Mntg Type	Trmnl (Std)
1030D	1/2"	125/250			RLD	RAWG	Snap	22 AWG
1030QD	1/2"		6/12/28		RLD	RAWG	Snap	QD
1090D	1/2"	125/250			RLD	RAWG	Snap	22 AWG
1050A	1/2"	125/250			RD	RCAWGB	Snap	22 AWG
1050QA	1/2"		6/12/28		RD	RAWGB	Snap	QD
1090A	1/2"	125/250			RD	RCAWGB	Snap	22 AWG
1050C	1/2"	125/250			RF	RCAWG	Snap	22 AWG
1050QC	1/2"		6/12/28		RF	RAWG	Snap	QD
1090C	1/2"	125/250			RF	RCAWG	Snap	22 AWG
1050N	1/2"	125/250			SQF	RCAWG	Snap	22 AWG
1050QN	1/2"		6/12/28		SQF	RAWG	Snap	QD
1090N	1/2"	125/250			SQF	RCAWG	Snap	22 AWG
1091M	1/2"			6/12/24	RD	RGY	Snap	22 AWG
1091QM	1/2"			6/12/24	RD	RGW	Snap	QD
2620K	7/8"	125/250			RLD	RAWG	Spdnt	22 AWG
2620QK	7/8"	125/250			RLD	RAWG	Spdnt	QD
2620T	7/8"	125/250			RC	RAG	Spdnt	22 AWG
2650T	7/8"	125/250	Flasher		RC	RA	Spdnt	22 AWG
2110A	9/16"	125/250			RLD	RCAWGB	Spdnt	22 AWG
2110QA	9/16"	125/250			RLD	RCAWGB	Spdnt	QD
2195A	9/16"		6/12/28		RLD	RAWGB	Spdnt	22 AWG
2120A	9/16"	125			RLD	RAW	Spdnt	22 AWG
2150A	9/16"	125			RF	RCAWGB	Spdnt	22 AWG
2150QA	9/16"	125			RF	RCAWGB	Spdnt	QD

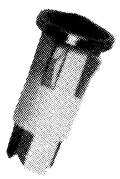
Model #	Mtg Hole	Neon Vac	Incan Volts	LED Volts	Lens Type	Lens Color	Mntg Type	Trmnl (Std)
2194A	9/16"		6/12/28		RF	RAWGB	Spdnt	22 AWG
2191L	9/16"			6/12/24	RF	RGY	Spdnt	22 AWG
2191QL	9/16"			12/24	RF	RGY	Spdnt	QD
2191U	9/16"			6/12/24	RD	RGY	Spdnt	22 AWG
2191QU	9/16"			12/24	RD	RGY	Spdnt	QD
2990D	9/16"		6/12/28		RC	RAWGB	Spdnt	22 AWG
2990P	1/2"		6/12/28		RFL	RAWGB	Snap	22 AWG
4700A	9/16"	125			RLD	RAWG	Spcl	22 AWG
2330D	Rect	125			Rect	RAWG	Snap	22 AWG
2330QD	Rect	125			Rect	RAWG	Snap	QD
2390QD	Rect		28		Rect	RAWG	Snap	QD
3620D	Rect	125			Rect	RAWG	Snap	22 AWG
3620QD	Rect	125			Rect	RAWG	Snap	QD
5900K	9/16" SQ	125			SQFL	RAG	Snap	22 AWG
5991K	9/16" SQ			12/24	SQFL	RGY	Snap	22 AWG
6010M	3/8"			125 Vac	RD	RAG	3/8-24	22 AWG
6011M	3/8"			250 Vac	RD	RAG	3/8-24	22 AWG
6091M	3/8"			12/24	RD	RGY	3/8-24	22 AWG

NOTES:
RLD = Round Low Dome, RF = Round Flat, RD = Round Dome, SQF = Square Flat, RC = Round Cone, RFL = Round Flat Surface, Rect = Rectangular, SQFL = Square Flat Surface, R = Red, C = Clear, A = Amber, W = White, G = Green, Y = Yellow, B = Blue, QD = Quick Disconnect, Spdnt = Speed Nut.

1030D, 1090D



1030QD

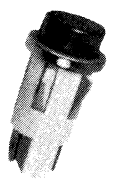


1050A, 1090A

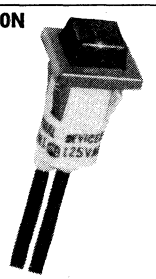
1050QA

1050C, 1090C

1050QC



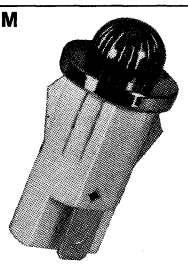
1050N, 1090N



1050QN

1091M

1091QM



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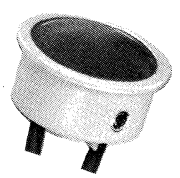

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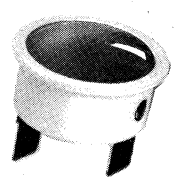

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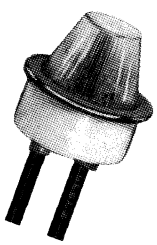

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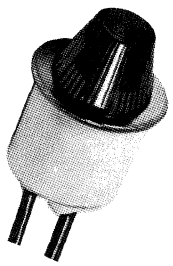
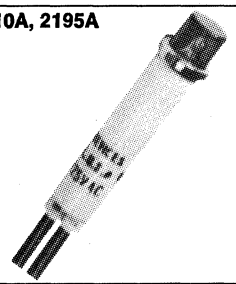


2110A, 2195A



2110QA

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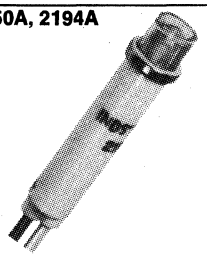
2120A

2150A, 2194A



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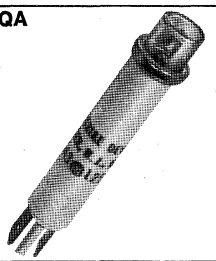

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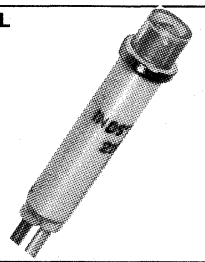

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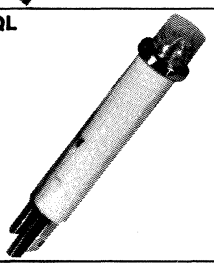

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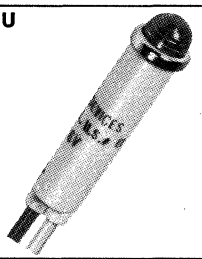

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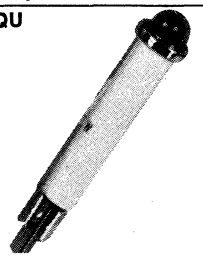
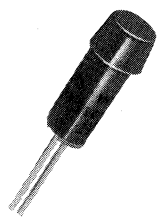
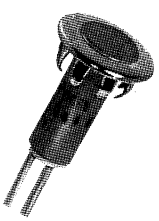


2990D



2990P



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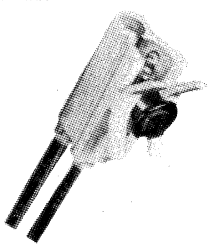

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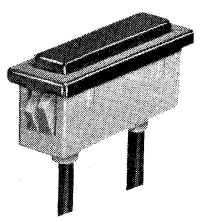

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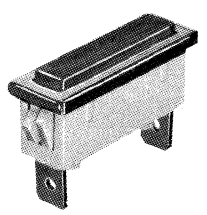

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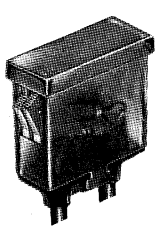
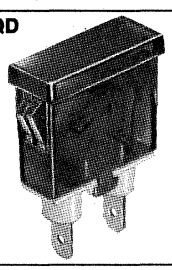
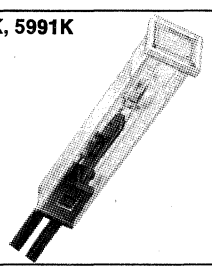


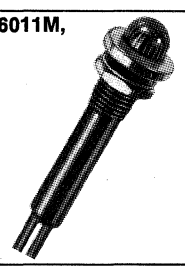
3620QD



5900K, 5991K

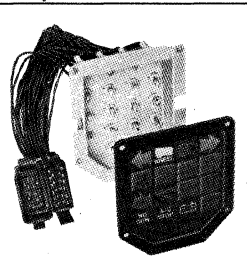


6010M, 6011M, 6091M

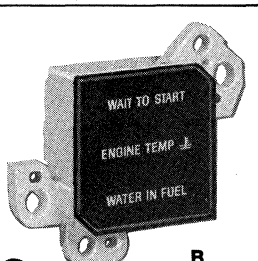


CUSTOM PRODUCTS

In addition to the standard products briefly described on the preceding pages, IDI supplies custom products as shown below: A. 18 lamp bus module; B. Assembly for diesel auto; C. Neon lamp for vaporizer; D. Custom lamps for solenoid operated hydraulic system; E. Automotive instrument lens clusters; F. Wire harness for auto vanity mirror; G. Lamp cluster for bowling scorer; H. Special imprinted lamps and clusters and harnesses.



A



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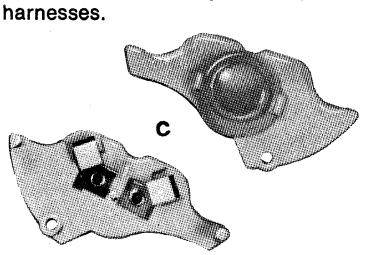

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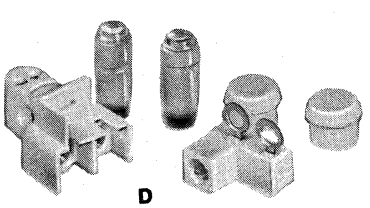

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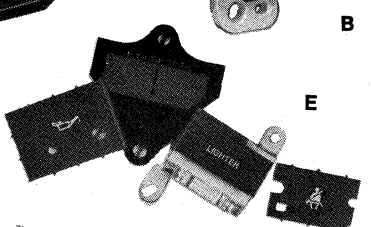

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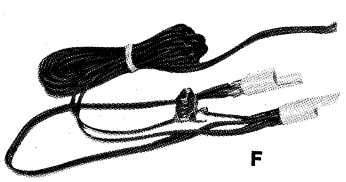

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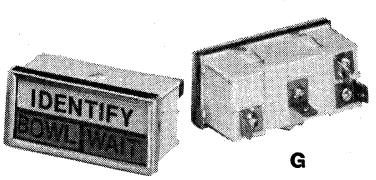

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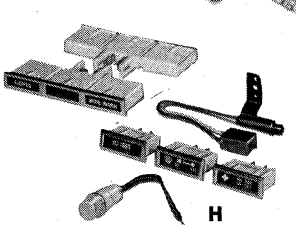

H

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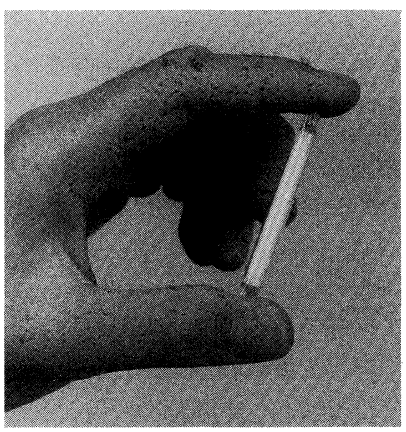
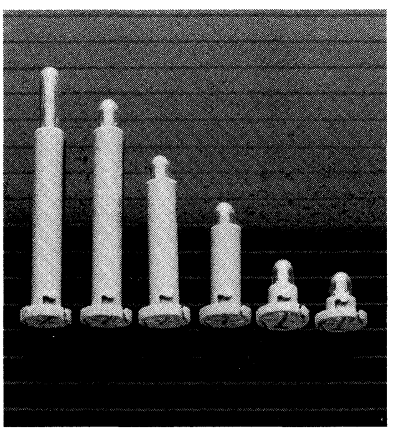


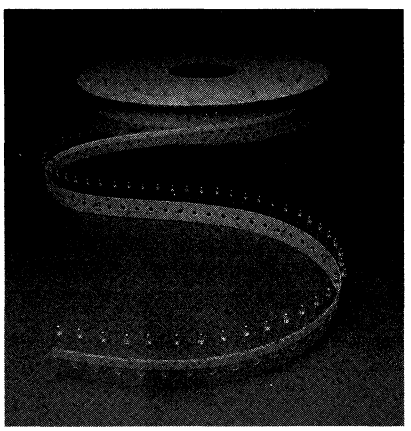
WORLD'S SMALLEST FLUORESCENT LAMP

Only .250″ (6.5mm) in diameter, and available in 2″, 4″ and 8″ standard lengths, this unique line is offered in a variety of colors, and provides a minimum of 20,000 hours operating life. A new, narrow spectrum RBG series is also available, as well as the Ultra-Violet Line in diameters as small as 3/8″ (9.5mm).



JKL NEO-WEDGE™ PCB LAMP SYSTEM

This patented design allows direct mounting of lamp assemblies to a PC board with a quarter turn twist, reducing labor costs and eliminating all secondary assembly operations. It is also available in a double-contact version for single sided boards that assures electrical contact whether lamp is pointing top or bottom, as well as a new gas filled line *guaranteed* for 2500 hours lamp life.



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This revolutionary concept permits utilization of leaded lamps with automatic insertion equipment, providing a practical and cost-effective solution to the problems of manual lamp insertion in what is otherwise an automatic operation. Available in high volume quantities on special order, to exacting customer specifications. Compatible with most auto-insertion systems. Consult factory.

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- Silicone Lamp Filters in Colors
- Miniature LED Devices
- Neon Glow Lamps
- Sub-Miniature Indicator Lamps
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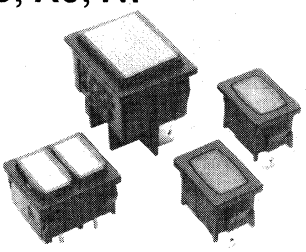
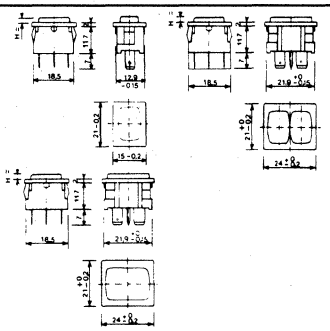
MOLVENO COMETTI

Switches, Switches/Indicator Lights, Indicator Lights, AC Receptacles

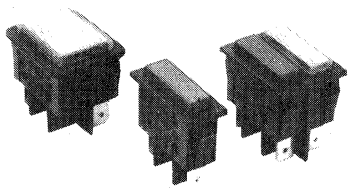
A5, A6, A7

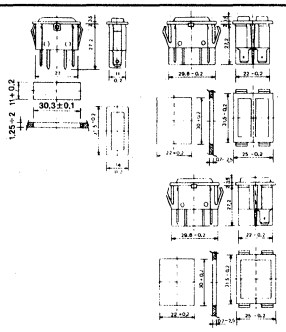




A5, A6, A7 SERIES
Rating: 120/240 Volts AC
6, 12, 24 Volts DC
Temp: 105C
Colors: Red, Green, Amber.
Others available on request.

B5, B6, B7

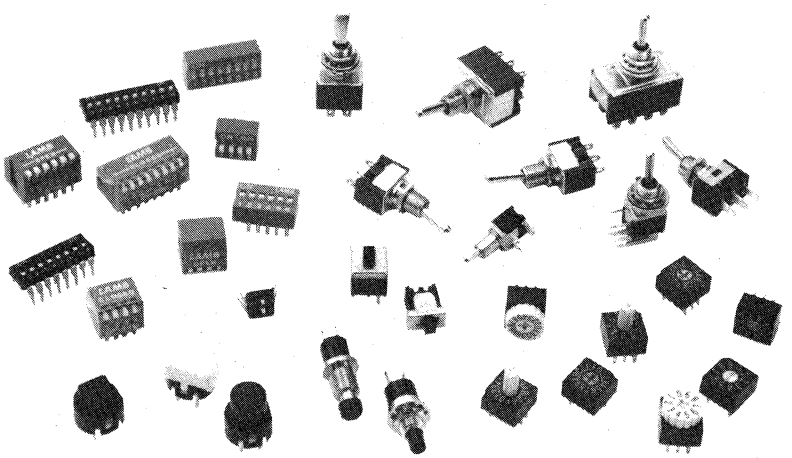




B5, B6, B7 SERIES
Rating: 120/240 Volts AC
6, 12, 24 Volts DC
Temp: 105C
Colors: Red, Green, Amber.
Others available on request.

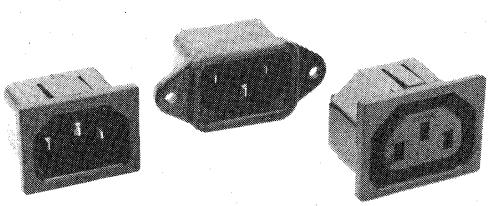
ALL DIMENSIONS IN MILLIMETERS

Additional Switches and AC Receptacles from LAMB INDUSTRIES, INC.



SWITCHES

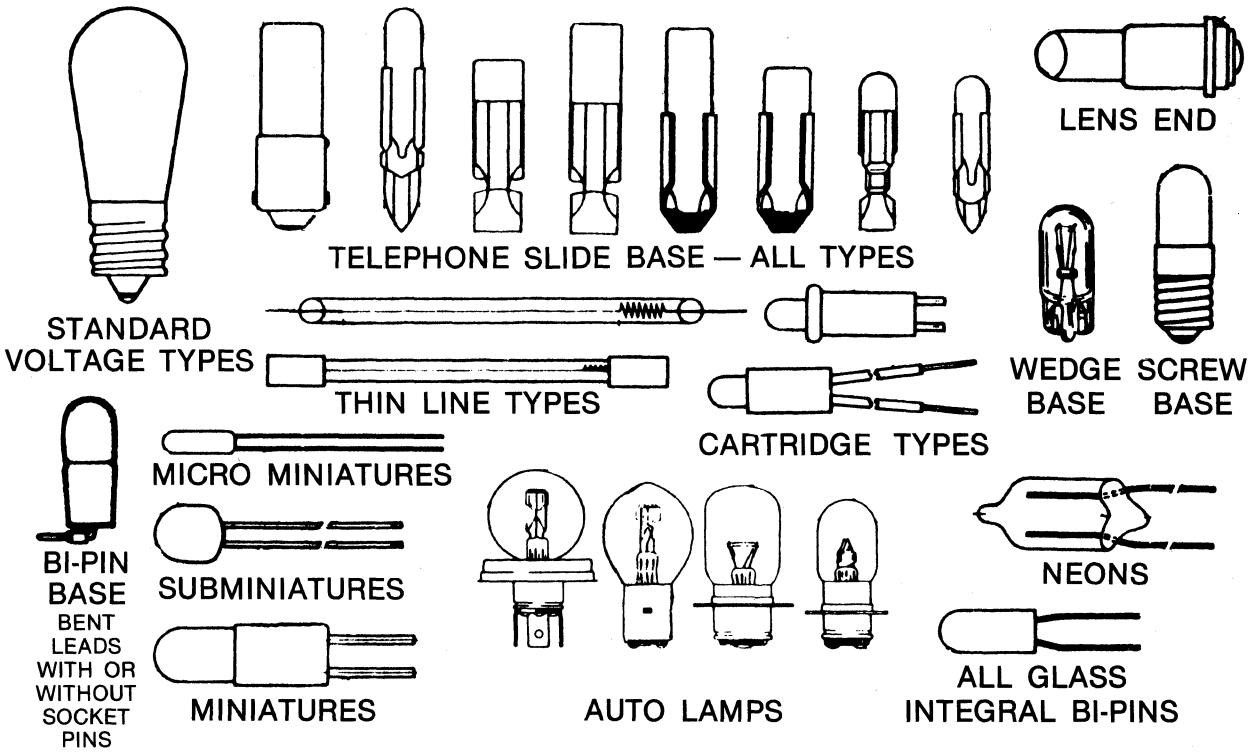
- TOGGLES
- TINY TOGGLES
- TINY SLIDES
- DIPS
- PIANO DIPS
- INSERTABLE DIPS
- MINIATURE DIP ROTARIES
- KEY SWITCHES
- PUSH BUTTONS



PLEASE SEE SECTION 5100 FOR ADDITIONAL LAMB/MOLVENO COMETTI PRODUCTS.

AC RECEPTACLES

NC-174	6A	125V
NC-180	15A	125V
NC-176	10A	250V
NC-176	15A	250V
NC-186	15A	250V



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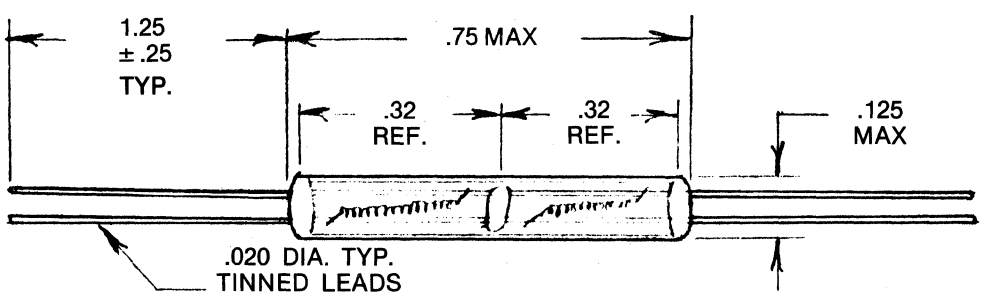

The Edgewedge™ — Available in Multi-Filament for Series/Parallel Connections.
Applications: Edge and/or Wedge Lighting, LCD Displays.

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213/697-IDEA
(697-4332)
Fax: 213/690-1352

QUALITY PRODUCTS are based on QUALITY PARTS

'IDEA' = LED

IDEA is a specialty company dealing exclusively in LEDs and LED-based components. If you need an LED, we either have it or will work with you to supply you with a product that will satisfy your need. The listing below is intended to show you some of the "IDEAs" we can provide!

LED Sizes:

- T 5/8 (1.6 mm Dia.) – 0580 Series
- T 1(3 mm Dia) – 2151, 2152, 2252 2351, 2352 Series
- T 1 3/4 (5 mm Dia.) – 4153, 4251, 4351, 4381, 4451, 4491 Series
- 2 x 4 mm Rect. – 6052, 6055 Series
- 2 x 5 mm Rect. – 6151, 6152, 6161, 6162, 6361 Series
- 1.8 x 5.3 mm Rect. – 6251, 6252 Series
- 1.3 x 6.1 mm Rect. – 6352 Series
- 2.4 x 7.1 mm Rect. – 6451 Series
- 2.4 x 4.8 mm Rect. – 6551, 6552, 6553 Series
- 2.5 x 5 mm Rect. – 6651, 6661, 6663 Series
- 1 x 5 mm Rect. – 6751, 6761, 6762 Series
- 1 x 4.8 mm Rect. – 6772 Series
- 4 x 7 mm Rect. – 6791 Series
- 1.4 x 4 mm Rect. – 6852 Series

Other Shapes:

- Tower Type – 7951 Series
- Triangular – 8153, 8252, 8352, 8451 Series
- 5 mm Square – 7151, 7161 Series
- 3mm Square – 7351 Series
- Twin Squares – 7552 Series

Other Styles:

- Bi-Polar, Bi-color – 9251, 9451, 9551, 9553 9661, 9663 series
- Flashing – 0231, 0451, 0651 Series
- "Large" Lamps – 5361, B-40 Series
- BarGraph and Bar Module- B-10, B-20, B-30 Series
- Legend Lamps – 0251 Series

Resins:

- "D" – Color Diffused
- "W" – White Diffused
- "T" – Color Transparent
- "C" – Water Clear

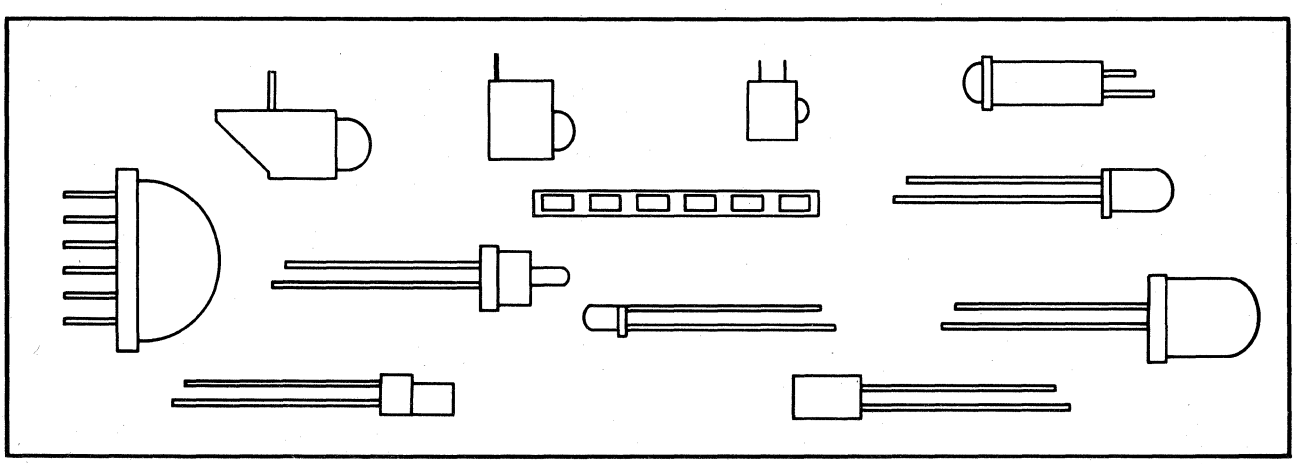
Colors:

- "R" – Red, 655 nm.
- "H" – Red, 697 nm.
- "I" – Red/Orange, 635 nm.
- "G" – Green, 565 nm.
- "Y" – Yellow, 585 nm.
- "E" – Orange, 635 nm.
- "A" – Amber, 600 nm.
- "S", "V", "U" and others – super-and ultra-bright

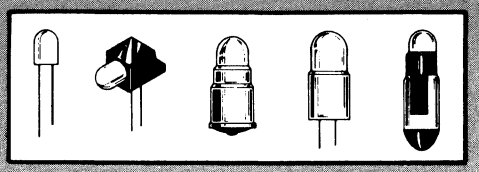
IDEA produces a profusion of LED holders, including single units and arrays.

Right Angle Holders:
T 1 and T 1 3/4–G60B, G61B, G62B, G63B, G64B, G65B, G66B, G67B, G68B Series
"Snap-in" Panel Mounts:
G70B, G71B Series

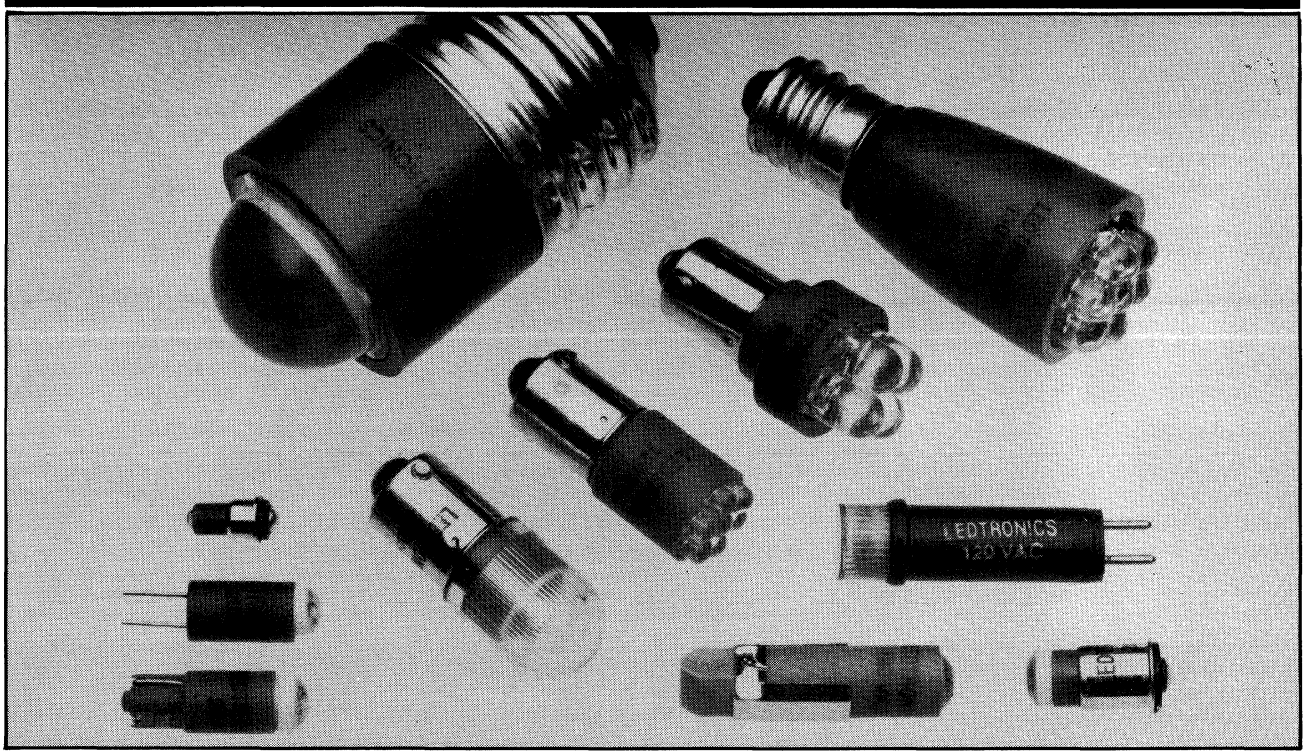
Our catalog shows 17 different styles of arrays, each holding as few as 2 LEDs and as many as 12 LEDs. With any color LED in any position, we call these our standard line. In addition, we have produced, and continue to produce, special holders designed for special applications.



LED T.M.



BASED LED LAMPS FOR DIRECT INCANDESCENT REPLACEMENT



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CONTENTS:

- 2 CHIP T1 SUB-MIDGET LED
- 4 CHIP T1 SUB-MIDGET LED
- T1¾ MIDGET FLANGE LED
- T1¾ MIDGET GROOVE LED
- T1¾ MIDGET SCREW LED
- T1¾ SUB. MIN. WEDGE LED
- T1¾ BIPIN LED
- T1¾ WIRE TERMINAL LED
- T3¼ MINIATURE BAYONET LED
- T3¼ MIN. BAY. CLUSTER LED
- CANDELABRA CLUSTER LED
- TELEPHONE SLIDE LEDS
- 2-PIN CARTRIDGE LEDS
- SOCKETS, LAMPHOLDERS, LENS CAPS

ORDERING: (SEE SAMPLE PART NO. BELOW)

WHEN PLACING ORDERS OR REQUESTING SAMPLES, PLEASE INDICATE INCANDESCENT NO. # BEING REPLACED. ALL LEDS AVAILABLE WITH FULL BURN-IN TO MIL STANDARDS OR YOUR SPECIFICATIONS.

PART NO.:
F206 C R 6 -28V/20- P

MODEL
F206=6-CHIP

LENS TYPE
C=CLEAR TINTED

LED COLOR G=STD GREEN
R=RED LV=LIME YELLOW
Y=YELLOW PG=PURE GREEN

BRIGHTNESS CODE
6=ULTRA HI-RELIAB.
6C=ULTRA COMMERCIAL
COMPARABLE TO 0.3 MSCP INCANDESCENT

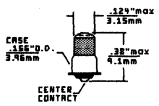
CENTER CONTACT
P=POS. +, N=NEG. –, AC=VAC
BP=BIPOLAR DUAL-POLARITY

VOLTS/CURRENT mA
4Vf, 6Vf, 12Vf, EXT. RESIS. RQD.
5V/60, 12V/40, 14V/40, 24V/20, 28V/20, 36V/20, 48V/15, 60V/12
12OVAC/ 8 ETC
OTHER VOLTAGES AVAILABE CONTACT FACTORY

LEDTRONICS, INC. 4009 PACIFIC COAST HWY., TORRANCE, CA 90505
(213) 549-9995 FAX (213) 549-4820 TELEX 4945454

2-CHIP T1 SUB-MIDGET LED

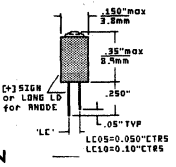
REPLACES INCAND.#: 6839, 8022, 714, 682, 685, 718, 7240, 7241, 32, 7880, 7683, 7714, 7715, 8099, 7839,



T1(3MM) SUB-MIDGET FLANGE LED, DUAL CHIP

MODEL: F122
CENTER CONTACT: P=ANODE+(CASE—)
N=CATH.—(CASE+)
NR=NO RESISTOR

MODEL: BP122
LEAD CENTERS:LC05=0.050"
LC10=0.10"

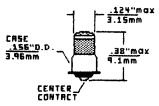


T1(3MM) BI-PIN LED DUAL CHIP,160°

LENS TYPE: C=CLEAR LENS
LED COLORS: R=RED, O=ORANGE, Y=AMBER YELLOW, LY=LIME YELLOW, G=STD GREEN, PG=PURE GREEN
BRIGHTNESS CODE:5=ULTRA BRIGHT ALL COLORS/6=H1—ULTRA RED ONLY
VOLTS/mAMPS,TYP: 2Vf, 4Vf, 3V/40, 5V/30, 12V/15, 14V/15, 24V/10, 28V/8
(OTHER VOLTAGES & LOWER mAMPS AVAILABLE.)

4-CHIP T1 SUB-MIDGET LED

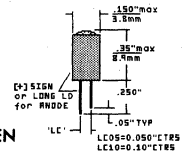
REPLACES INCAND.#: SAME AS 2-CHIP(SEE ABOVE)



T1 (3MM) 4-CHIP SUB-MIDGET FLANGE LED, 160°

MODEL: F124
CENTER CONTACT: P=ANODE+(CASE—)
N=CATH.—(CASE+)
NR=NO RESISTOR

MODEL: BP124
LEAD CENTERS: LC05=0.050"
LC10=0.10"
NR=NO RESISTOR

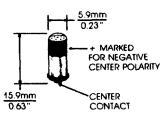


T1(3MM) 4-CHIP BI-PIN LED, 160°

LENS TYPE: C=CLEAR
LED COLORS: R=RED, O=ORANGE, Y=AMBER YELLOW, LY=LIME YELLOW, G=STD GREEN, PG=PURE GREEN
BRIGHTNESS CODE: 5=ULTRA—BRIGHT ALL COLORS/6=H1—ULTRA RED ONLY
VOLTS/mAMPS, TYP: 4Vf, 8Vf 5V/40, 12V/20, 14V/20, 24V/12, 28V/10
(OTHER VOLTAGES & LOWER mAMPS AVAILABLE.)

T1¾ MIDGET FLANGE LED

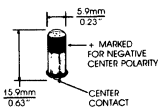
REPLACES INCAND.#: 327, 387, 382, 330, 269, 328, 344, 345, 349, 350, 367, 370, 376, 377, 380, 381, 385, 394, 459, 3150, 7332, C7A (NE2D)



MULTICHIP (6-CHIP) CLEAR XTRA WIDE ANGLE 160°

MODEL: F206
BRIGHTNESS CODE: 6=ULTRA HI-REL
6C=COMML, 7= HI-ULTRA 660mm RED ONLY
(COMPARABLE TO 0.3 MSCP INCAND)
VOLTAGE/CURRENT mA: 4Vf, 6Vf, 12Vf,
5V/60, 12V/40, 14V/40, 24V/20, 28V/20, 36V/20,
48V/15, 60V/12, 120 VAC/8,
(OTHER VOLTAGES AVAIL.)

MODEL: F204
BRIGHTNESS CODE: 4= HI-EFF. HI-RELIABLE
4C= HI-EFF. COMMERCIAL
(COMPARABLE TO 0.2 MSCP INCAND)
VOLTS/CURRENT mA: 4Vf, 8Vf,
5V/30, 6V/30, 12V/15,
18V/15, 24V/15, 28V/15...
(OTHER VOLTAGES AVAIL.)

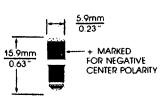


MULTICHIP (4 CHIP) CLEAR XTRA WIDE ANGLE 160°

LENS TYPE: C=CLEAR TINTED
LED COLORS: R=RED, O=ORANGE, Y=AMBER YELLOW, LY=LIME YELLOW, G=STD GREEN, PG=PURE GREEN
CENTER CONTACT: P=POS.+, N=NEG.—, AC=VAC, BP=BIPOLAR DUAL—POLARITY

T1¾ MIDGET GROOVE LED

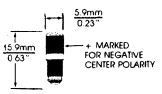
REPLACES ENCAND.#334, 336, 337, 346, 379, 386, 388, 397, 398, 709,



MULTICHIP (6-CHIP) CLEAR XTRA-WIDE ANGLE 160°

MODEL: G206
BRIGHTNESS CODE: 6=H1-ULTRA HI-REL
7=H1-ULTRA 660mm RED ONLY
(COMPARABLE TO 0.3 MSCP INCAND.)
VOLTS/CURRENTmA: 4Vf, 6Vf, 12Vf,
5V/60, 12V/40, 14V/40, 24V/20, 28V/20, 36V/20
48V/15, 60V/12,(OTHER VOLTAGES AVAIL.)

MODEL: G204
BRIGHTNESS CODE: 4=H1-EFF H1-RELIABLE
(COMPARABLE TO 0.2 MSCP INCAND)
VOLTS/CURRENT mA: 4Vf, 8Vf,
5V/30, 6V/30, 12V/15, 14V/15, 18V/15,
24V/15, 28V/15, (OTHER VOLTAGES AVAIL.)

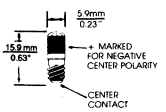


MULTICHIP (4-CHIP) CLEAR XTRA-WIDE ANGLE 160°

LENS TYPE: C=CLEAR TINTED
LED COLORS: R=RED, O=ORANGE, Y=AMBER YELLOW, LY=LIME YELLOW, G=STD GREEN, PG=PURE GREEN.
CENTER CONTACT: P=POS.+, N=NEG.—, AC=VAC

T1¾ MIDGET SCREW LED

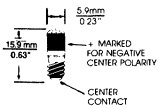
REPLACES ENCAND.#: 335, 342, 369, 373, 378, 383, 389, 399, 1767, 1768, 1769, 1775,



MULTICHIP (6-CHIP) CLEAR XTRA WIDE ANGLE 160°

MODEL: S206
BRITHTNESS CODE: 6=ULTRA HI-REL
7= HI-ULTRA 660mm RED. ONLY
(COMPARABLE TO 0.3 MSCP INCAND.)
VOLTAGES/CURRENT mA : 4Vf, 6Vf, 12Vf,
5V/60, 12V/40,
14V/40, 12V/20, 28V/20, 36V/20,
48V/15, 60V/12 (OTHER VOLTAGES AVAIL.)

MODEL: S204
BRIGHTNESS CODE: 4= HI-EFF HI-REL.
(COMPARABLE TO 0.2 MSCP INCAND.)
VOLTAGES/CURRENT mA: 4Vf, 8Vf,
5V/30, 6V/30,
12V/15, 14V/15, 18V/15, 24V/15,
28V/15, (OTHER VOLTAGES AVAIL.)

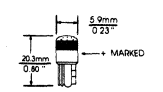


MULTICHIP (4-CHIP) CLEAR XTRA WIDE ANGLE 160°

LENS TYPE: C=CLEAR TINTED
LED COLORS: R=RED, O=ORANGE, Y=AMBER YELLOW, LY=LIME YELLOW G=STD GREEN, PG=PURE GREEN
CENTER CONTACT: P=POS. +, N=NEG.—, AC=VAC.

T1¾ SUB. MIN. WEDGE LED

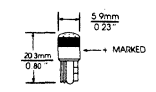
REPLACES INCAND.#: 17, 18, 37, 56, 73, 74, 79, 84, 85, 86,



MULTICHIP (6-CHIP) CLEAR XTRA WIDE ANGLE 160°

MODEL: W206
BRIGHTNESS CODE: 6=ULTRA HI-REL
7=HI-ULTRA 660mm RED ONLY
VOLT/CURRENT mA: 4Vf, 6Vf, 12Vf,
5V/60, 12V/40, 14V/40
ETC. (OTHER VOLTAGES AVAIL.)

MODEL: W204
BRIGHTNESS CODE: 4=HI-EFF, HI-REL.
(COMPARABLE TO 0.2 MSCP INCAND.)
VOLTS/CURRENT mA: 4Vf, 8Vf,
5V/30, 6V/30, 12V/15,
(OTHER VOLTAGES AVAIL.)

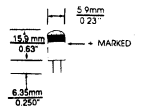


MULTICHIP (4-CHIP) CLEAR XTRA WIDE ANGLE 160°

LENS TYPE: C=CLEAR TINTED
LED COLORS: R=RED, O=ORANGE, Y=AMBER YELLOW, LY=LIME YELLOW, G=STD. GREEN, PG=PURE GREEN.

T1¾ BIPIN PCB LED

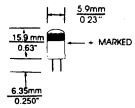
REPLACES INCAND.#: 2301 THRU 2314, 2316, 2319, 2322, 2324, 2332, 2335, 2337, 2339, THRU 2342, 3149, 7001, 7003, 7327, 7328, 7330, 7334, 7349, 7361, 7362, 7363, 7370, 7371, 7373, 7375, 7376, 7377



MULTICHIP (6-CHIP) CLEAR XTRA WIDE ANGLE 160°

MODEL: BP206
BRIGHTNESS CODE: 6=ULTRA HI-REL, 7=HI-ULTRA 660mm RED ONLY (COMPARABLE TO 0.3 MSCP INCAND.)
VOLTS/CURRENTS mA: 4Vf, 6Vf, 12Vf, 5V/60, 12V/40, 14V/40, 24V/20, 28V/20, 36V/20, 48V/15, 60V/12 (OTHER VOLTAGES AVAIL.)

MODEL: BP204
BRIGHTNESS CODE: 4=HI-EFF, HI-RELIAB. (COMPARABLE TO 0.2 MSCP INCAND.)
VOLTS/CURRENT mA: 4Vf, 8Vf, 5V/30, 6V/30, 12V/15, 14V/15, 18V/15, 24V/15, 28V/15 (OTHER VOLTAGES AVAIL.)

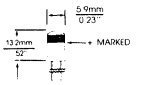


MULTICHIP (4-CHIP) CLEAR XTRA WIDE ANGLE 160°

LENS TYPE: C=CLEAR TINTED
LED COLORS: R=RED, O=ORANGE, Y=AMBER YELLOW, LY=LIME YELLOW, G=STD GREEN, PG=PURE GREEN.

T1¾ WIRE TERMINAL LED

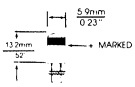
REPLACES INCAND.#: 17E, 18E, 37E, 56E, 73E, 74E, 79E, 84E, 85E, 1705, 1730, 1738, 1739, 1749, 1762, 1764,



MULTICHIP (6-CHIP) CLEAR XTRA WIDE ANGLE 160°

MODEL: WT206
BRIGHTNESS CODE: 6=ULTRA HI-REL, 7=HI-ULTRA 660mm RED ONLY (COMPARABLE TO 0.3 MSCP INCAND.)
VOLTS/CURRENT mA: 4Vf, 12Vf, 5V/60, 12V/40, 14V/40, 24V/20, 28V/20, 36V/20, 48V/15, 60V/12 (OTHER VOLTAGES AVAIL.)

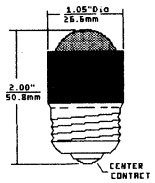
MODEL: WT204
BRIGHTNESS CODE: 4=HI-EFF, HI-RELIAB. (COMPARABLE TO 0.2 MSCP INCAND.)
VOLTS/CURRENT mA: 4Vf, 8Vf, 5V/30, 6V/30, 12V/15, 14V/15, 18V/15, 24V/15, 28V/15... (OTHER VOLTAGES AVAIL.)



MULTICHIP (4-CHIP) CLEAR XTRA WIDE ANGLE 160°

LENS TYPE: C=CLEAR TINTED
LED COLOR: R=RED, O=ORANGE, Y=AMBER YELLOW, LY=LIME YELLOW, G=STD GREEN, PG=PURE GREEN

1.O2 MEDIUM SCREW LED



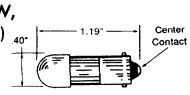
MEDIUM SCREW (6-CHIP) BIG DOME LED

MODEL: S100
LED COLOR: R=RED, Y=YELLOW, G=GREEN
BRIGHTNESS CODE: 4 = H1-EFFICIENCY
VOLTS/CURRENT mA: 6Vf, 12Vf, 12V/30, 14V/30, 24V/30, 28V/30, 36V/20, 48V/20, 120VAC
LENS TYPE: T=TRANSLUSCENT

T3¼ MINIATURE BAYONET LED

REPLACES INCAND.#: 6MB, 12MB, 24MB, 120MB, 44, 47 51, 130, 137,.

MODEL: B3206 BAYONET, F3206 FLANGE, S3206 SCREW.
LED COLOR: R=RED, O=ORANGE, Y=AMBER YELLOW, LY=LIME YELLOW, G=STD GREEN, PG=PURE GREEN.)
BRIGHTNESS CODE: 6=ULTRA HI-REL, T=HI-ULTRA 660mm RED ONLY (COMPARABLE TO 0.3 MSLP INCAND.)
VOLTS/CURRENT mA: 4Vf, 6Vf, 12Vf, 5V/60, 12V/40, 14V/40 24V/20, 28V/20, 36V/20, 48V/15, 60V/12, 120VAC/8
LENS TYPE: CW=WATER CLEAR.

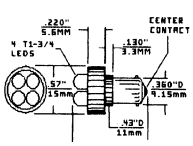


MULTICHIP (6-CHIP) CLEAR XTRA WIDE ANGLE 160°

CENTER CONTACT: P=POS.+, N=NEG.—, AC=VAC, BP=BIPOLAR DUAL POLARITY

T3¼ MIN. BAYONET CLUSTER LED

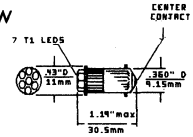
REPLACES INCAND.#: 6MB, 12MB, 24MB, 120MB, 44, 47, 51, 130, 137, 219, 239, 240, 755, 757, 1302, 1437, 1445, 1819,



4-LED CLUSTER MIN. BASED W/T1¾ LEDS

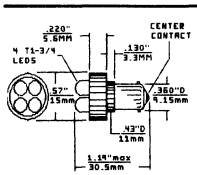
MODEL: B304 BAY., F304 FLANGE, S304 SCREW
VOLTS/CURRENT mA: 4Vf, 8Vf, 5V/60, 6VAC/40, 12V/40, 24V/30, 28V/30, 36V/20, 48V/20, 60V/20, 120VAC/10

MODEL: B3127 BAY, F3127 FLANGE, S3127 SCREW
VOLTS/CURRENT mA: 14Vf, 18V/30, 24V/30, 28V/30, 36V/20, 48V/20, 60V/20, 120VAC/10,



7-LED CLUSTER MIN. BASED W/T1 LEDS

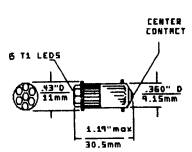
LENS TYPE: CW=WATER CLEAR, T=TRANSLUSCENT
LED COLORS: R=RED, Y=YELLOW, G=STD GREEN, LY=LIME YELLOW, PG=PURE GREEN
BRIGHTNESS CODE: 6=GoA1As ULTRA RED, 5=ULTRA (R,O,Y,LY,G,PG,) 4=HI-EFF(R,O,Y,G)
CENTER CONTACT: P=POS.+, N=NEG.—,AC=BI POLAR DUAL-POLARITY



4-LED CLUSTER MIN. BASED WITH T1¾ DUALCHIPS

MODEL: B308 BAY., F308 FLANGE, S308 SCREW
LENS TYPE: C=CLEAR TINTED
LED COLORS: R=RED, O=ORANGE, Y=YELLOW, G=GREEN
BRIGHTNESS CODE: 5=ULTRA, WIDE ANGLE
VOLTS/CURRENT mA: 8Vf, 16Vf, 12V/60, 18V/60, 24V/30, 28V/30, 36V/30, 48V/20, 60V/20, 120VAC/10 ECT...

MODEL: B3126 BAY., F3126 FLANGE, S3126 SCREW
LENS TYPE: CW=CLEAR WATER, T=TRANSLUSCENT
LED COLORS: G=STD GREEN, R=RED, Y=YELLOW LY=LIME YELLOW, PG=PURE GREEN
BRIGHTNESS CODE:6=Go1As ULTRA RED, 5=ULTRA (R, O, Y, LY, G, PG, 4=HI-EFF. (R, O, Y, G,)
VOLTS/CURRENT mA: 4Vf, 6Vf, 12Vf, 5V/90, 6V/90, 12V/60, 14V/60, 18V/30

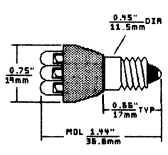


6-LED CLUSTER MIN. BASED WITH T1 LEDS

CENTER CONTACT: P=POS.+,N=NRG.—, DC=VAC, BP=BI POLAR DUAL-POLARITY

S6 SCREW BASE CANDELABRA CLUSTER LED

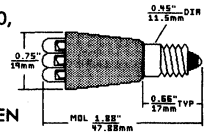
REPLACES INCAND.#: 3S6, 6S6, 1N6V, 12V, 24V, 30V, 48V, 60V, 75V, 125VDC, 125VAC



4-LED S6 CAND. SCREW BASE CLUSTER LED

MODEL: S464 (MDL 1.25") SL464 (MDL 1.75")
VOLTS/CURRENT mA: 4Vf, 8Vf, 5V/60, 6VAC/40, 12V/40, 24V/30, 28V/30, 36V/20, 48V/20, 60V/20, 120VAC/10

MODEL: S466/SL466=6LED, S467/SL467=7LED
VOLTS/CURRENT mA: 6Vf, 14Vf, 12V/60, 14V/60, 16V/60, 18V/30, 24V/30, 28V/30, 36V/20, 48V/20, 60V/20, 120VAC/10

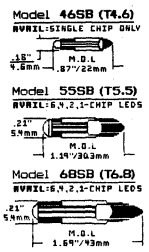


7-LED S6 CAND. SCREW BASE CLUSTER LED

LENS TYPE: CW=WATER CLEAR, T=TRANSLUSCENT
LED COLORS: R=RED, O=ORANGE, Y=AMBER YELLOW, LY=LIME YELLOW, G=STD GREEN, PG=PURE GREEN
BRIGHTNESS CODE: 6=GoA1As ULTRA RED, 5=ULTRA (R, O, Y, LY, G, GP) 4=HI-EFF. (R, O, Y, G)
CENTER CONTACT: P=POS.+, N=NEG—, AC=VAC, BP=BI-POLAR DUAL-POLARITY

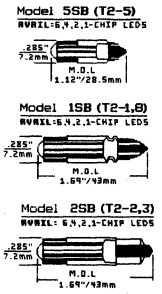
TELEPHONE SLIDE LEDS, T4.6, T5.5, T6.8, T2

REPLACES INCAND.: 5SLB, 6PSB, 12PSB, 16XCB, 24PSB, 28PSB, 48PSB, 60PSB, 120PSB,



MODEL: 46SB, 55SB, 68SB, 5SB, 1SB, 2SB
BRIGHTNESS CODE: 6=ULTRA HI-REL
7=HI-ULTRA 66mm RED ONLY
(COMPARABLE TO 0.3 MSCP INCAND.)
VOLTS/CURRENT mA: 4Vf, 6Vf, 12Vf,
5V/60, 12V/40, 14V/40,
24V/20, 28V/20, 36V/20, 48V/15, 60V/12,
120VAC/8

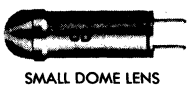
MODEL: 46SB, 55SB, 68SB, 5SB, 1SB, 2SB
BRIGHTNESS CODE: 4=H1-RELIAB.
(COMPARABLE TO 0.2 MSCP INCAND.)
VOLTS/CURRENT mA: 4Vf, 8Vf,
5V/30, 6V/30, 12V/15,
14V/15, 18V/15, 24V/15, 28V/15



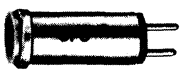
LENS TYPE: C=CLEAR TINTED
LED COLORS: R=RED, O=ORANGE, Y=AMBER YELLOW, LY=LIME YELLOW, G=STD GREEN, PG=PURE GREEN

2 PIN CARTRIDGE LEDS

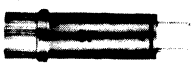
REPLACES INCAND.#: DIALIGHT SERIES 249, 250, 253, 507, LITTLEFUSE SERIES 900, GI-CM SERIES



SMALL DOME LENS



LOW PROFILE LENS

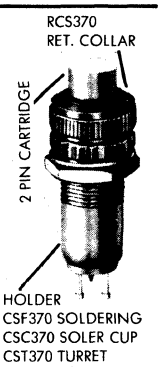


SHORT STOVEPIPE LENS

MODEL: CF296 (6-CHIP), CF294 (4-CHIP)
LED COLORS: R=RED, A=AMBER, Y=LIME YELLOW, G=GREEN
BRIGHTNESS CODE: 6=HI-ULTRA INTENSITY
VOLTS/mAmps: 5V60, 6V60, 10V40, 12V40, 14V40, 18V20, 24V20, 28V20, 48V15, 60V12, 120VAC
SPEC. FEATURES: B=BLK BEZEL, S=SILVER BEZEL, BPS=BIPOLAR SILVER BZL, PLS=NON FLUTED PLAIN LENS, SILVER BEZEL

MODEL: CF290 (SINGLE CHIP)
LED COLORS: R=RED, A=AMBER, Y=LIME YELLOW, G=GREEN, O=ORANGE
BRIGHTNESS CODE: 5=ULTRA, 4=HI-EFF.
VOLTS/mAmps: 5V40, 6V40, 10V30, 14V30, 18V25, 24V20, 28V20
SPEC. FEATURES: B=BLK BEZEL, S=SILVER BEZEL, PLS=NON FLUTED PLAIN LENS, SILVER BEZEL

LENS TYPE: C=CLEAR, D=DIFFUSED, T=TRANSLUSCENT, CW=WATER CLEAR



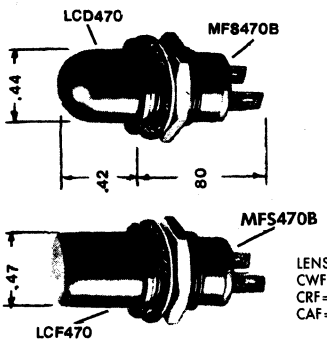
SPECIALS: BIPOLARS, BICOLORS/TRICOLORS, BLINKING/FLASHING

SOCKETS, LAMPHOLDERS AND LENSCAPS

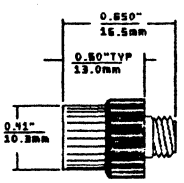
HOLDERS	MIL. TYPE
MFS470B STANDARD, BLACK	LH73/1
MFS470B-WP WATERPROOF, BLACK	LH89/1
RMM64Y0 RFI/EMI SHIELDED	LH73/2

LENS CAPS	MIL. TYPE
LCF470-CHF SPECIAL FLUTED CLR	
LCF470/XX FLAT TOP, DIFF/CLR	LC29XXX
LCD470-XX STD DOME, DIFF/CLR	LC12XXX
LCD470W-XX WATERPROOF DOME	LC35XXX
RM820XX RFI/EMI SHIELDED	LC27XXX

GENERAL SPECIFICATIONS:
MTG HOLE DIA=0.484"
MTG CENTERS=0.750"
PANEL THICKNESS=UPTO 0.265"



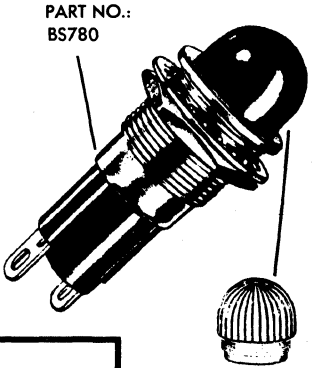
SPECIAL FLUTED LENS CAP
(REPLACES LH73/1)
P/N LCF470-CXF



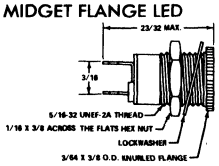
LENS COLORS:
CWF=WATER CLEAR CYF=YELLOW CLEAR
CRF=RED CLEAR CGF=GREEN CLEAR
CAF=AMBER CLEAR TWF=TRANS. WHITE

LAMPHOLDERS AND LENS CAPS FOR T3¼ MIN. BAYONET LEDS
HOLDER (SOLDER TERMINALS)

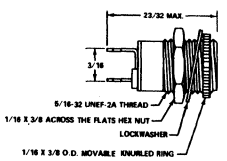
PART NO.:
BS780



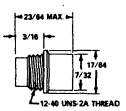
HOLDERS,
T1-SUB MIDGET FLANGE LED



Part Number	Finish
HLC-2010	Bright Nickel
HLC-2020	Black Nickel



Part Number	Finish
HLD-2010	Bright Nickel
HLD-2020	Black Nickel



ALL PLASTIC TYPES

Standard Part Number	Watertight Part Number
HL230XX	HL430XX

HLC-2020-HL230WT

LENS CAP FLUTED DOME

RED: LCD 780CRF
AMBER:LCD 780CAF
GREEN:LCD 780CGF
CLEAR: LCD780CWF

WE ARE QUALIFIED SUPPLIERS TO THE FOLLOWING: ROCKWELL INT'L, McDONNELL DOUGLAS, GENERAL DYNAMICS, HUGHES AIRCRAFT, NORTHROP CORP, RAYTHEON, ALLIED BENDIX, U.S. ARMY, U.S.AIR FORCE, U.S. NAVY, PENNSYLVANIA POWER & LIGHT, E.I. DUPONT, 3-M CO, EASTMAN KODAK, LOCKHEED, PHILIP MORRIS USA, ALBERTA POWER, TVA AND MANY MORE

FULL PRODUCT CATALOGS

BASED LED LAMPS, DIRECT INCANDESCENT REPLACEMENT (GREEN CATALOG)
LED PANEL INDICATORS, SNAP-INS & RELAMPABLES (GOLD CALALOG)
PC BOARD LED LAMPS, ARRAYS, BILEVELS, QUADS (BLUE CATALOG)
DISCRETE LED LAMPS, ALL SHAPES, SIZES & TYPES (RED CATALOG)
DISPLAYS, BARGRAPHS, DOT MATRIX, ALL SIZES/COLORS (PURPLE CATALOG)

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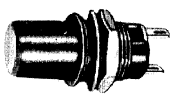
LITTELITES® SELECTOR GUIDE

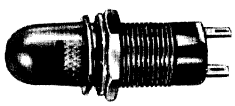
WRITE OR CALL FOR OUR COMPLETE CATALOG.

900 Series Cartridge Lamps

Cartridge Lampholders

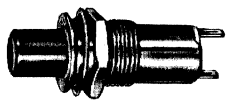


920 Series Subminiature

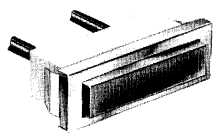


921 Series Subminiature

922, 923, 924 Series Subminiature



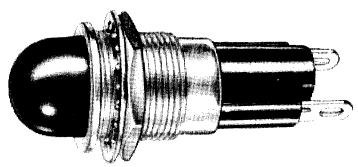
925, 926, 927 Series Subminiature



960 Series Rectangular Snap-Mount Plastic

970 Series 5/16" Diameter Snap-Mount Plastic

980 Series 1/2" Diameter Snap-Mount Plastic

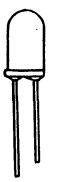
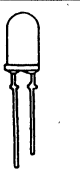
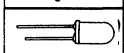
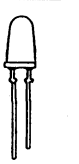
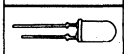
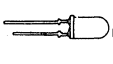
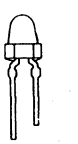
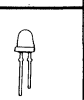
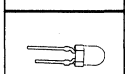
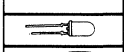
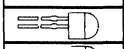
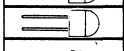
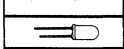
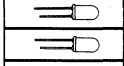
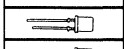
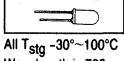


930 Series Miniature Lampholders

		CARTRIDGE LAMPS & HOLDERS					SUBMINIATURE LAMPHOLDERS								MINIATURE LAMPHOLDERS	SNAP-MOUNT PLASTIC LITES		
		CARTRIDGE LAMPS		CARTRIDGE LAMPHOLDERS		SOCKETS												
		900 SERIES	901 SERIES	910 SERIES (Mate with 900 SERIES Cartridge lamps)	911 SERIES (Mate with 901 SERIES Cartridge lamps)	910-000-***	920 SERIES	921 SERIES	922 SERIES	923 SERIES	924 SERIES	925 SERIES	926 SERIES	927 SERIES	930 SERIES	960 SERIES (Rectangular)	970 SERIES (5/16" DIA.)	980 SERIES (1/2" DIA.)
MOUNTINGS	FRONT MOUNT						X	X	X	X	X			X	X	X	X	X
	REAR MOUNT			X	X						X	X	X					
	MOUNTING HOLE SIZE			3/8"	3/8"		15/32"	15/32"	15/32"	17/32"	15/32"	3/8"	3/8"	15/32"	11/16"	1.281" X .395"	.312" / .318"	.500" / .510"
	MAXIMUM PANEL THICKNESS			3/8"	3/8"		3/16"	7/16"	1/4"	1/4"	1/4"	1/8"	3/16"	5/16"	3/8"	.090"	W/BEZ .050 W/O BEZ .125	W/BEZ .090 W/O BEZ .125
TERMINATIONS	SOLDER LUG			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	SOLDER CUP			X	X	X												
	SCREW TYPE														X			
	TURRET PIN			X	X													
	6" WIRE LEADS															X	X	X
	1/8" Q.C.																X	
	3/16" Q.C.															X		X
	1/4" Q.C.															X		
	.040 STAIN. BI-PIN	X	X															
	.040 TIN BI-PIN	X	X															
OPTIONS	D-HOLE MOUNTING			X	X										X			
	DRIP-PROOFING											X	X	X	X			
LAMPS	INCANDESCENT	X					X		X	X	X	X	X	X	X	X	X	X
	NEON STANDARD	X	X					X				X	X	X	X	X	X	X
	NEON GREEN		X													X	X	X
	NEON BLUE		X													X	X	X
	LED RED	X															X	
	LED GREEN	X															X	
	LED YELLOW	X															X	
	LAMPS INCLUDED	X	X	NA	NA	NA										X	X	X
UL	LISTED														X	X	X	X
	RECOGNIZED	X	X	X	X		X	X	X	X	X	X	X	X		X	X	X
CSA	APPROVED	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X

marktech international, corp.

Ultra Bright Selector Guide, 2nd Ed.

Diag.	Part Number	Lens	θ Typ.	Iv mcd Min.	Iv mcd Typ.	Iv mcd Max	Iv mcd @ mA	V_F (V) Typ.	V_F (V) Max	V_F (V) @ mA	I_R uA	I_R V_R	MAXIMUM RATINGS (Ta=25°C) I_F (mA)	V_R (V)	Pd (mW)	Pkg.
	MT5000-UR ††	Water/Clear	12	4000	5000		20	1.8	2.4	20	100	4	50	4	125	A
	MT4000-UR ††	Water/Clear	12	2500	3700	3000	20	1.8	2.4	20	100	4	50	4	125	A
	MT3200-UR ††	Water/Clear	12	1600	2400	3200	20	1.8	2.4	20	100	4	50	4	125	A
	MT1600-UR ††	Water/Clear	12	1000	1600	2000	20	1.8	2.4	20	100	4	50	4	125	A
	MT810-CUR	Light Red/Clear	15		500		20	1.8	2.2	20	100	4	25	4	55	A
	MT810-UR	Light Red/Clear	15		250		20	1.8	2.2	20	100	4	25	4	55	A
	MT820-CUR	Light Red/Diffused	25		300		20	1.8	2.2	20	100	4	25	4	55	A
	MT820-UR	Light Red/Diffused	25		150		20	1.8	2.2	20	100	4	25	4	55	A
	MT400-CUR	Colorless/Clear	15	180	400	640	20	1.8	2.2	20	100	4	25	4	55	A
	MT700-CUR	Colorless/Clear	15	320	700	1120	20	1.8	2.2	20	100	4	25	4	55	A
	MT200-CUG	Colorless/Clear	15	100	200	360	20	2.1	2.8	20	5	4	40	4	120	A
	MT400-CUG	Colorless/Clear	15	180	400	640	20	2.1	2.8	20	5	4	40	4	120	A
	MT1500A-UR ††	Water/Clear	25	1000	1500		20	1.8	2.4	20	100	4	50	4	125	B
	MT1000A-UR ††	Water/Clear	25	550	1000	1350	20	1.8	2.4	20	100	4	50	4	125	B
	MT500A-UR ††	Water/Clear	25	300	500	750	20	1.8	2.4	20	100	4	50	4	125	B
	MT360-UR	Milky/Diffused	30	26	50		20	1.8	2.2	20	100	4	25	4	55	B
	MT350-UR	Water/Clear	25	47	150	310	20	1.8	2.2	20	100	4	25	4	55	B
	MT340-UR	Red/Diffused	30	19	45	120	20	1.8	2.2	20	100	4	25	4	55	B
	MT330-UR	Red/Clear	25	46	120	270	20	1.8	2.2	20	100	4	25	4	55	B
	MT250-UR	Red/Diffused	50		250		20	1.8	2.4	20	100	4	50	4	125	B
	MT150-UR	Red/Diffused	50		150		20	1.8	2.4	20	100	4	50	4	125	B
	MT100-UR	Red/Diffused	50	60	100		20	1.8	2.4	20	100	4	50	4	125	B
	MT150F-URB †	Water/Clear	30	1600	2300	3200	20	1.8	2.4	20	100	3	50	3	100	C
	MT150F-URA †	Water/Clear	30	800	1100	1600	20	1.8	2.4	20	100	3	50	3	100	C
	MT80F-UR ★†	Water/Clear	26		200		20	1.85	2.2	20	10	3	50	3	120	C
	MT540-CUR	Red/Diffused	30	25	110		20	1.8	2.2	20	100	4	25	4	55	D
	MT540-UR	Red/Diffused	30	15	100		20	1.75	2.2	20	100	4	25	4	55	D
	MT540-UG	Green/Diffused	30	20	60		20	2.1	2.8	20	5	4	25	4	70	D
	MT540-UY	Yellow/Diffused	30	20	60		20	2.1	2.8	20	100	4	25	4	70	D
	MT530-UR	Red/Clear	10	50	200		20	1.75	2.2	20	100	4	25	4	55	D
	MT530-UG	Green/Clear	10	60	120		20	2.1	2.8	20	5	4	25	4	70	D
	MT530-UY	Yellow/Clear	10	60	120		20	2.1	2.8	20	100	4	25	4	70	D
	MT400-UR	Water/Clear	8	170	400	1100	20	1.8	2.2	20	100	4	25	4	55	D
	MT350A-UR	Water/Clear	8	135	400	860	20	1.8	2.2	20	100	4	25	4	55	D
	MT220-UR	Water/Clear	8	50	220		20	1.75	2.2	20	100	4	25	4	55	D
	MT500-UR	Water/Clear	15	100	250	720	15	1.8	2.2	20	100	4	25	4	55	E
	MT200-UR	Water/Clear	50	6	22		20	1.75	2.2	20	100	4	25	4	55	E
	MT70-UR	Water/Clear	15		70		20	1.75	2.2	20	100	4	25	4	55	E
	MT60-UR ††	White/Diffused	60	32	70	112	20	1.8	2.4	20	100	4	50	4	125	F
	MT120-UR ††	White/Diffused	60	56	125	200	20	1.8	2.4	20	100	4	50	4	125	F
	MT900-UR ††	Water/Clear	40	650	900		20	1.8	2.4	20	100	4	50	4	125	F
	MT600-UR ††	Water/Clear	40	350	600	900	20	1.8	2.4	20	100	4	50	4	125	F
	MT300-UR ††	Water/Clear	40	200	300	500	20	1.8	2.4	20	100	4	50	4	125	F
	MT600-CUR	Water/Clear	10	110	300	720	20	1.8	2.2	20	100	4	25	4	55	G
	MT600-CUG	Water/Clear	10	63	150	320	20	2.1	2.8	20	5	4	40	4	120	G
	MT640-CUR	Red/Diffused	25	22	50	146	20	1.8	2.2	20	100	4	25	4	55	G
	MT640-UR	Red/Diffused	20	10	20		20	1.75	2.2	20	100	4	25	4	55	G
	MT640-UG	Green/Diffused	20	10	20		20	2.1	2.8	20	5	4	25	4	70	G
	MT640-UY	Yellow/Diffused	20	10	20		20	2.1	2.8	20	100	4	25	4	70	G
	MT630-UR	Red/Clear	10	20	40		20	1.75	2.2	20	100	4	25	4	55	G
	MT630-UG	Green/Clear	10	20	40		20	2.1	2.8	20	5	4	25	4	70	G
	MT630-UY	Yellow/Clear	10	20	40		20	2.1	2.8	20	100	4	25	4	70	G
	MT630-CUR	Red/Clear	15	90	240	560	20	1.75	2.2	20	100	4	25	4	55	G
	MT430-UR	Red/Clear	20	30	100		15	1.75	2.2	20	100	4	25	4	55	H
	MT440-UR	Red/Diffused	30	10	50		15	1.75	2.2	20	100	4	25	4	55	H
	MT430-UG	Green/Clear	20	30	60		15	2.1	2.8	20	5	4	25	4	70	H
	MT440-UG	Green/Diffused	30	10	30		15	2.1	2.8	20	5	4	25	4	70	H
	MT430-UY	Yellow/Clear	20	30	60		15	2.1	2.8	20	100	4	25	4	70	H
	MT440-UY	Yellow/Diffused	30	10	30		15	2.1	2.8	20	100	4	25	4	70	H
	MT250-CUR	Water/Clear	60	22	50		20	1.8	2.2	20	100	4	25	4	55	J
	MT230A-UR ††	Red/Clear	60		250		20	1.8	2.4	20	100	4	50	4	125	J
	MT240A-UR ††	Red/Diffused	75		150		20	1.8	2.4	20	100	4	50	4	125	J
	MT250A-UR ††	Water/Clear	60		400		20	1.8	2.4	20	100	4	50	4	125	J
	MT260A-UR ††	Milky/Diffused	75		150		20	1.8	2.4	20	100	4	50	4	125	J
	MT550-AUR	Water/Clear	80	85	350		20	3.6	4.4	20	100	8	30	8	130	K
	MT2500G-UR †	Water/Clear	8		700		20	1.85	2.2	20	100	4	30	4	75	L
	MT2500E-UR †	Water/Clear	8		500		20	1.85	2.2	20	100	4	30	4	75	L
	MT108L-UR3	Water/Clear	16	1.0mW	3.0mW		20	1.8	2.4	20	100	4	50	4	100	M
	MT1250-UR ††	Water/Clear	26	850	1250		20	1.8	2.4	20	100	4	50	4	125	N
	MT850-UR ††	Water/Clear	26	450	850		20	1.8	2.4	20	100	4	50	4	125	N
	MT450-UR ††	Water/Clear	26	250	450		20	1.8	2.4	20	100	4	50	4	125	N
	MT350A-CUG	Water/Clear	30	63	150	320	20	2.1	2.8	20	5	4	40	4	120	P
	MT300-CUG	Water/Clear	15	100	240	500	20	2.1	2.8	20	5	4	40	4	120	Q
	MT511 ††	Water/Clear	130	1.4mW	2.8mW		20	1.8	2.4	20	100	4	75	4	150	R
	MT85F-UR ★†	Water/Clear	130	1.0mW	2.0mW		20	1.85	2.2	20	10	3	50	3	120	S
	MT631-UR3 *†††	Water/Clear	8	2500	3000		20	1.7	2.4	20	10	5	40	5	110	T

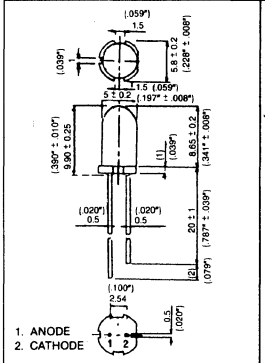
All T_{stg} -30°~100°C All T_{opr} -20°~75°C *T_{stg} -40°~100° †T_{opr} -20°~80°C ††T_{opr} -20°~85°C †††T_{opr} -40°~85°C ★Typical Wavelength is 700nm.

Contact factory for the following: 2:1 brightness binning; sorting for luminous intensity, power output, wavelength, etc.
Typical wavelength for UR devices is 660nm; UG is 565nm; UY is 585nm.

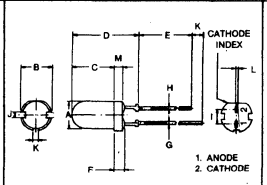
All information in this guide is subject to change without prior notice.

Specialists in Ultra Optics

A - T1¾ ROUND

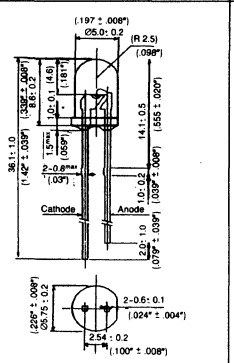


B - T1¾ ROUND

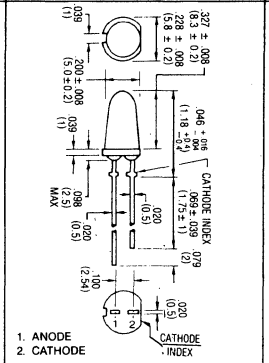


SYMBOL	INCHES	MM
A	0.197 ± 0.008	5 ± 0.2
B	0.228 ± 0.008	5.8 ± 0.2
C	0.315 ± 0.008	8.0 ± 0.2
D	0.453 +0.004 −0.008	11.5 +0.1 −0.2
E	0.689 ± 0.039	17.5 ± 1
F	0.098 MAX	2.5 MAX
G	0.020	0.5
H	0.020	0.5
I	0.100	2.54
J	0.028	0.7
K	0.039	1.0
L	0.020	0.5
M	0.039	1.0

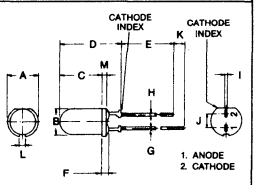
C - T1¾ ROUND



D - T1¾ TAPERED

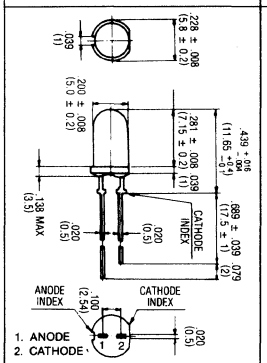


E - T1¾ ROUND

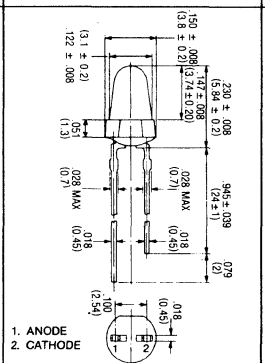


SYMBOL	INCHES	MM
A	0.228 ± 0.008	5.8 ± 0.2
B	0.197 ± 0.008	5.0 ± 0.2
C	0.341 ± 0.008	8.65 ± 0.2
D	0.478 +0.008 −0.004	12.15 +0.2 −0.1
E	0.689 ± 0.039	17.5 ± 1
F	0.098 MAX	2.5 MAX
G	0.020	0.5
H	0.020	0.5
I	0.020	0.5
J	0.100	2.54
K	0.079	2.0
L	0.039	1.0
M	0.039	1.0

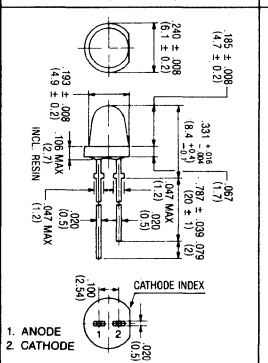
F - T1¾ ROUND



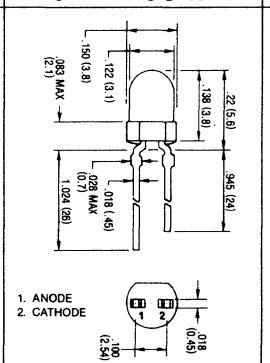
G - T1 TAPERED



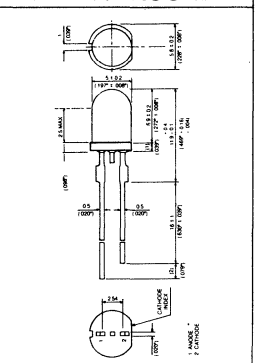
H - T1¾ LOW PROFILE



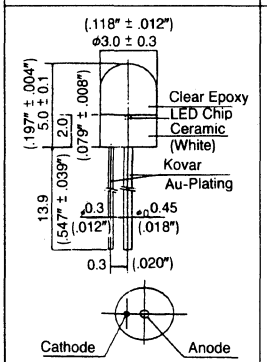
J - T1 ROUND



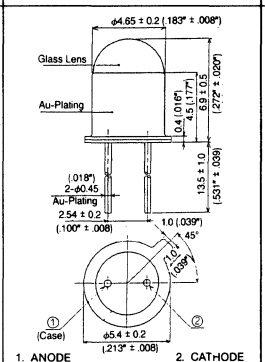
K - T1¾ 2-CHIP ROUND



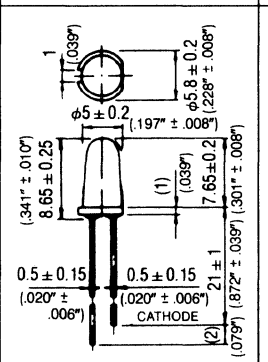
L - 3mm CERAMIC STEM



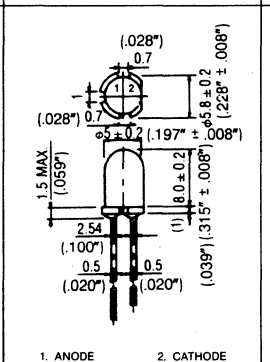
M - TO-18 METAL CAN



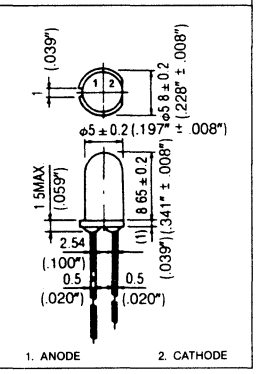
N - T1¾ TAPERED



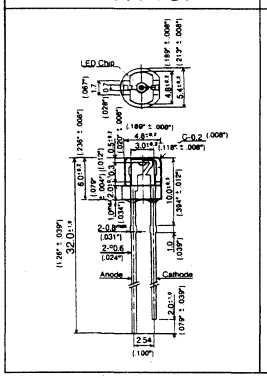
P - T1¾ ROUND



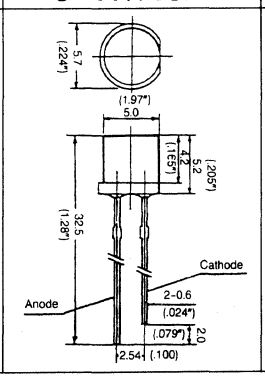
Q - T1¾ ROUND



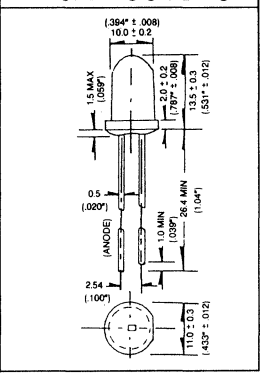
R - T1¾ FLAT TOP



S - T1¾ FLAT TOP



T - 10mm GUMDROP



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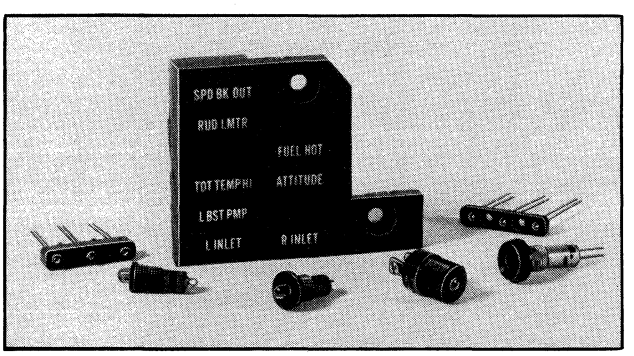

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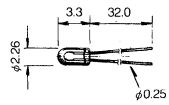
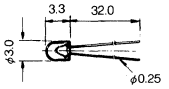
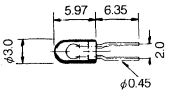
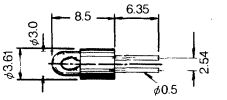
T-3/4 Short Wire Terminal	T-1 Short Wire Terminal	T-1 IBP-G	T-1 Bi-Pin, Type-E
			
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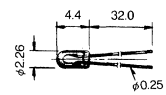	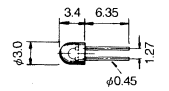	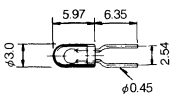	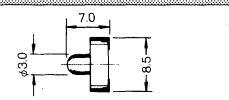
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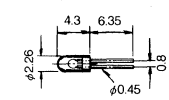	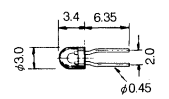	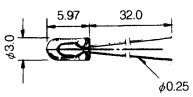	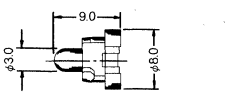
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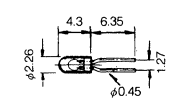	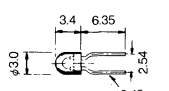	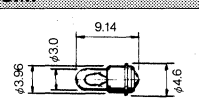	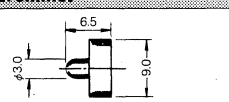
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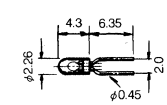	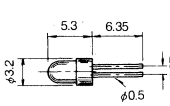	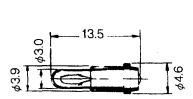	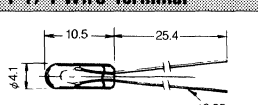
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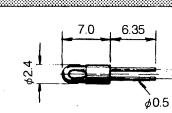
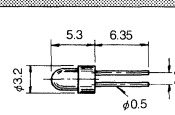
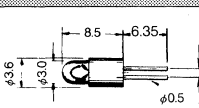
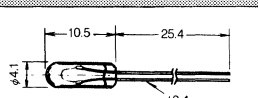
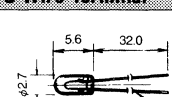
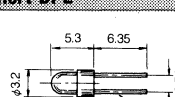
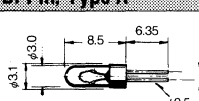
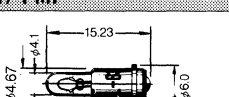
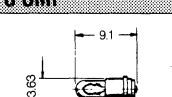
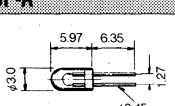
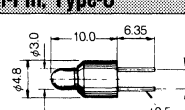
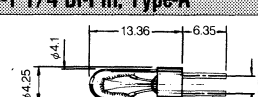
			
T-7/8 Wire Terminal	**T-1 Short BPE**	**T-1 Bi-Pin, Type-A**	**T-1 1/4 MF**
			
T-7/8 SMF	**T-1 IBP-A**	**T-1 Bi-Pin, Type-C**	**T-1 1/4 Bi-Pin, Type-A**
			

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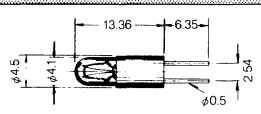
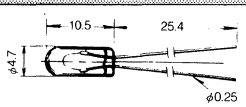
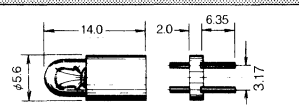
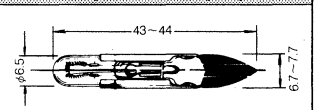
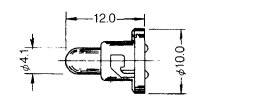
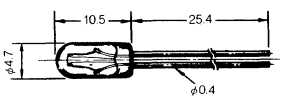
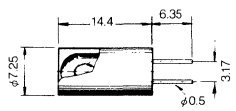
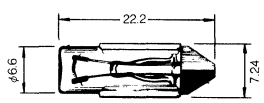
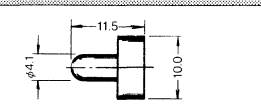
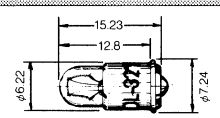
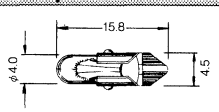
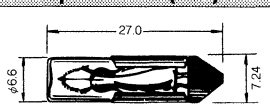
T-1 1/4 Bi-Pin, Type-E	T-1 3/4 Wire Terminal	T-1 3/4 BPR	T-6.8 Telephone Slide (JIS)
			
T-1 1/4 Neowedge	**T-1 3/4 IBP**	**T-1 3/4 BPS**	**T-2 Telephone Slide (ESB)**
			
T-1 1/4 Grommet	**T-1 3/4 MF**	**T-4.5 Telephone Slide**	**T-2 Telephone Slide (PCB)**
			
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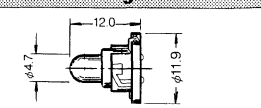
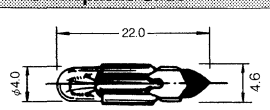
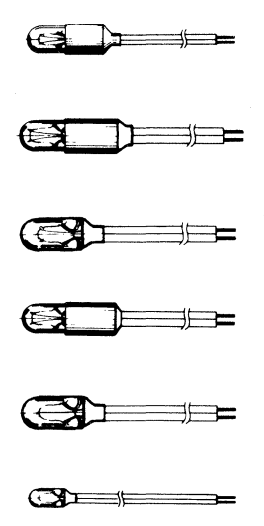
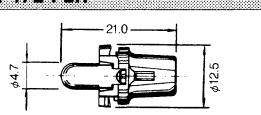
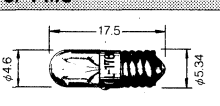
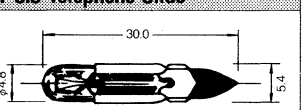
			
T-1 1/2 PBA	**T-1 3/4 MS**	**T-5.5 Telephone Slide**	
			
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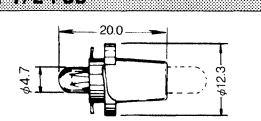	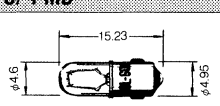	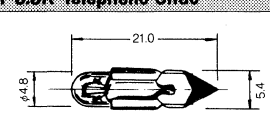	
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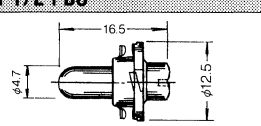
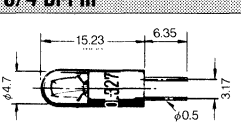
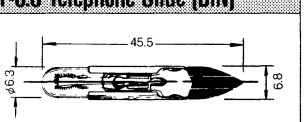
			

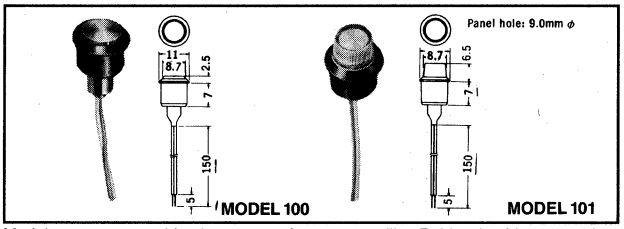
Unit in mm

OSHINO ELECTRIC LAMP WORKS, LTD.
2-5-2, Minami-Shinagawa, Shinagawa-ku, Tokyo, 140 Japan
Tel: 03-471-8548 Facsimile: 03-450-3939 Telex: 242-2117

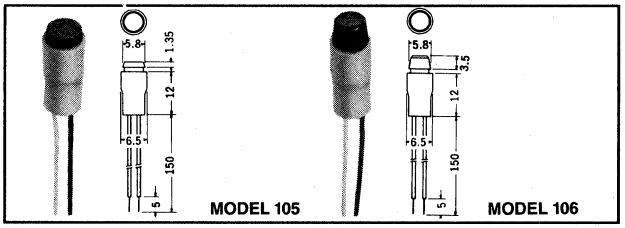
WAMCO, INC.
11555-A Coley River Circle, Fountain Valley, California 92708-4272
Tel: 714-545-5560 Facsimile: 714-545-6093 Telex: 678459 WAMCO INC FNVY

IMLEC INTER-MARKET INCORPORATED
1946 LEHIGH AVENUE, GLENVIEW, ILLINOIS 60025 • (312) 729-5330 • FAX (312) 729-4849

MODULAR INDICATORS

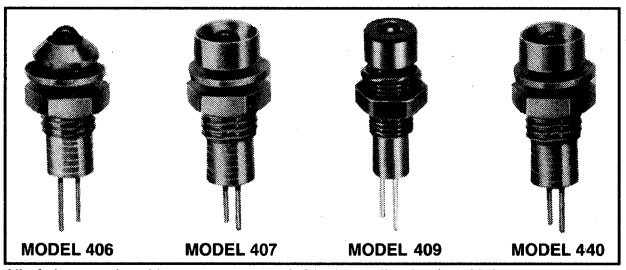


Modular concept provides low cost and great versatility. Rubber bushing snaps into 9mm panel cut out. Lens then snaps into bushing from front while light source fits in from behind.



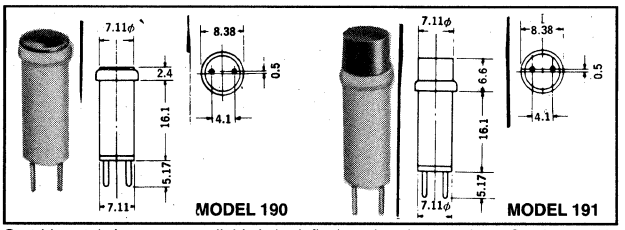
Miniature modular concept requires only 5mm panel hole. They are installed by pressing the lens through the panel from the front into the rubber bushing containing the lamp on the back.

SOLID STATE INDICATORS



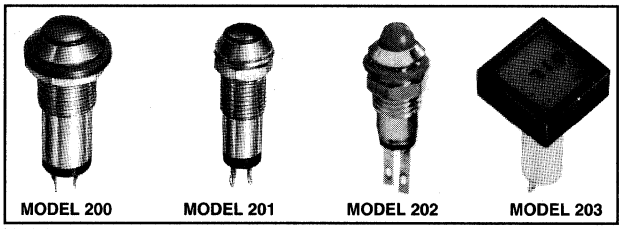
All of chrome plated brass except 409 is black anodized only, with low current LED lamp.

CARTRIDGE LAMPS



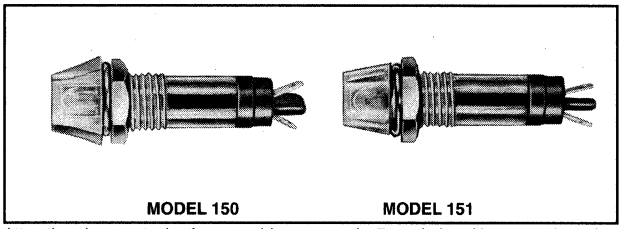
Cartridge style lamps are available in both flush and top hat type lens. Can be used in place of similar types from other manufacturers. Cartridge Lamp holders are also available as black or silver.

INCANDESCENT INDICATORS



Model 200 is rugged chrome plated brass with long life T1 3/4 lamp. Model 201 is smaller version of 200 above. Model 202 is chrome plated brass with removable lens for lamp replacement. Model 203 is designed to accommodate custom legends and is front relampable.

UNIVERSAL INDICATORS



Attractive, low cost plastic assembly, mounts in 7mm hole with nut and washer supplied. Square or round in a variety of light sources and colors.

THUMBWHEEL SWITCHES

MODEL II IMLEC INDEXER PUSHBUTTON FRONT MOUNT The Imlec Indexer is a bi-directional push indexing front mount switch, 5/16" in width. Identical in size to our popular MF switches. With snap together banking and snap-in panel mounting. Pushbuttons above and below the legend allow the user to add or subtract from the count.

These 10- or 16-position switches are available in all popular codes.

MODEL MI MINI INDEXER PUSHBUTTON FRONT MOUNT The Mini Indexer is a bi-directional push indexing front mount switch. 0.30" in width. Similar to our Imlec Indexer but smaller in size. Features snap together banking and snap-in panel mounting. Pushbuttons above and below the legend allow the user to add or subtract from the count.

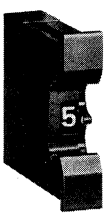
Available in most popular 10-position codes.

MODEL MF MINIATURE FRONT MOUNT The MF is our most popular, low cost, 5/16" wide Thumbwheel Switch. Slim, attractive, snap-in panel mounting requires no panel mounting hardware.

Available in all popular 10- and 16-position codes. Matte black finish on high impact moldings, with white legend on black wheel standard.

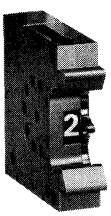
MODEL TR THIN REAR MOUNT For applications that require a lot of switch in a small space, these 5/16" wide TR switches are ideal. Rear mount counterpart to our popular MF front mount switches.

Available in most 10-position codes including Decimal, BCD, BCD plus Complement and Complement only.



MODEL IF INTERMEDIATE FRONT MOUNT A rugged front mount switch with large digits, 1/2" wide module. Snap-in front mounting hardware. Available in most popular 10- and 16-position codes.

Matte black finish with white legends on black wheel standard. Gloss finish, other wheel colors and legends available.

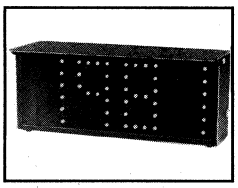


MODEL IR INTERMEDIATE REAR MOUNT Rugged rear mount counterpart to our IF model, with large readable digits, 1/2" wide module. Available in most popular 10- and 16-position codes.

Matte black finish with white legends on black wheel standard. Gray bodies, gloss finish, other wheel colors and legends available.

MODEL MR MINIATURE REAR MOUNT Popular rear mount switch, 1/2" wide module but lower profile than IR model. Available in matte black in most popular 10-position codes including Decimal, BCD, and BCD plus Complements.

Contact us today for free catalogs, including complete specifications and ordering information. Your Fax request will be handled same day.



DIGITAL COUNTER DCL300

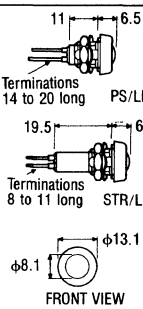
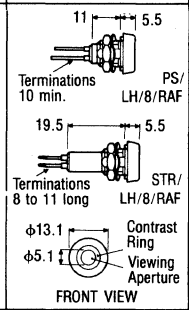
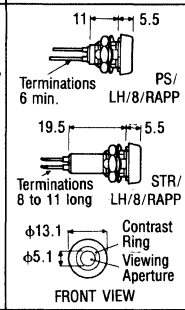
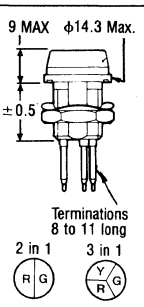
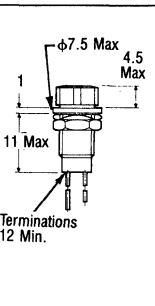
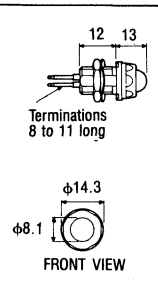
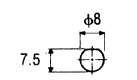
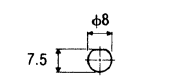
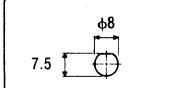
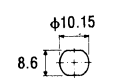
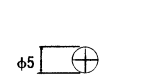
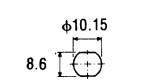
The Model DCL300 Digital Counter has four three-inch high digits composed of 18 individual LEDs. Provides exceptional visibility to 60 feet even under high overhead lighting conditions. Accepts your switch closure through miniature jack provided to count up to 9999.
Ideal for any counting applications where results need to be seen from a distance. Eliminates need to be within several feet of counter to monitor production. Creates competition between similar assembly lines to improve output.
Incandescent styles with 4, 6, 9, and 12 inch digit heights to accept BCD or analog input also available.

OXLEY SEALED MILITARY & PROFESSIONAL LED INDICATOR LAMPS

With Sunlight Viewability, NVG Compatibility, EMC, and Secure Lighting Features

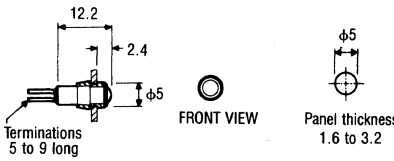
Approved for MILITARY APPLICATIONS to DESC Selected Item Drawings 85122 and 87019

(See Oxley in Volume B Product Section 2440, MIL COMPONENTS, Page B•1025)

Series		STR/LH/8	STR/LH/8/RAF	STR/LH/8/RAPP	2/STR/LH23/10 3/STR/LH23/10	OXL/MIL/50	STR/LH23/10/—
	Panel and front sealing	PS/LH/8	PS/LH/8/RAF	PS/LH/8/RAPP			
Outline Dimensions (mm)							
Mounting Details (mm)		 Panel thickness 3 max.	 Panel thickness 3 max.	 Panel thickness 3 max.	 Panel thickness 6.5 max.	 Panel thickness 1 to 4	 Panel thickness 6.5 max.
Special Features		Plano-convex lens to provide even illumination over a large area of emission. Special functions available:— Low current (Type—/LC) Flashing (Type—/5/Z) Bi-color (Type 2/—) Integral resistor types for operation from 5, 12, 15, 24 or 28Vd.c. supplies available.	Sunlight viewable up to 100,000 lux. Focused light source for optimum forward viewing. Contrast ring. Optional anti-reflection coating. NVIS/NVG compatible types available.	Sunlight viewable up to 100,000 lux. Pin-point light source for very wide angle viewing. Contrast ring. Optional anti-reflection coating. NVIS/NVG compatible types available.	Multicoloured 2 in 1 and 3 in 1 lamps with segmented display areas. Standard segment colors shown in front views above 2 in 1 lamp has two LED's independently terminated. 3 in 1 has common cathode configuration as standard.	Miniature Lamps, high brightness LEDs (100% screened and burnt-in) in a 7.5 mm diameter aluminum package, similar in construction to the STR/-series lamps, MIL/50 fits a 5mm diameter hole for applications where panel space is limited.	Replacement for obsolescent incandescent types. Integral current limiting resistor and protection diode for operating from 5, 12, 15, 24 or 28 V d.c. supplies. Domed lens fitted as standard to give wide viewing angle.
Electro-magnetic Screening Mesh (Type-/-/-/SES)		Option on STR/LH/8 only	Option on STR/LH/8/RAF only	Option on STR/LH/8/RAPP only	Not Available	Available	Not Available
Standard Features		Rugged construction with sealed glass lenses. Panel sealing to a depth of 20 meters of sea water. High brightness LED's. 100% burnt in to optimize reliability. Black anodized shroud to enhance visual appearance, all metal construction for grounding when panel mounted. Nut mounted. STR/-types have sealed rear terminations. Pigtail terminations available for STR/-types.					

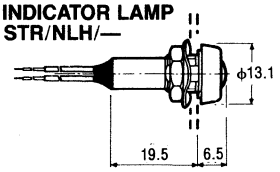
OTHER OXLEY DISPLAY PRODUCTS

MINIATURE LED INDICATOR LAMP, TYPE SSI/5



Barb® Cone-Lock self locking mounting technique for rapid assembly. SSI/5 Black anodized body version available for optimum contrast.

HIGH BRIGHTNESS SEALED NEON INDICATOR LAMP TYPE: STR/NLH/—



Similar packaging to above LED types, these lamps incorporate integral resistor for 110 or 240 Vac. This rugged military style panel seal indicator incorporates a glass lens and can, if required, be fitted with an Electro-magnetic screening mesh.

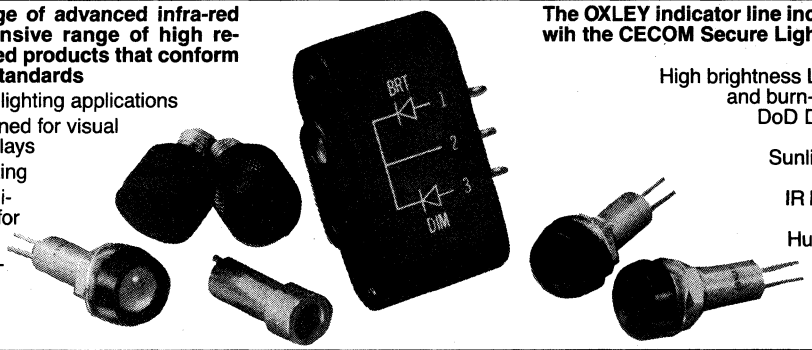
OXLEY SOLID STATE ELAPSED TIME INDICATORS, EVENT COUNTERS AND EQUIPMENT CONDITION MONITORS

FEATURES:
- Non-Volatile Semiconductor Memory
- Accurate Quartz Crystal Timing
- Military Specifications

Oxley meets the challenge of advanced infra-red technology with an extensive range of high reliability and quality assured products that conform to exacting U.S. military standards

- NVIS compatible cockpit lighting applications
- Color discrimination retained for visual warning and caution displays
- NVG Visible Covert Lighting
- Spectoradiometrically calibrated infra-red emitters for avionic formation lights.
- Custom NVG/NVIS Compatible Lighting

NVIS/NVG COMPATIBLE LIGHTING



The OXLEY indicator line includes parts complying wih the CECOM Secure Lighting Program.

High brightness LEDs 100% screening and burn-in to MIL-S-19500 US DoD DESC Selected items. ■

Sunlight readable displays ■

IR Blocking Optical Filters ■

Human factor engineered ■

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OXLEY

SHARP®
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LED Lamps

ϕ3 Cylinder LED Lamps

Lens type	Lead frame	Red		Green	Green (HL)	Yellow-Green	Yellow-green (HL)	Lemon Yellow	Yellow	Sunset Orange
		GaP	GaAsP on GaP	GaP	GaP	GaP	GaP	GaP	GaAsP on GaP	GaAsP on GaP
Colored diffusion	Reflective long	GL3PR8	GL3HD8	GL3PG8	GL3KG8	GL3NG8	GL3EG8	GL3PY8	GL3HY8	GL3HS8
Milky diffusion	Reflective long		GL3HD18		GL3KG18					
Colored trans	Reflective long	GL3PR43	GL3HD43	GL3PG43	GL3KG43	GL3NG43	GL3EG43	GL3PY43	GL3HY43	GL3HS43
Colorless trans	Reflective long	GL3PR44	GL3HD44	GL3PG44	GL3KG44	GL3NG44	GL3EG44	GL3PY44	GL3HY44	GL3HS44
Colored trans	Reflective long	GL3PR47	GL3HD47	GL3PG47	GL3KG47	GL3NG47	GL3EG47	GL3PY47	GL3HY47	GL3HS47

ϕ4 Cylinder LED Lamps

Lens type	Lead frame	Red		Green	Yellow-green	Yellow-green (HL)	Yellow	Sunset orange
		GaP	GaAsP on GaP	GaP	GaP	GaP	GaAsP on GaP	GaAsP on GaP
Colored diffusion	Reflective Long	GL4PR8	GL4HD8	GL4PG8	GL4NG8	GL4EG8	GL4HY8	GL4HS8

ϕ5 Cylinder LED Lamps

Lens type	Lead frame	Red		Green	Green (HL)	Yellow-Green	Yellow-green (HL)	Lemon Yellow	Yellow	Sunset Orange
		GaP	GaAsP on GaP	GaP	GaP	GaP	GaP	GaP	GaAsP on GaP	GaAsP on GaP
Colored diffusion	Reflective long	GL5PR8	GL5HD8	GL5PG8	GL5KG8	GL5NG8	GL5EG8	GL5PY8	GL5HY8	GL5HS8
Colored trans	Reflective long	GL5PR40	GL5HD40	GL5PG40		GL5NG40	GL5EG40		GL5HY40	GL5HS40
Colored trans	Reflective long	GL5PR41	GL5HD41	GL5PG41	GL5KG41	GL5NG41	GL5EG41	GL5PY41	GL5HY41	GL5HS41
Colored trans	Reflective long	GL5PR42	GL5HD42	GL5PG42	GL5KG42	GL5NG42	GL5EG42	GL5PY42	GL5HY42	GL5HS42
Colorless trans	Reflective long		GL5HD43	GL5PG43		GL5NG43	GL5EG43		GL5HY43	GL5HS43
Colorless trans	Reflective long	GL5PR44	GL5HD44	GL5PG44	GL5KG44	GL5NG44	GL5EG44	GL5PY44	GL5HY44	GL5HS44
Colorless trans	Reflective long	GL5PR45	GL5HD45	GL5PG45	GL5KG45	GL5NG45	GL5EG45	GL5PY45	GL5HY45	GL5HS45
Colorless trans	Reflective long	GL5PR46			GL5KG46					
Colored trans	Reflective long	GL5PR47	GL5HD47	GL5PG47	GL5KG47	GL5NG47	GL5EG47	GL5PY47	GL5HY47	GL5HS47
Colored trans	Reflective long						GL5EG48			
Colorless trans	Reflective long						GL5EG49			

Convex LED Lamps

Radiation shape (mm)	Lens type	Lead frame	Red		Green	Yellow-green	Yellow-green (HL)	Yellow	Sunset orange
			GaP	GaAsP on GaP	GaP	GaP	GaP	GaAsP on GaP	GaAsP on GaP
ϕ1.6	Colored diffusion	Standard	GL2PR7			GL2NG7		GL2HY7	
	Colored diffusion	Standard	GL2PR9			GL2NG9		GL2HY9	
ϕ2	Colored diffusion	Standard	GL2PR1		GL2PG1	GL2NG1		GL2HY1	
	Colored diffusion	Standard long	GL2PR2						
	Colored diffusion	Reflective long	GL2PR6	GL2HD6	GL2PG6	GL2NG6	GL2EG6	GL2HY6	GL2HS6

Arch LED Lamps

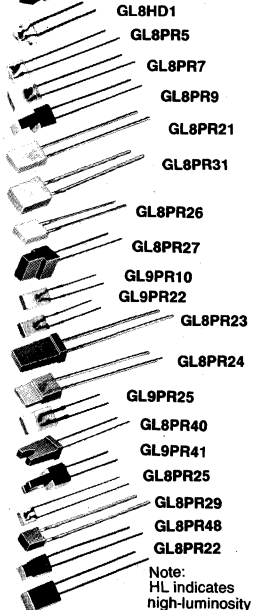
Radiation shape (mm)	Lens type	Lead frame	Red		Green	Yellow-green	Yellow-green (HL)	Yellow	Sunset orange
			GaP	GaAsP on GaP	GaP	GaP	GaP	GaAsP on GaP	GaAsP on GaP
2.5 × 5.0	Colored diffusion	Reflective long	GL8PR2	GL8HD2	GL8PG2	GL8NG2	GL8EG2	GL8HY2	GL8HS2

Triangle LED Lamps

Radiation shape (mm)	Lens type	Lead frame	Red		Green	Green (HL)	Yellow-green	Yellow-green (HL)	Yellow	Lemon yellow	Sunset orange
			GaP	GaAsP on GaP	GaP	GaP	GaP	GaP	GaAsP on GaP	GaP	GaAsP on GaP
Equilateral triangle (Side: 5.6)	Colored diffusion	Reflective long	GL9PR3		GL9PG3		GL9NG3	GL9EG3	GL9HY3		
Equilateral triangle (Side: 3.0)	Colored diffusion	Reflective long	GL8PR49	GL8HD49	GL8PG49		GL8NG49	GL8EG49	GL8HY49		GL8HS49
Isosceles triangle (Base: 3.0 Height: 4.5)	Colored diffusion	Reflective long	GL8PR28	GL8HD28	GL8PG28	GL8KG28	GL8NG28	GL8EG28	GL8HY28	GL8PY28	GL8HS28

Rectangle LED Lamps

Radiation shape (mm)	Lens type	Lead frame	Red		Green	Green (HL)	Yellow-green	Yellow-green (HL)	Yellow	Lemon yellow	Sunset orange
			GaP	GaAsP on GaP	GaP	GaP	GaP	GaP	GaAsP on GaP	GaP	GaAsP on GaP
1.5 × 2.8	Colored trans	Reflective standard		GL8HD1	GL8PG1		GL8NG1		GL8HY1		
1.9 × 3.9	Colored trans	Reflective long	GL8PR5	GL8HD5	GL8PG5		GL8NG5	GL8EG5	GL8HY5		GL8HS5
2.5 × 5.0	Colored diffusion	Reflective long	GL8PR7	GL8HD7	GL8PG7		GL8NG7	GL8EG7	GL8HY7		GL8HS7
2.5 × 6.0	Colored diffusion	Reflective long	GL8PR9	GL8HD9			GL8NG9	GL8EG9	GL8HY9		GL8HS9
2.0 × 5.0	Colored diffusion	Reflective long	GL8PR21	GL8HD21	GL8PG21	GL8KG21	GL8NG21	GL8EG21	GL8HY21	GL8PY21	GL8HS21
	Milky diffusion	Reflective long	GL8PR31		GL8PG31				GL8HY31		
	Colored diffusion	Reflective long	GL8PR26	GL8HD26	GL8PG26		GL8NG26	GL8EG26	GL8HY26		GL8HS26
1.2 × 5.9	Colored diffusion	Reflective long	GL8PR27	GL8HD27	GL8PG27		GL8NG27	GL8EG27	GL8HY27		GL8HS27
1.5 × 3.9	Colored diffusion	Standard	GL9PR10	GL9HD10			GL9NG10	GL9EG10	GL9HY10		
1.8 × 3.9	Colored diffusion	Standard	GL9PR22	GL9HD22			GL9NG22	GL9EG22	GL9HY22		
2.0 × 4.5	Colored diffusion	Reflective long	GL8PR23	GL8HD23	GL8PG23		GL8NG23	GL8EG23	GL8HY23		GL8HS23
1.0 × 5.0	Colored diffusion	Reflective long	GL8PR24	GL8HD24	GL8PG24	GL8KG24	GL8NG24	GL8EG24	GL8HY24	GL8PY24	GL8HS24
1.5 × 4.5	Colored diffusion	Standard	GL9PR25				GL9NG25	GL9EG25	GL9HY25		
2.0 × 1.5 × 2pcs	Colored diffusion	Reflective long	GL8PR40	GL8HD40	GL8PG40	GL8KG40	GL8NG40	GL8EG40	GL8HY40		GL8HS40
1.9 × 1.9 × 2pcs	Colored diffusion	Reflective standard	GL9PR41				GL9NG41		GL9HY41		
2.0 × 3.2	Colored trans	Reflective long	GL8PR25	GL8HD25	GL8PG25	GL8KG25	GL8NG25	GL8EG25	GL8HY25	GL8PY25	GL8HS25
	Colored diffusion	Reflective long	GL8PR29								
3.0 × 3.0	Colored diffusion	Reflective long	GL8PR48	GL8HD48	GL8PG48		GL8NG48	GL8EG48	GL8HY48		GL8HS48
5.0 × 5.0	Colored diffusion	Reflective long	GL8PR22	GL8HD22	GL8PG22		GL8NG22	GL8EG22	GL8HY22	GL8PY22	GL8HS22



Note:
HL indicates high-luminosity

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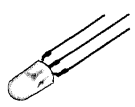
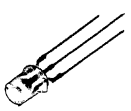
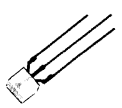
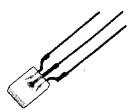
Dichromatic LED Lamps/High-luminosity LED Lamps/ Super-luminosity LED Lamps/Mini-mold Lamps

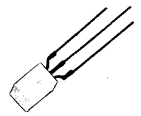
Dichromatic LED Lamps

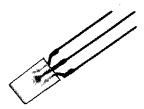

GL5NP5 SERIES


GL5NP27 SERIES


GL8NP5 SERIES


GL9NP2 SERIES


GL9NP4 SERIES


GL9NP24 SERIES

Note: HL indicates high-luminosity

Appearance	Radiation shape	Lens type	Yellow-green + Red	Yellow-green + Red	Yellow-green (HL) + Red	Yellow-green (HL) + Red	Yellow-green (HL) + Yellow	Yellow + Red	Red + Green
			GaP + GaP	GaP + GaAsP on GaP	GaP + GaAsP on GaP	GaP + GaP	GaP + GaAsP on GaP	GaAsP on GaP + GaP	GaP + GaP
Cylinder	5	Milky diffusion	GL5NP5	GL5ND5	GL5ED5	GL5EP5		GL5HP5	GL5RG5
		Colorless trans.	GL5NP27	GL5ND27	GL5ED27	GL5EP27		GL5HP27	
Rectangle	1.9×3.9	Milky diffusion	GL8NP5	GL8ND5	GL8ED5			GL8HP5	
	2.0×5.0	Milky diffusion	GL9NP2	GL9ND2	GL9ED2		GL9EH2	GL9HP2	
	5.0×5.0	Milky diffusion	GL9NP4	GL9ND4	GL9ED4			GL9HP4	
	1.0×5.0	Milky diffusion	GL9NP24	GL9ND24	GL9ED24			GL9HP24	

Notes: Lead Frame — Reflective long

High-luminosity LED Lamps

Model No.	Radiation shape (mm)	Radiation color	Radiation material	Lens type	Absolute maximum ratings				Electro-optical characteristics				
					I_F (mA)	V_R (V)	P (mW)	Topr (°C)	Iv (mcd) MIN.	Iv (mcd) TYP.	V_F (V) TYP.	V_F (V) MAX.	I_F (mA)
GL3TR8	3(Cylinder)	Red	GaA/As on GaAs	Colored diffusion	50	5	110	−25 ~ +85	30	60	1.75	2.20	20
GL3TR43	3(Cylinder)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	10	20	1.75	2.20	20
GL3TR44	3(Cylinder)	Red	GaA/As on GaAs	Colorless trans.	50	5	110	−25 ~ +85	45	110	1.75	2.20	20
GL3TR47	3(Inverse cone)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	2.5	5.0	1.75	2.20	20
GL5TR8	5(Cylinder)	Red	GaA/As on GaAs	Colored diffusion	50	5	110	−25 ~ +85	40	80	1.75	2.20	20
GL5TR43	5(Cylinder)	Red	GaA/As on GaAs	Colorless trans.	50	5	110	−25 ~ +85	200	500	1.75	2.20	20
GL5TR47	5(Inverse cone)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	2	4	1.75	2.20	20
GL3LR8	3(Cylinder)	Red	GaA/As on GaAs	Colored diffusion	50	5	110	−25 ~ +85	70	140	1.75	2.20	20
GL3LR43	3(Cylinder)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	20	40	1.75	2.20	20
GL3LR47	3(Inverse cone)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	7	14	1.75	2.20	20
GL5LR8	5(Cylinder)	Red	GaA/As on GaAs	Colored diffusion	50	5	110	−25 ~ +85	100	200	1.75	2.20	20
GL5LR40	5(Cylinder)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	600	1200	1.75	2.20	20
GL5LR41	5(Cylinder)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	170	340	1.75	2.20	20
GL5LR42	5(Cylinder)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	80	160	1.75	2.20	20
GL5LR43	5(Cylinder)	Red	GaA/As on GaAs	Colorless trans.	50	5	110	−25 ~ +85	600	1200	1.75	2.20	20
GL5LR44	5(Cylinder)	Red	GaA/As on GaAs	Colorless trans.	50	5	110	−25 ~ +85	170	340	1.75	2.20	20
GL5LR47	5(Inverse cone)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	5	12	1.75	2.20	20
GL5LR48	5(Cylinder)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	170	340	1.75	2.20	20
GL5LR49	5(Cylinder)	Red	GaA/As on GaAs	Colorless trans.	50	5	110	−25 ~ +85	170	340	1.75	2.20	20
GL8LR2	Rectangle	Red	GaA/As on GaAs	Colored diffusion	50	5	110	−25 ~ +85	25	50	1.75	2.20	20

Notes: Lead Frame — Reflective long

Super-luminosity LED Lamps

Model No.	Radiation shape (mm)	Radiation color	Radiation material	Lens type	Absolute maximum ratings				Electro-optical characteristics				
					I_F (mA)	V_R (V)	P (mW)	Topr (°C)	Iv (mcd) MIN.	Iv (mcd) TYP.	V_F (V) TYP.	V_F (V) MAX.	I_F (mA)
GL5UR46	5(Cylinder)	Red	GaA/As on GaA/As	Colored trans.	30	4	75	−25 ~ +85	250	400	1.85	2.50	20
GL5UR2K	5(Cylinder)	Red	GaA/As on GaA/As	Colored trans.	30	4	75	−25 ~ +85	1400	2000	1.85	2.50	20
GL5UR2K1	5(Cylinder)	Red	GaA/As on GaA/As	Colorless trans.	30	4	75	−25 ~ +85	1400	2000	1.85	2.50	20
GL5UR3K	5(Cylinder)	Red	GaA/As on GaA/As	Colored trans.	30	4	75	−25 ~ +85	2400	3000	1.85	2.50	20
GL5UR3K1	5(Cylinder)	Red	GaA/As on GaA/As	Colorless trans.	30	4	75	−25 ~ +85	2400	3000	1.85	2.50	20
LT9512U	10(Cylinder)	Red	GaA/As on GaA/As	Colorless trans.	30	4	75	−25 ~ +85	4000	5000	1.85	2.50	20

Notes: Lead Frame — Reflective long

LED Mini-mold Lamps

GL1PR11 SERIES

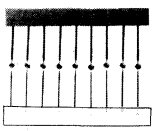
GL1PR21 SERIES

GL1PR111 SERIES

GL1PR112 SERIES

GL1PR211 SERIES

GL1PR212 SERIES


LT1P11A SERIES LT1P21A SERIES

Note: HL indicates high-luminosity

Appearance	Radiation shape (mm)	Lens type	Red		Red (HL)	Green	Yellow-green	Yellow-green (HL)	Yellow	Sunset orange
			GaP	GaAsP on GaP	GaAlAs on GaAs	GaP	GaP	GaP	GaAsP on GaP	GaAsP on GaP
Mini-mold	2	Colored diffusion	GL1PR11	GL1HD11	GL1TR11	GL1PG11	GL1NG11	GL1EG11	GL1HY11	GL1HS11
		Colorless trans.	GL1PR21	GL1HD21	GL1TR21	GL1PG21	GL1NG21	GL1EG21	GL1HY21	GL1HS21
		Colored diffusion	GL1PR111	GL1HD111		GL1PG111	Gl1NG111	GL1EG111	GL1HY111	GL1HS111
		Colored diffusion	GL1PR112	GL1HD112		GL1PG112	GL1NG112	GL1EG112	GL1HY112	GL1HS112
		Colorless trans.	GL1PR211	GL1HD211		GL1PG211	GL1NG211	GL1EG211	GL1HY211	GL1HS211
		Colorless trans.	GL1PR212	GL1HD212		GL1PG212	GL1NG212	GL1EG212	GL1HY212	GL1HS212
		Colored diffusion	LT1P11A*	LT1D11A*	LT1T11A*	LT1G11A*	LT1N11A*	LT1E11A*	LT1H11A*	LT1S11A*
		Colorless trans.	LT1P21A*	LT1D21A*	LT1T21A*	LT1G21A*	LT1N21A*	LT1E21A*	LT1HS1A*	LT1S21A*

*Taping type, Tape width: 38mm, Taping: 2,000pcs/tape

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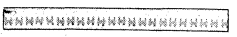
Chip LED Devices/LED Mini Lamps/ Constant Voltage Diodes/ LED Lamps for Light Source/LED Large Lamps

Chip LED Devices

GL1PR51 SERIES

GL1TR52 SERIES

GL1PR53 SERIES


LT1P51A SERIES

Radiation shape (mm)	Lens type	Red		Red (HL)	Green	Yellow-green	Yellow-green (HL)	Yellow	Sunset orange
		GaP	GaAsP on GaP	GaAlAs on GaAs	GaP	GaP	GaP	GaAsP on GaP	GaAsP on GaP
1.5×2.9 ×1.1t	Colored diffusion	GL1PR51	GL1HD51	GL1TR51	GL1PG51	GL1NG51	GL1EG51	GL1HY51	GL1HS51
	Colorless trans.			GL1TR52					
	Milky diffusion	GL1PR53	GL1HD53		GL1PG53	GL1NG53	GL1EG53	GL1HY53	GL1HS53
	Colored diffusion	LT1P51A*	LT1D51A*	LT1T51A*	LT1G51A*	LT1N51A*	LT1E51A*	LT1H51A*	LT1S51A*
	Colorless trans.			LT1T52A*					
	Milky diffusion	LT1P53A*	LT1D53A*		LT1G53A*	LT1N53A*	LT1E53A*	LT1H53A*	LT1S53A*

Chip LED Devices (Dichromatic Radiation Type)

Radiation shape (mm)	Lens type	Yellow-green + Red		Yellow-green (HL) + Red		Yellow-green (HL) + Red (HL)	Yellow + Red	Yellow-green + Yellow
		GaP + GaP	GaP + GaAsP on GaP	GaP + GaAsP on GaP	GaP + GaP	GaP + GaAlAs on GaAs	GaAsP on GaP + GaP	GaP + GaAsP on GaP
1.5×2.9 ×1.1t	Colorless trans.					GL1ET52		
	Milky diffusion	GL1NP53	GL1ND53	GL1ED53	GL1EP53	GL1ET53	GL1HP53	GL1NH53
	Colorless trans.					LT1ET52A*		
	Milky diffusion	LT1NP53A*	LT1ND53A*	LT1ED53A*	LT1EP53A*	LT1ET53A*	LT1HP53A*	LT1NH53A*

*Taping type, Tape width: 8mm, Taping: 3,000pcs/reel

LED Mini Lamps

Specification		Red				Yellow-green		
		GaAsP on GaAs	GaP	Taping type		GaP	Taping type	
General specification			LT8001P	LT8101P*1	LT8201P*2	LT8001N	LT8101N*1	LT8201N*2
Constant voltage diode specification	I_F = 1mA : $V_{F\ MAX.}$ = 1.60V I_F = 10μA : $V_{F\ MIN.}$ = 1.25V	LT8002R*						
	I_F = 1mA : $V_{F\ MAX.}$ = 1.85V I_F = 10μA : $V_{F\ MIN.}$ = 1.55V		LT8002P	LT8102P*1	LT8202P*2	LT8002N	LT8102N*1	LT8202N*2
	I_F = 1mA : $V_{F\ MAX.}$ = 1.90V I_F = 10μA : $V_{F\ MIN.}$ = 1.60V		LT8003P	LT8103P*1	LT8203P*2	LT8003N	LT8103N*1	LT8203N*2

*Non-radiation type *1 Tape width: 64mm *2 Tape width: 38mm Taping: 2,000 pcs/tape

LED Lamps for Light Source

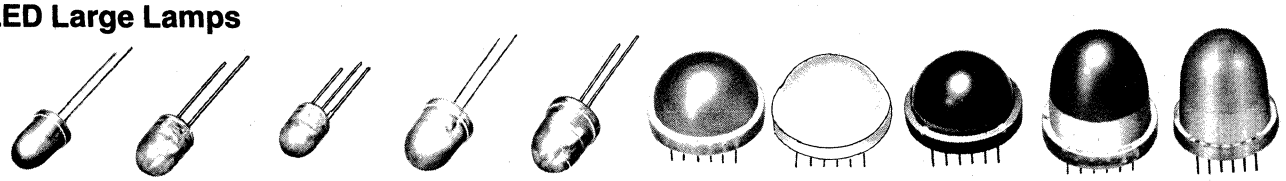
Appearance	Radiation shape (mm)	Lens type	Model No.	Radiation material	Radiation Wavelength
Cylinder	5	Colorless transparency	LT9800D	GaAsP on GaP	635nm
			LT9800E	GaP	565nm
			LT9800H	GaAsP on GaP	585nm
			LT9800L	GaAlAs on GaAs	660nm
			LT9800V		700nm

Constant Voltage Diodes

Specification	GaAsP on GaAs	GaP
I_F = 1mA : $V_{F\ MAX.}$ = 1.60V I_F = 10μA : $V_{F\ MIN.}$ = 1.25V	LT8500R	
I_F = 1mA : $V_{F\ MAX.}$ = 1.76V I_F = 10μA : $V_{F\ MIN.}$ = 1.55V		LT8500P

Note: Non-transmissive type (black resin)

LED Large Lamps


LT9507D SERIES LT9550L SERIES LT9550EL SERIES LT9512D SERIES LT9560L SERIES LT9520D SERIES LT9521D SERIES LT9525D SERIES LT9526D SERIES LT9527U

Radiation shape (mm)	Lens type	Red (HL)			Red	Yellow	Yellow-green (HL)	Yellow-green (HL) + Red (HL)	Yellow-green + Red
		GaAlAs on GaAlAs	GaAlAs on GaAs	GaAlAs on GaAs	GaAaP on GaP	GaAsP on GaP	GaP	GaP + GaAlAs on GaAs	GaP + GaAsP on GaP
ϕ7.5	Colored diffusion		LT9552U		LT9507D	LT9507H	LT9507E		
	Colorless trans.		LT9550L				LT9550E	LT9550EL	LT9550ED
ϕ10	Colored diffusion	LT9562U			LT9512D	LT9512H	LT9512E		
	Colorless trans.	LT9512U	LT9560L	LT9560T					
ϕ20	Colored diffusion				LT9520D	LT9520H	LT9520E		
	Milky diffusion				LT9521D	LT9521H	LT9521E		
	Colored diffusion				LT9525D	LT9525H	LT9525E		
	Colored diffusion				LT9526D	LT9526H	LT9526E		
	Milky diffusion	LT9527U							

Note: HL indicates high-luminosity

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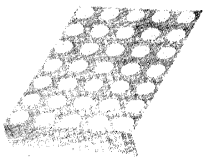
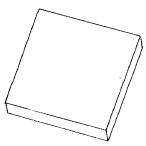
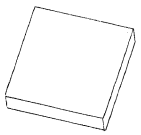
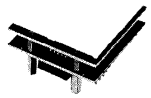
SHARP Optoelectronics Dot Matrix LEDs/Dot Matrix LED Units

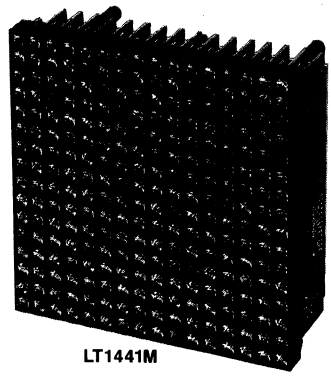
LT5101P series


LT5103D series


LT5105D series


LT5107D series


LT1401E series


LT1441M

Dot Matrix LEDs

Type	Character height (inch)	Common pins	Red		Yellow-Green	Yellow-Green (HL)	Yellow	Yellow-Green (HL) + Red	Orange
			GaP	GaAsP on GaP	GaP	GaP	GaAsP on GaP	GaP + GaAsP on GaP	GaP
5 × 7 dot matrix	0.33	Anode	LT5001P		LT5001N				
		Cathode	LT5002P		LT5002N				
	1.08	Anode	LT5101P	LT5101D		LT5101E			
		Cathode	LT5102P	LT5102D		LT5102E			
	1.8	Anode		LT5103D		LT5103E			
		Cathode		LT5104D		LT5104E			
8 × 8 dot matrix	1.05	Anode		LT5105D		LT5105E	LT5105H	LT5007ED	
		Cathode		LT5106D		LT5106E	LT5106H	LT5008ED	
	1.1	Anode							LT5007S
		Cathode							LT5008S
4 × 4 dot matrix	0.9	Anode		LT5107D		LT5107E	LT5107H	LT5107ED	
		Cathode		LT5108D		LT5108E	LT5108H	LT5108ED	
16 × 16 dot matrix	1.48	Anode							LT5005S

Dot Matrix LED Units

Type	Construct of Dots	Dot Pitch (mm)	Size (mm)	Color	Power Supply	Duty Cycle
LT1410D	16 × 16	3.8	60 × 60	Red	5V 1.6A	1/8
LT1401S	16 × 16	3.8	60 × 60	Sunset Orange	5V 1.6A	1/8
LT1401E	16 × 16	3.8	60 × 60	Green	5V 1.6A	1/8
LT1421ED	16 × 16	7.5	120 × 120	Green-Red	5V 3.2A	1/16
LT1450ED*	16 × 16	4	64 × 64	Green-Red	5V	1/16
LT1460ED*	16 × 16	6	96 × 96	Green-Red	5V	1/16
LT1441M	16 × 16	10	160 × 160	Green-Red	±5V 6.4A	Static

*Soon Available

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FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1404, **B**•1090, **C**•1119 **D**•1156
AC Power Supplies, Product Selection Guide ..... **D**•2156
ASCII Code ..... **D**•1080
Batteries, Product Selection Guide .... **D**•1447
Batteries & Fuel Cells, Characteristics ..... **D**•1450
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide . **A**•1002
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1197
Conductors, Maximum Current Capacity of Copper & Aluminum ... **A**•2272, **C**•1316
Connectors, Miniglossary ..... **C**•1271
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1339
DC Power Supplies, Product Selection Guide ..... **D**•1537
Delay Lines, Product Selection Guide ..... **A**•1503
Dielectrics, Thermal Conductivity ..... **B**•1916
Discrete Semiconductors, Product Selection Guide ..... **A**•2154
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1041
EBCDIC Code ..... **D**•1086
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Fiber Optics, Miniglossary ..... **B**•1185
Fiber Optics, Product Selection Guide ..... B•1204
Filters, Power, Product Selection Guide ..... **A**•1642
Filters, Signal, Product Selection Guide ..... **A**•1683
IC Master ..... **A**•1740
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1210
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Keyboards & Keypads, Product Selection Guide ..... **B**•1854
Lamps, Lights, & Indicators, Product Selection Guide ..... **B**•1126
Logofinder & Trademark Directories ... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1776
Military Qualified Products List ..... **B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1221
Opto Semiconductors, Miniglossary ..... **A**•2169
Oscilloscopes, Product Selection Guide ..... **D**•1426
Panel Hardware, Product Selection Guide ..... **C**•1583
Panel Meters, Analog & Digital, Product Selection Guide ..... **D**•1376
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Power Supplies, Miniglossary ..... A•2276, **D**•1541
Power Supplies, AC, Product Selection Guide ..... **D**•2156
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Relays, Product Selection Guide ..... **B**•1411
Resistor Color Codes ..... **A**•1952
Resistors, Product Selection Guide ... **A**•1867
Servo Components, Miniglossary ..... **B**•1266
SI Units, Basic Guide To, ... **A**•1434, **B**•1472, **C**•1692, **D**•1386
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Trademark & Logofinder Directories ... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1928
Transformers, Product Selection Guide ..... **A**•2215
Voltage Drop Nomograph ..... **A**•2262, **C**•1469, **C**•1960 **D**•1718
Wire & Cable, Product Selection Guide ..... **C**•1755
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1343, **C**•1759

MINIGLOSSARY FIBER OPTICS

Acceptance Angle
The maximum angle within which light will be accepted by an element such as a detector or waveguide. In the latter, it is quantified as half the vertex angle of the cone within which optical power may be coupled into bound modes of a fiber.

Aligned Bundle
An assembly of fibers in which the coordinates of each fiber are the same at the two ends of the bundle, also called *Coherent Bundle*.

Bend Radius
The radius of curvature that an optical fiber can bend without breaking.

Bundle
Multiple optical fibers in a single housing used to transmit light or images.

Cladding
The low refractive index material that surrounds the core of the fiber to contain core light while protecting against surface contaminant scattering. In all-glass fibers, the cladding is glass.

Effective Numerical Aperture
The real numerical aperture of a fiber when the computed NA is not valid due to a change in the glass indices during the drawing and fusion process.

Fiber Bundle
A rigid, or flexible, concentrated assembly of glass or plastic fibers used to transmit optical images or light.

Fiber Optic Light Guide
A bundle of optical fibers arranged randomly for the purpose of transmitting energy, not images.

Fiber Optic Probe
A flexible optical probe having a bundle of glass fiber arranged to transmit an image

Gap Loss
The optical power loss caused by space between axially aligned fibers.

Image Transducer
Any arrangement of a bundle of optical fibers that alters the shape of the image.

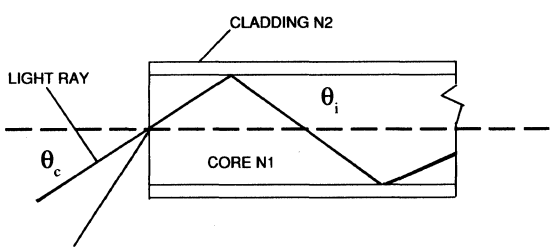
For example, by a systematic regulation of the spacing of the fibers from the entrance end to the exit end, a distortion of the image can occur that may be used to neutralize or compensate for the distortion introduced by the lens, prism or mirror components in an optical system.

Large-Core Fiber
Optical fiber with a large core, often a step-index fiber. "Large" is sometimes defined as greater than 85 μm.

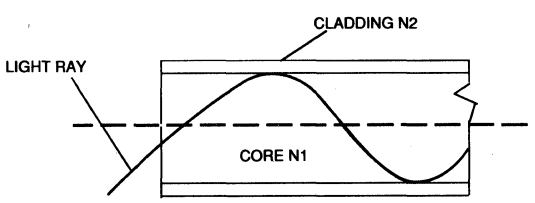
Multifibers
An array of optically distinct fibers that are fused into one strand. They are used to keep the resolution efficiency of the smaller single fibers and eliminate difficulty in handling. Their specific usage is determined by their flexibility or rigidity.

Packing Fraction
The ratio of the active core area of the fiber bundle to the total area at its light emitting or receiving end.

Plastic Fiber
Fiber in which both the core and cladding are made of plastic.



(a) Light propagation in a step index fiber.



(b) Path of light rays in a graded index fiber.

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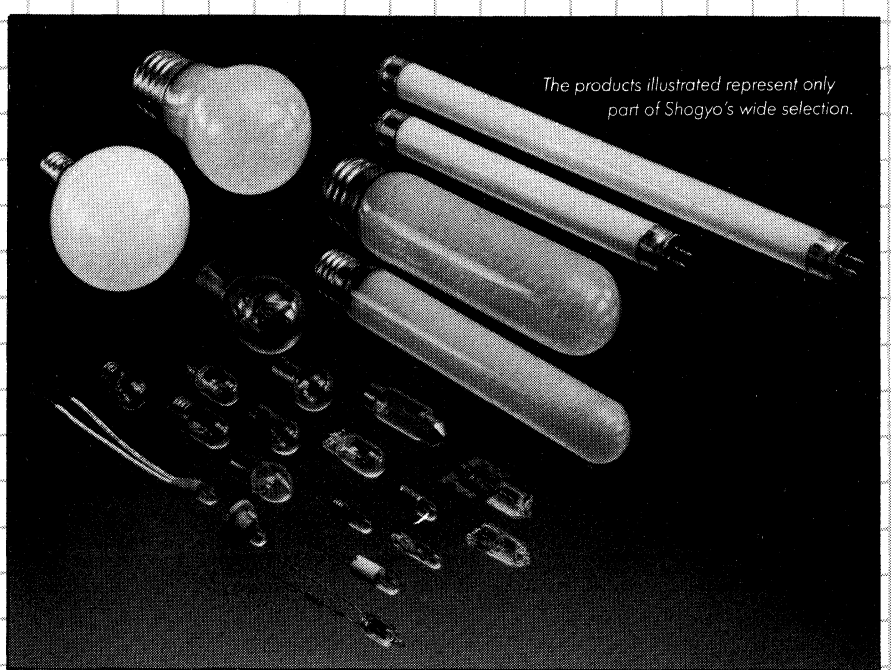

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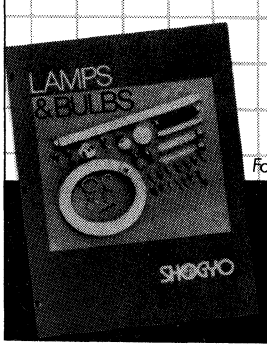

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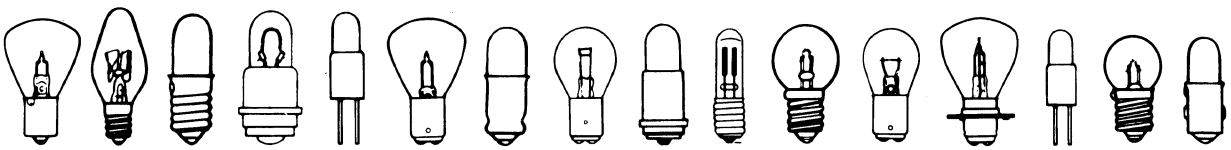

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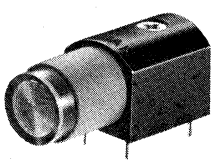

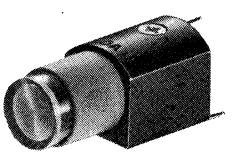

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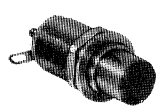

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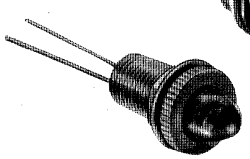

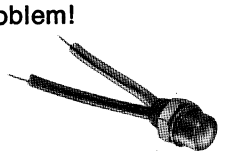

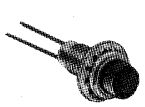

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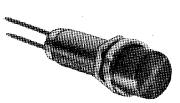
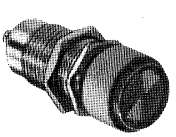
Free samples and prototypes available.

We will be glad for the opportunity to help you to find or develop the product you envisioned.





SLOAN

The Sloan Company

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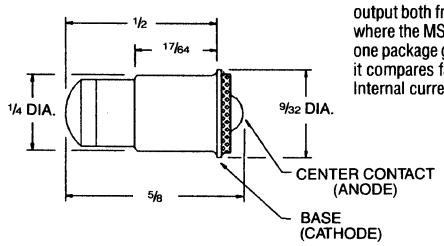
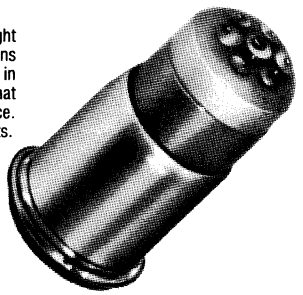
T-1¾ MIDGET FLANGED BASE LED

MODEL 510

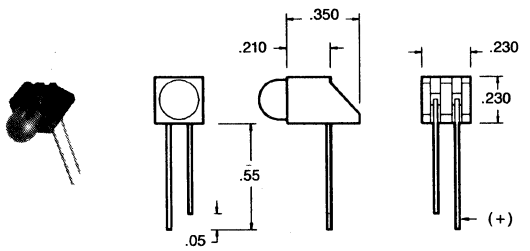


The Model 510 six chip LED T1¾ Midget Flange Base lamp has abundant light output both front and side viewing, for use in indicator lights and other applications where the MS25237 (327, 328, etc.) incandescent lamps are used. The six chips in one package give far greater light output totally than earlier single chip LEDs so that it compares favorably in use with the incandescent lamp it is intended to replace. Internal current limiting resistors allow for supply voltages from 5 up to 28 volts.



CIRCUIT BOARD MOUNT LED

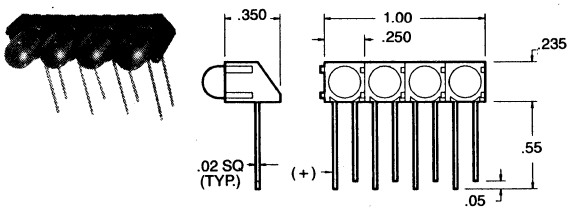
MODEL 210



Designed specifically for parallel mounting to printed circuit boards. Used as single indicator lights mounted in various places along the edge of the printed circuit board on any center-to-center distance.

CIRCUIT BOARD MOUNT LED

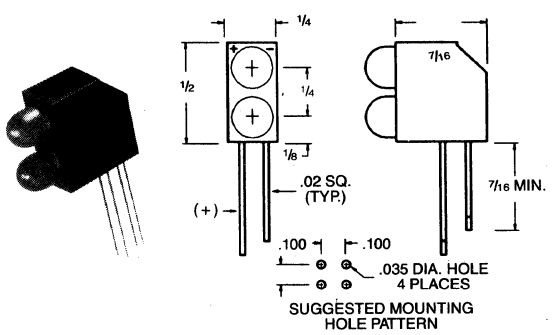
MODEL 211



Designed specifically for parallel mounting to printed circuit boards. Used where two or more indicator lights are needed in arrays of virtually any number. Close tolerance spacing makes assembly of the board with the front panel easy and trouble free.

CIRCUIT BOARD MOUNT LED

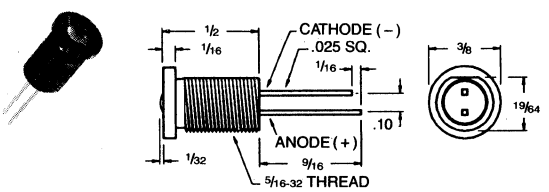
MODEL 220



This is an extremely versatile device for a wide range of applications and space saving status indicator for horizontal mounting in printed circuit boards. The bi-level feature saves board space by cutting space requirements in half. Standard .100 inch center to center distance of the leads make it easy for both assembly and servicing of the circuit board.

PANEL MOUNT LED

MODEL 250



Utilizes hermetically sealed solid state LEDs with high brightness and wide viewing angle. Can be supplied with standard, JAN Qualified, or JANTX LEDs. It can also be supplied with a current limiting resistor depending on your particular requirement. The Model 251 is supplied with an O-ring for proper panel sealing.

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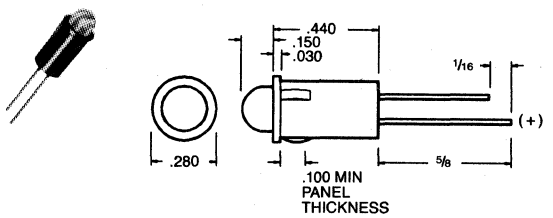
PANEL MOUNT LED

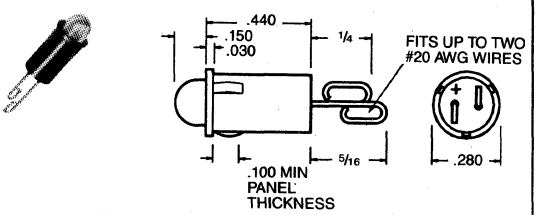
MODEL 240



This model uses high brightness LEDs mounted in easy press to fit bodies. Ideal for fast production, this model presses into place permanently, eliminating the need for mounting hardware. Uses straight terminal leads to which wires can be soldered directly or the leads can be hand soldered into PC boards either vertically or horizontally by bending the leads.

PANEL MOUNT LED

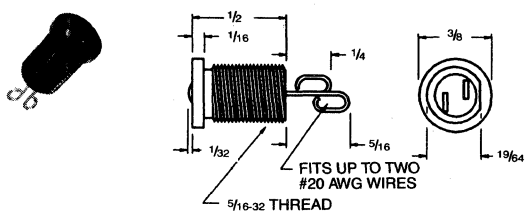
MODEL 241



Identical to Model 240 but has solder loops in the terminal leads to accommodate up to two #20 AWG or smaller wires. Robust terminal leads are formed with the loops in opposite directions to keep the wires apart from each other.

PANEL MOUNT LED

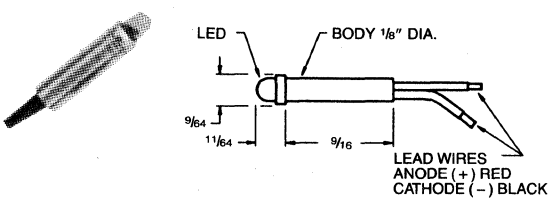
MODEL 252



Identical to the Model 250 except this model incorporates a standard package high bright LED. The Model 253 is supplied with an O-ring for proper panel sealing.

PANEL MOUNT LED

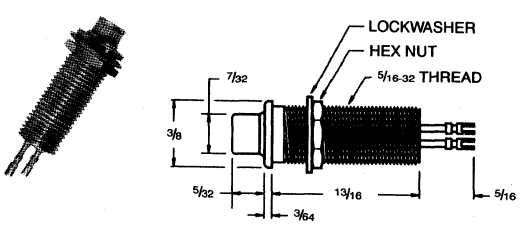
MODEL 5L3



The mini-cartridge provides front panel indication in applications where space is at a premium. The Model 5L3 is one of the smallest panel mount LED on the market. A series resistor is available allowing operation from sources up to 28 volts. Lead wires are color coded for polarity and provide simple solder connections. A speed clip permits easy and positive panel installation.

PANEL MOUNT LED

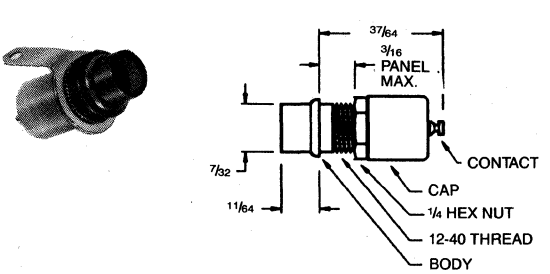
MODEL 3L5



This rugged unit houses high bright T1¾ LEDs in an all metal threaded housing. Termination is by wire wrap posts or solder lugs. Built in current limiting resistors allow these units to be powered from sources up to 28 volts.

PANEL MOUNT REAR RELAMP
INCANDESCENT OR LED

MODEL 107



Designed for rear replacement of T-1 size midget flanged base incandescent or LED lamps. Rugged construction allows operation at severe conditions. Available in different lens configurations. The two terminal version is the 107SI.

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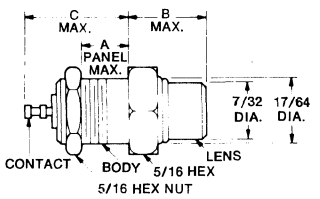
PANEL MOUNT FRONT RELAMP INCANDESCENT OR LED

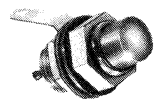
MODEL 102S

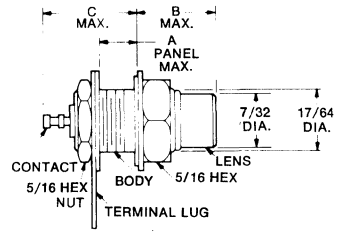


Utilizes the T-1 flanged-based incandescent lamp or LED. An internal silicone rubber pressure pad maintains electrical contact with the lamp and is an effective front-to-back of panel moisture seal.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290 Delrin per LP-392
LENS—Lexan LP-393 Nylon MIL-M-20693 Aluminum 2024-T4 Anodize MIL-A-8625
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727
HDWE—Brass SAE 72 Nickel Plate QQ-N-290 Phenolic per MIL-P-15035 Nylon MIL-M-20693

MODEL 102SI



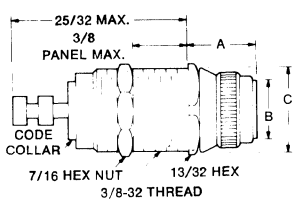


This is the two-terminal version of the basic 102S Model. It is created by the addition of special insulating hardware (above) which includes a solder lug as the second terminal.

NOTE 1—Both the 102S and the 102SI are available in four body styles: S-(above) provides a bright hex flange on the panel, SK-is a knurled flange, SS-a short low-profile hex, and SR-(above left) a small, plain flange.
NOTE 2—The 102S and 102SI are available in several lens styles: Q, QB, DSC, DS, STD. (Contact Factory)
NOTE 3—The 102 series can be furnished in a waterproof version, and can be RF shielded. (Contact Factory)

PANEL MOUNT FRONT RELAMP INCANDESCENT OR LED

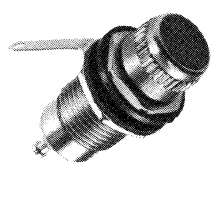
MODEL 855S

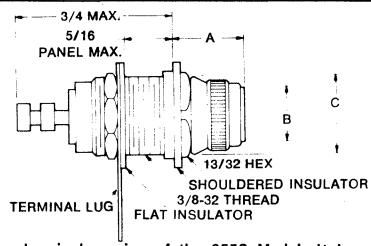


Among the features of the 855 Series are • Small Mounting Size • Front Relamping • Interchangeable Lens Assemblies. Contact pressure is maintained by a silicone rubber pressure pad which seals out moisture front to back of panel. Uses T-1¾ Flanged Base lamp, incandescent or LED.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290
LENS—Butyrate LP-349 Lexan LP-393 Nylon MIL-M-20693 Aluminum 2024-T4 Anodize MIL-A-8625 Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—Brass SAE 72 Tin Plate MIL-7-10727
CODE COLLAR—Nylon MIL-M-20693
HDWE.—Brass SAE 72 Nickel Plate QQ-N-290 Nylon MIL-M-20693 Linen Base Phenolic MIL-P-15035

MODEL 855SI





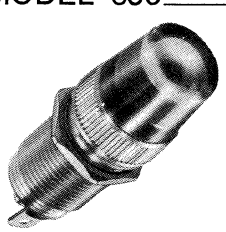
The 855SI Model is the two-terminal version of the 855S Model. It is created by the addition of special insulating hardware (above) which includes a solder lug as the second terminal.

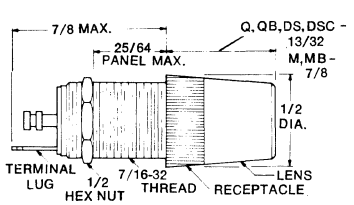
NOTE: Available in Lens styles—Q, QB, DSC, DS, STD, M, MB, D, SE, DDS, U and I, see last page.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290 Nylon MIL-M-20693
LENS—Lexan LP-393 Butyrate LP-349 Nylon MIL-M-20693 Brass SAE 72 Aluminum 2024-T4 Nickel Plate QQ-N-290 Anodize MIL-A-8625
TERMINALS—Brass SAE 72 Nickel Plate QQ-N-290

PANEL MOUNT FRONT RELAMP INCANDESCENT OR LED

MODEL 856

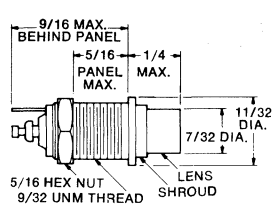




A two-terminal, front-relampable indicator light designed to use the T-1¾ midget flange based incandescent bulb or LED. An internal silicone-rubber pressure-pad maintains electrical contact inside the lamp body. It also provides an effective moisture seal front to back.
NOTE: Available in lenses styles: Q, QB, DSC, DS, M and MB.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290 Nylon MIL-M-20693 Delrin per LP-329
LENS—Lexan LP-393 Alum. 2024 Brass SAE 72 Anodize per MIL-A-8625 Nickel Plate QQ-N-290
HDWE.—Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727

MODELS—121, 122—123, 124



The 121 Model lamp holder is a two terminal, front relampable indicator light specifically designed for use with T-1 Midget Flange Based incandescent or LED lamps. The 122 is a waterproof version of the 121. The Model 123 is the same but with the more conventional ⅜-32 screw body. The 124 is the waterproof version of the 123.
Available in lens styles: STB, STC, DS, DSC, QB, Q.

MATERIAL & PROCESSES
BODY—Alum. 2024 Anodize MIL-A-8625 Nylon MIL-M-20693 Delrin per LP-392
LENS—Lexan LP-393 Alum. 2024 Brass SAE 72 Anodize per MIL-A-8625 Nickel Plate QQ-N-290
HDWE.—Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727

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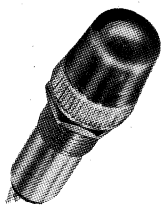
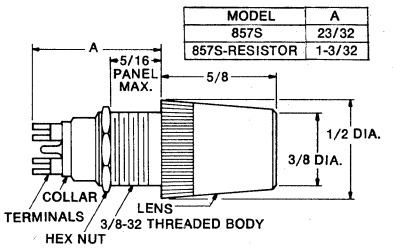
PANEL MOUNT FIXED LAMP

MODEL 857



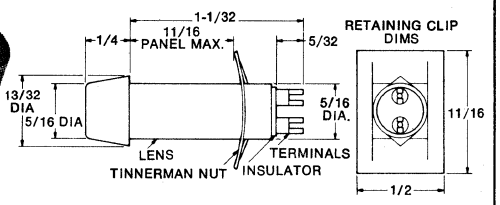


A sub-miniature fixed neon, offering optimum light dispersion and direction. Uses, Hi-Brightness or other NE-2 Series unbased bulb with or without resistors. Mounted in a ⅜ dia. hole with resistor, the Model 857 can be used directly on commercial line currents (115 VAC).

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290 General Purpose Phenolic
LENS—Butyrate LP-349
TERMINALS—Brass SAE 72 Tin Plate per MIL-T-10727
HARDWARE—Brass SAE 72 Nickel Plate QQ-N-290

PANEL MOUNT FIXED LAMP
NEON OR INCANDESCENT

MODEL 858



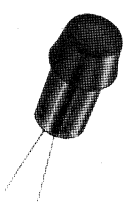
Uses the T-2 unbased neon lamp or can be supplied with the **T-1 or T-1¾** unbased incandescent lamp. It accommodates long neon lamps (C2A Type) without dropping resistor built-in, as well as short neon lamps (A1C Type) with dropping resistor built-in. When resistor is built-in it can be used directly on commercial line current (115 volts A.C.). For LED applications see note below.

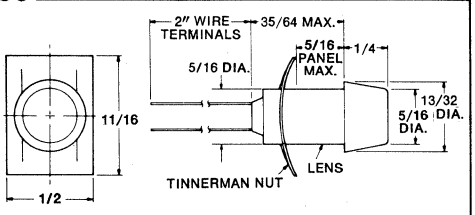
FOR LED APPLICATIONS LED can be supplied as a special in red, green and amber with or without built-in resistor. Voltage up to 28 volts available. (Contact factory).

MATERIAL & PROCESSES
LENS—Butyrate LP-349
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727
TINNERMAN NUT—Carbon Steel Phosphate Oil Finish
INSULATOR—General Purpose Phenolic

PANEL MOUNT FIXED LAMP
NEON OR INCANDESCENT

MODEL 859



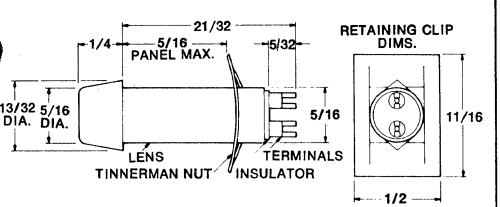


Uses the T-2 unbased neon lamp and long neon lamps without dropping resistor or with dropping resistor. It can also accommodate short neon lamps (A1C type) with or without resistor. With resistor the 859 Series can be used directly with commercial current (115 volts A.C.). Incandescent unbased lamps (T-1 or T-1¾) can also be furnished.

MATERIAL & PROCESSES
LENS—Butyrate LP-349
TINNERMAN NUT—Carbon Steel Phosphate Oil Finish

PANEL MOUNT FIXED LAMP
NEON OR INCANDESCENT

MODEL 862

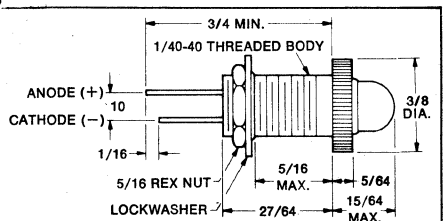


The 862 series accommodates short (A1C) neon lamps only with no resistor built in. Useful where space is limited behind the panel and offers wire wrap™ terminals for soldering.

MATERIAL & PROCESSES
LENS—Butyrate LP-349
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727
INSULATOR—General Purpose Phenolic
TINNERMAN NUT—Carbon Steel Phosphate Oil Finish

PANEL MOUNT FIXED LAMP
LED

MODEL 1L3

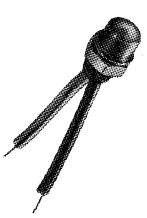


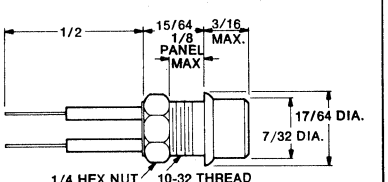
Designed for applications requiring LED indication without a lens. The 1L3 Model provides high brightness in the smallest threaded metal body available in the industry. Termination is by wire leads. Built-in dropping resistors allow these units to be powered from sources up to 28 VDC.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290
HDWE—Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—.02 Sq. Solid Cu. Tin plated for solderability

PANEL MOUNT FIXED LAMP
INCANDESCENT/LED

MODEL 105S/1L5S





Featuring a T-1 unbased commercial or MIL-Spec. lamp. Standard unit has two ½" long leads. Longer leads furnished upon request. RFI shielding and waterproofed version available. The 1L5S is the LED indicator model.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290
LENS—Lexan LP393 Nylon MIL-M-20693 Aluminum 2024-T4 Anodize MIL-A-8625
HDWE.—Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—32 AWG Solid Cu.

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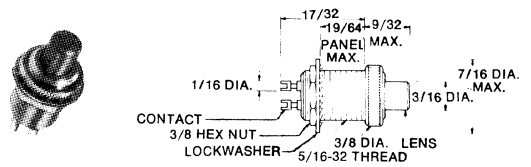
PANEL MOUNT FIXED LAMP
INCANDESCENT/LED

MODEL 106S/1L6



Specifically designed for use with T-1 unbased MIL-Spec., commercial incandescent or LED light source. Can be installed from front or rear of panel.

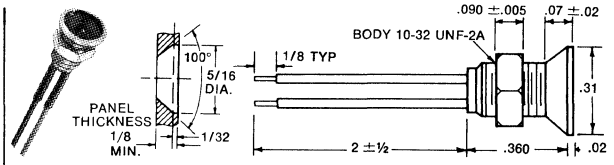
The light source in Model 1L6 is a special high bright T-1¾ LED protruding from a metal body. No lens is provided. Built-in dropping resistors allow these units to be powered from sources up to 28 VDC.

NOTE: The 1L6 is available in red only.

MATERIAL & PROCESSES
BODY/HEX NUT/RD NUT—Brass SAE 72 Nickel Plated QQ-N-290
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727
LENS—Lexan LP-393 Nylon MIL-M-20693

T-1 UNBASED INCANDESCENT/LED PANEL MOUNT FIXED LAMP

MODEL 109/1L9



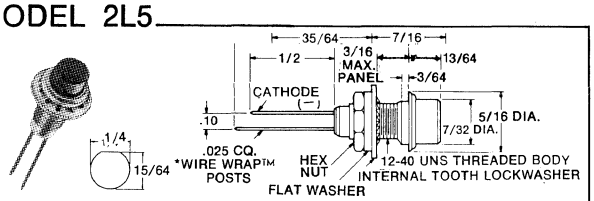
The new flush mount design can be used only with any T-1 size LED or incandescent lamp, including the new super bright LED which gives luminous intensity and color never before possible in the T-1 size. LED colors include red, green and amber with red, green amber, clear and white transparent and translucent lens, and are available with or without a resistor and RFI shielding.

The incandescent models offer the brightness and variety of incandescent colors, including red, green, amber, blue, white and clear with either transparent or translucent lens, and the option of RFI shielding.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290
LENS—Lexan LP-393
TERMINALS—26 AWG Stranded Cu. MIL-W-16878 24 AWG Solid Cu. MIL-W-16878
HARDWARE—Brass SAE 72 Nickel Plate QQ-N-290

PANEL MOUNT FIXED LAMP
LED

MODEL 2L5



This Series incorporate a red, green or amber T-1 size LED in an all-metal threaded body. Available with wire leads or wire wrap™ terminals. Two kinds of color contrast lenses are provided. When unlit, the white or clear lens material alone is visible. When lit, the color LED shows through plainly, giving the appearance of a lens which changes color.

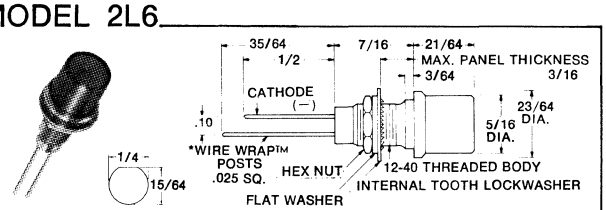
Built-in dropping resistors allow these units to be powered from sources up to 14VDC. Model 2L501 available with superbright LED.

Available with either a round body or flat sided "D" body for consistent terminal location and ease of tightening. *Gardener—Denver

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate per QQ-N-290
LENS—Lexan LP-393 Nylon MIL-M-20693
TERMINALS—Phosphor Bronze ¾ Hard Tin Plate per MIL-T-10727
Wire per MIL-W-16878 24 AWG Solid Cu. 26 AWG Stranded Cu.
HDWE.—Brass SAE 72 Spring Steel per MIL-W-6986 Nickel Plate per QQ-N-290

PANEL MOUNT FIXED LAMP
LED

MODEL 2L6

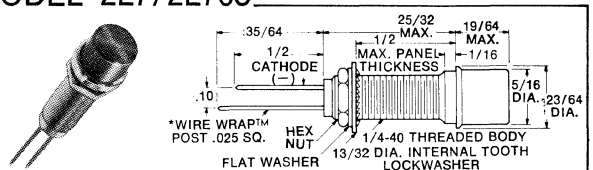


The 2L6 Model incorporates a red, green or amber T-1¾ size Hi-Bright LED in an all-metal threaded body, suitable for panel mounting. Large lens permits 180° visibility, up to 50 mcd. Termination is by wire-wrap™ posts, or wire leads. Lenses available in transparent material for head-on viewing or translucent material for side viewing. Built-in dropping resistors allow these units to be powered from sources up to 14 VDC. Bodies come round or in flat sided "D" for ease of tightening and consistent terminal location. *Gardener—Denver

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate per QQ-N-290
LENS—Nylon per MIL-M-20693 or Lexan per LP-393
TERMINALS—Phosphor Bronze—¾ Hard Tin Plate per MIL-T-10727
Wire per MIL-W-16878 24 AWG Solid Cu. 26 AWG Stranded Cu.
HDWE.—Brass SAE 72 Spring Steel per MIL-W-6986 Nickel Plate per QQ-N-290

PANEL MOUNT FIXED LAMP
HI-BRIGHT LED

MODEL 2L7/2L703

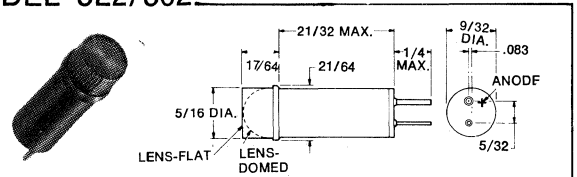


Utilizes a T-1¾ Hi-Bright LED. Permits 180° visibility, up to 50 mcd. The lens incorporates Fresnel rings and flutes which allow maximum distribution of light output. Also available with plain lens (no flutes or rings). Termination is by wire leads or wire-wrap™ post. Built-in dropping resistors allow these units to be powered from sources up to 28 VDC. 2L703 is waterproof version. Bodies can be round or "D" type.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate per QQ-N-290 Nylon per MIL-M-20693
LENS—Lexan per LP-393
TERMINALS—Phosphor Bronze—¾ Hard Tin Plate per MIL-T-10727
Wire per MIL-W-16878 24 AWG Solid Cu. 26 AWG Stranded Cu.
HDWE.—Brass SAE 72 Spring Steel per MIL-W-6986 Nickel Plate per QQ-N-290

PANEL MOUNT FIXED LAMP
LED/INCANDESCENT/NEON

MODEL 5L2/502



These rugged aluminum cartridges incorporate LED, incandescent or neon light sources. Termination is by stainless steel pins suitable for use with a solder lug socket connector, wire wrap™ post adapter or lead wire terminal connector. *Gardener—Denver

Lens styles are flat or domed in transparent or translucent material. All lenses are furnished with fresnel rings for maximum distribution of light output.

MATERIAL & PROCESSES
BODY—Aluminum 3003 Anodize MIL-A-8625
LENS—Butyrate LP-349 Lexan LP-393
TERMINALS—Stainless Steel
HDWE.—General Purpose Phenolic Brass SAE 72 H.T. Spring Steel (Not shown).

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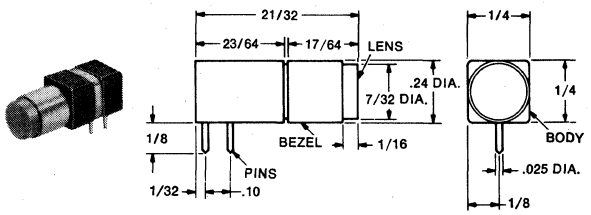
CIRCUIT BOARD MOUNT FRONT RELAMP INCANDESCENT OR LED

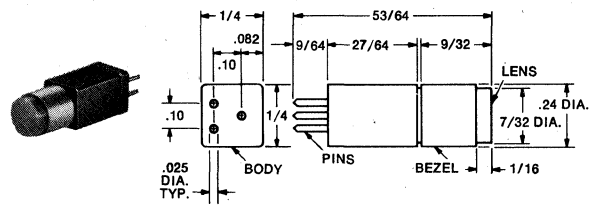
MODEL 101
PARALLEL MOUNT



Designed specifically for printed circuit board mounting. Uses any T-1 flange based lamp.

MATERIAL & PROCESSES
BODY—General Purpose Phenolic Nylon MIL-M-20693
LENS—Lexan LP-393 Nylon MIL-M-20693 Aluminum 2024-T4 Anodize MIL-A-8625 Brass SAE 72 Nickel Plate per QQ-N-290
TERMINAL PINS—Brass SAE 72 Tin Plate MIL-T-20727 Berylium Copper

MODEL 111
PERPENDICULAR MOUNT

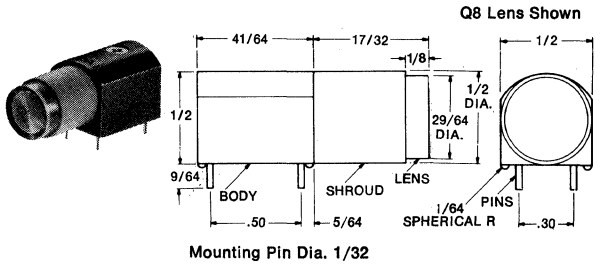


Same features as 101 Model but unit mounts perpendicular to surface of printed circuit board.

MATERIAL & PROCESSES
BODY—General Purpose Phenolic Nylon MIL-M-20693
LENS—Lexan LP-393 Nylon MIL-M-20693 Aluminum 2024-T4 Anodize MIL-A-8625 Brass SAE 72 Nickel Plate per QQ-N-290
TERMINAL PINS—Brass SAE 72 Tin Plate MIL-T-20727 Berylium Copper

CIRCUIT BOARD MOUNT FRONT RELAMP INCANDESCENT OR LED

MODEL 864
PARALLEL MOUNT

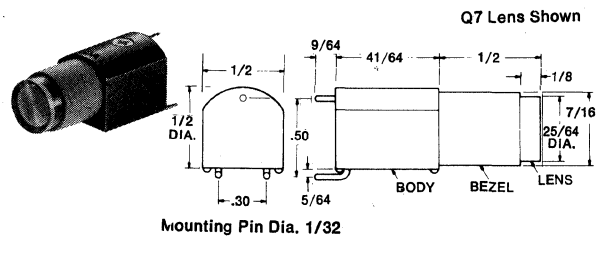


Mounting Pin Dia. 1/32

Designed specifically for printed circuit board mounting. May be used where illumination is need for the circuit board area as well as enunciation thru a panel.
Lens styles available in two diameters: 7/16" (7 series) Q7, QB7, DSC7, DS7 and 1/2" diameter (8 series) QB, QB8, DSC8, DS8.

MATERIAL & PROCESSES
BODY—Brass SAE 72 General Purpose Phenolic Linen Based Phenolic MIL-P-15035 Nylon MIL-M-20693 Nickel Plate QQ-N-290
LENS—Lexan LP-393 Nylon MIL-M-20693 Brass SAE 72 Aluminum 2024-T4 Nickel Plate QQ-N-290 Anodize MIL-A-8625
TERMINALS—Brass SAE 72 Tin Plate MIL-7-10727 Phosphor Bronze QQ-W-321

MODEL 874
PERPENDICULAR MOUNT



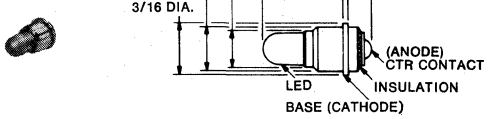
Mounting Pin Dia. 1/32

Same features as 864 Model but unit mounts perpendicular to surface of printed circuit board. Also available in two lens sizes.

MATERIAL & PROCESSES
BODY—Brass SAE 72 General Purpose Phenolic Linen Based Phenolic MIL-P-15035 Nylon MIL-M-20693 Nickel Plate QQ-N-290
LENS—Lexan LP-393 Nylon MIL-M-20693 Brass SAE 72 Aluminum 2024-T4 Nickel Plate QQ-N-290 Anodize MIL-A-8625
TERMINALS—Brass SAE 72 Tin Plate MIL-7-10727 Phosphor Bronze QQ-W-321

T-1 SUB-MIDGET FLANGED BASE LED

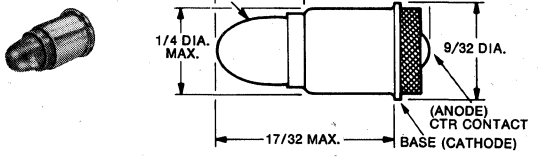
MODEL 4L001



The 4L001, available in diffused lens material is the Sloan T-1 based LED designed to offer diode reliability as a replacement unit in T-1 hardware. When maximum light output is desired using based LEDs in indicator applications, it is recommended that the lens be of transparent material with Fresnel rings. If translucent material is desired, then the lens should be without Fresnel rings.

T-1¾ MIDGET FLANGED BASE LED

MODEL 5L001



The versatile T-1¾ based LED is available in red, green or amber. Viable voltage range is 2.1 volts to 28 volts with power dissipation up to 400mW. Built-in dropping resistors allow these units to be powered from sources up to 28 VDC. The higher voltage capability permits the Sloan T-1¾ based LED to be used as direct replacement for incandescent bulbs in applications where light intensity is not critical but diode reliability is required.

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GENERAL INFORMATION:

- RFI shielding available with virtually all models.
- It is wise to avoid using blue or green lenses with neon lamps.
- It is also wise to avoid using blue lenses with LED lamps.
- Ultra-bright, multichip and other exotic lamps available.
- All materials meet or exceed applicable military specs.

HOW TO ORDER

Example

LED 2L5 — RL — DL — 5/20

- 2L5 — Model No.
- RL — Lens Color: Transparent, Red, Lexan
- DL — Lens Style: Domed, Fresnel
- 5/20 — Voltage/current

INCANDESCENT OR NEON

855S — A — STD. — 327

- 855S — Model No.
- A — Lens Color: Amber, Gen. Purpose
- STD. — Lens Style: Standard
- 327 — Lamp Type

INCANDESCENT LAMP ELECTRICAL SPECIFICATIONS

T-1 LAMPS

LAMP	VOLTS	CURRENT (A)	MSCP	LIFE (K HRS.)	INDUSTRY STD. NO
FB60	5	.060	.050	100	685*
FB59	28	.024	.150	16	—
FB44	18	.028	.150	10	—
					*MS-24515

T-1¾ LAMPS

327	28	.04	.340	4000	—
328	6	.20	.600	1000	—
387	28	.04	.300	7000	—

NEON LAMP ELECTRICAL SPECIFICATIONS

LAMP WITH RESISTOR	VOLTS A.C. OR D.C.	AMPS NOMINAL	WATTS NOMINAL	LIFE	RESISTOR
A1B	105-125	.03	1/25	25,000	220K
A1C	105-125	1.2	1/7	25,000	47K
A9A (NE-2E)	105-125	0.7	1/12	25,000	100K
C2A (NE-2H)	105-125	1.9	1/4	25,000	30K

NOTE: A1C and NE2H are high brightness. Other lamps available. Life figures for A.C—Life at D.C. ½ A.C. (Approx.). 862 Series cannot be supplied with resistor. We suggest that you do not order neon with Green or Blue lenses.

IMPORTANT: The lamps shown represent the most popular types normally requested. MANY OTHER LAMPS ARE AVAILABLE—PLEASE CONTACT FACTORY.

COLOR TABLE

LENS MATERIAL	LEXAN	LEXAN	GENERAL PURPOSE	BUTYRATE
Color	Transparent	Translucent	Translucent	Transparent
Red	RL	RLUC	R	RTP
Green	GL	GLUC	G	GTP
Blue	BL	BLUC	B	BTP
Amber	AL	ALUC	A	ATP
Clear	CL	—	—	CTP
White	—	WLUC	W	W

LED LAMP INFORMATION

We have virtually any LED you want. The two basic sizes are T-1 and T-1¾ with flanged bases. The brightest varies with color, with green lowest to red highest. To order extra or super bright lamps simply add 01 or 04 to the model number. One more suggestion do not order LEDs with blue lenses.

NO.	LAMP TYPE	T-1	T-1¾
—	Standard-Bright	2 mcd	3-8 mcd
01	Extra-Bright	8-18 mcd	15-18 mcd
04	Super-Bright	20 mcd	60-80 mcd

IMPRINTING

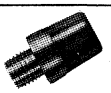
Lenses may be hot stamped, engraved, or opaqued and engraved so that the character only is displayed.

The chart below designates type size available for hot stamping. Size of lens determines size of type that can be used.

TYPE	ACTUAL SIZE	
	WIDTH	HEIGHT
2 Pt	.050	.060
6 Pt	.060	.080
8 Pt	.080	.110
10 Pt	.090	.120
12 Pt	.110	.160

NOTE: For other size type, contact factory.

LENS STYLE

STYLE		DESCRIPTION
Q		Clear anodized bezel allows 180° visibility.
QB		Same as Q lens except with black anodized bezel.
DSC		Clear anodized bezel prevents sidelight emission.
DS		Same as DSC lens except with black anodized bezel.
STD		Full 180° visibility. Maximum illumination.
M		Large lens for maximum visibility from all angles. Engineered to offer the most uniform light distribution. Full 180° visibility.
MB		Same as M lens except with black anodized bezel.
D		Skirted lens covers metal parts for neat panel appearance. Large lighted surface assures positive indication.
SE		Edgelight for plastic panels. Small diameter light gasket minimizes wasted panel space.
DDS		DIMMER: Rotating outer collar changes light output from full to minimum. Rotation to dim can be clockwise or counter-clockwise. Easy adjustment with gloved hand.
U		UNLIMITED: Has no lens to diminish light output. Specifically suited to T-1¾ flanged based LED for maximum light output.

120 SERIES

STB		Full 180° visibility. Maximum illumination. Black bezel.
STC		Full 180° visibility. Maximum illumination. Clear bezel.
QB		Black anodized bezel allows 180° visibility.
Q		Same as QB lens except with clear anodized bezel.

STYLES

FLAT		NOTE: Lens style may be flat or domed, plain or lensed, meaning that the lens is provided with internal concentric rings on the inner face and flutes on the sides, thus giving better light distribution.
DOMED		

SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
$\ll$	much smaller than
$>$	larger than
$\geq$	larger than or equal to
$\gg$	much larger than
$\equiv$	identical to or equivalent
$\uparrow$	increases
$\downarrow$	decreases

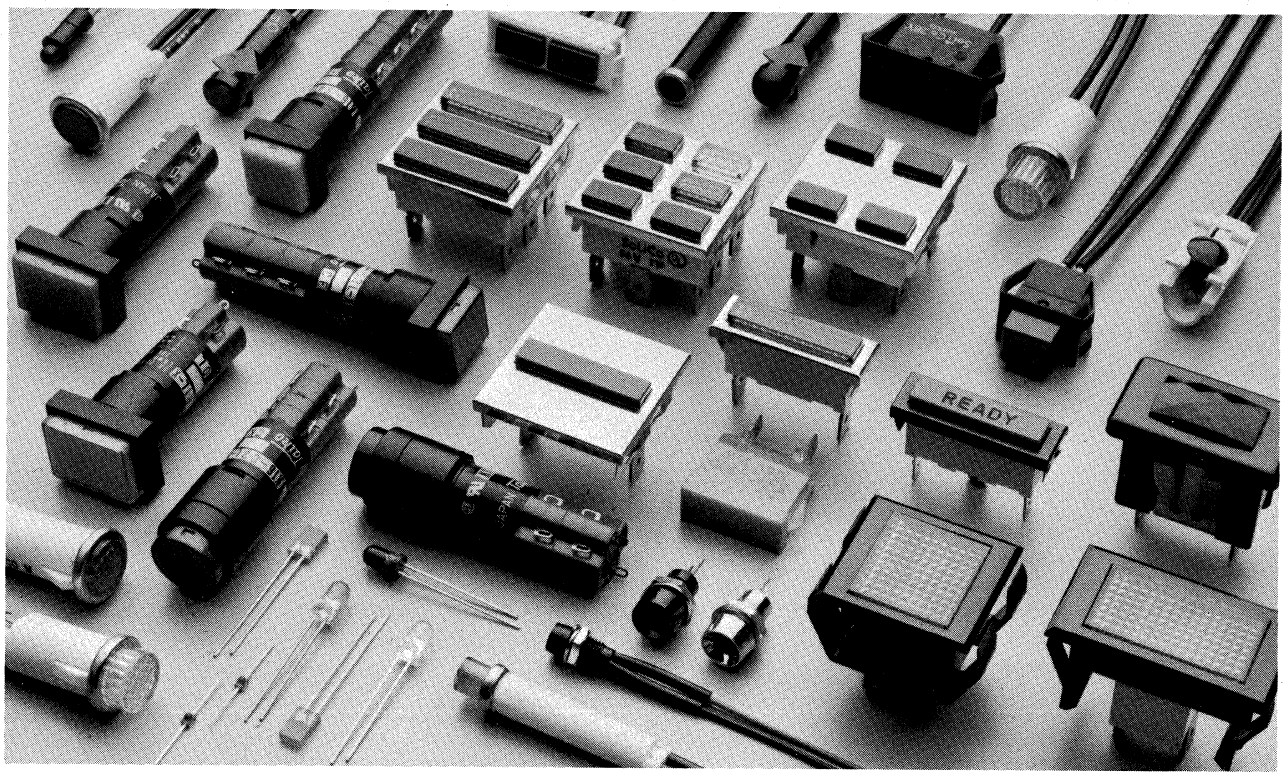
PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg $m\ s^{-2}$
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

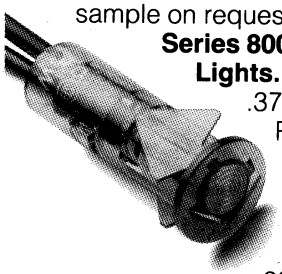
eem SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

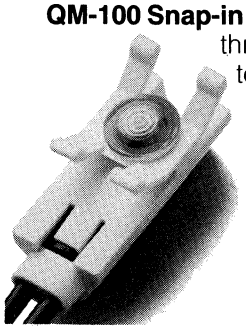


Ask us for solutions to your product lighting needs.

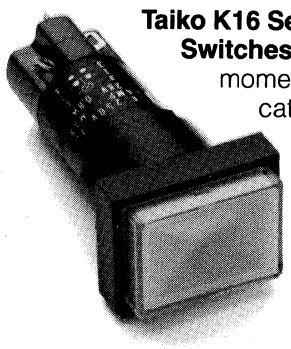
SoLiCo pilot lights, indicator lights and lighted pushbuttons come in a wide variety of styles and sizes for a broad range of products and applications. Give us your panel depth, required hole size, mounting method, lens size and style, material, and termination. Chances are, we'll have an inexpensive standard part for your needs. We'll even send you a free sample on request.



Series 8000 Snap-in Indicator Lights. Real time savers. Snap into .375" hole from front of panel. Pre-wired leads. Red, green, yellow or amber LED's. Red or green neon. Lens bodies domed or flat, translucent or transparent. Bright, quick, easy.



QM-100 Snap-in Indicator Lights. Lens fits through panel front. Lamp snaps to it from back. Pre-wired 6" leads. Standard, blue or green neon lamp. 4 lens shapes, 6 colors. Rated at 125-250V.



Taiko K16 Series Lighted Pushbutton Switches. Incandescent or LED. In momentary, maintained, and indicator styles. Solder lug terminals, independent lamp terminals, and T1 BiPins for durability. Round, square, or rectangular. Lenses clear or in 5 colors. 1, 2, 3, or 4-pole double-make/double-break contacts. Fit 5/8" round hole.

Special items and special assistance, too. Contact our factory sales department for quick solutions to unique lighting demands. Technical aid is always available to help you find the light that's best for your application. To find out just how many ways SoLiCo can help you see the light, call for our full-line brochure—**(203) 527-3092**

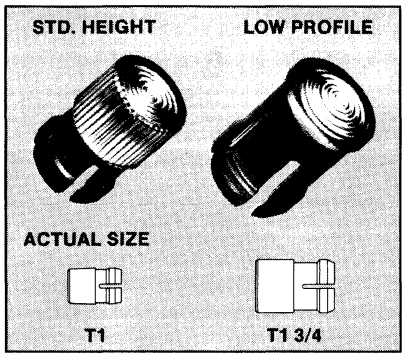
SoLiCo

Sorenson Lighted Controls, Inc. 75 Locust Street, Hartford, CT 06114

VCC MINIATURE INDICATORS

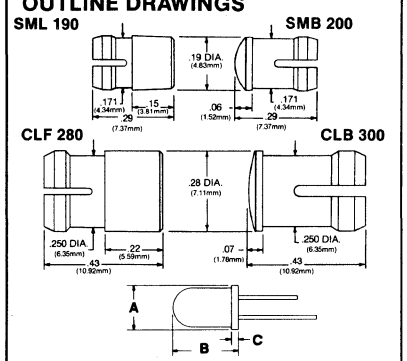
VISUAL COMMUNICATIONS COMPANY, INC.

7920-G Arjons Drive San Diego, CA 92126 U.S.A. IN CA (619) 549-6900
FAX (619) 549-3520 Toll Free (800) 522-5546



U.S. & For. Pat. Issued & Pend.

OUTLINE DRAWINGS



RECOMMENDED LEDs

	A	B	C
T1	.150	.200	.02 MIN to .04 MAX
T1 3/4	.230	.340	.02 MIN to .05 MAX

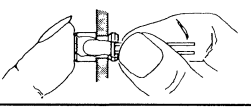
CLIPLITE® LENS/MOUNTS FOR T1 & T1 3/4 LEDs

FEATURES

- Installs with finger pressure — no tools required — takes only six seconds
- Increases viewing angle up to 180 degrees using either diffused or point source LEDs
- Protects LED from being pushed back through panel — LED blackout
- Moisture seals easily to panel with the application of common sealants
- Intensifies apparent brightness up to 125% by the use of striated lines and fresnel rings
- Guards against IC damage by electrostatic discharge transmitted thru exposed LED

SIMPLE TWO-STEP INSTALLATION

1 Snap the CLIPLITE into panel hole.



2 While holding the CLIPLITE tight to the panel with your finger, insert the LED into the CLIPLITE from the back.

SPECIFICATIONS

MATERIAL Lens — Polycarbonate; Spacer — Nylon, (U.L. Listed plastics).

DESIGN Standard and low profile lens using fresnel rings and striated lines.

MOUNTING Mounts thru front of panel. Mounting holes should be deburred but not chamfered.
T1 size (SML 190, SMB 200) mounts in a .171+/-.002 (4.34mm) hole on 1/4" centers. Panel thickness for SML 190, 1/32" to 1/16"; SMB 200, 1/16" to 1/8".
T1 3/4 size (CLF 280, CLB 300) mounts in a .250+/-.002 (6.35mm) hole on 3/8" centers. Panel thickness for CLF 280, 1/16" to 1/8"; CLB 300, 1/32" to 1/4"; (panels less than 3/16", SPC 125 spacer available).
Standard metal or plastic washers can be used to increase panel thickness if necessary.

ORDERING CODES

CLF 280 RTP

MODEL
SML 190 (T1 Size) Std. Hgt.
SMB 200 (T1 Size) L/Profile
CLF 280 (T1 3/4 Size) Std. Hgt.
CLB 300 (T1 3/4 Size) L/Profile
SPC 125 (Spacer for CLB 300)

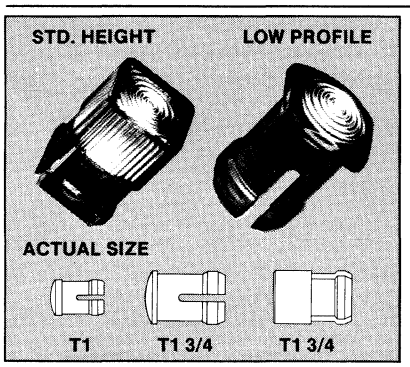
COLOR

RTP Red Transparent	BTP Blue Transparent
ATP Amber Transparent	YTP Yellow Transparent
GTP Green Transparent	CTP Clear Transparent

OEM PRICES

QUANTITY	100	500	1000
SML 190	.18	.15	.12
SMB 200	.18	.15	.12
CLF 280	.19	.16	.13
CLB 300	.19	.16	.13
SPC 125	.03	.027	.023

All colors can be combined for price advantage per line item. For higher quantity pricing contact VCC. Prices subject to change without notice.



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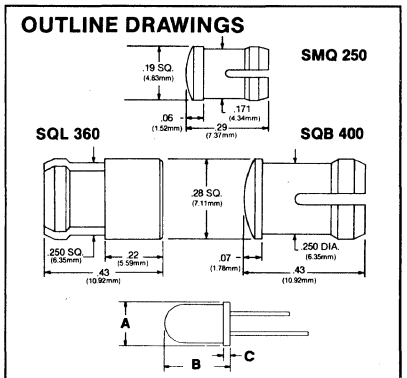
OUTLINE DRAWINGS



RECOMMENDED LEDs

	A	B	C
T1	.150	.200	.02 MIN to .04 MAX
T1 3/4	.230	.340	.02 MIN to .05 MAX

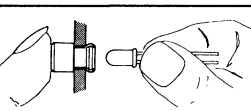
CUBELITE® SQUARE LENS/MOUNTS FOR LEDs

FEATURES

- Enhances aesthetics, square design in both standard and low profile configurations
- Mounts either as a single square lens or stacks in bar configuration
- Increases viewing angle up to 180 degrees using either diffused or point source LEDs
- Intensifies apparent brightness up to 140% by the use of striated lines and fresnel rings
- Installs with finger pressure — no tools required — takes only six seconds
- Guards against IC damage from electrostatic discharge transmitted thru exposed LED

EASY TWO-STEP INSTALLATION

1 Snap CUBELITE in a .250 inch panel hole.



2 Holding CUBELITE firmly to panel, insert LED into CUBELITE from the back. Installs in just 6 seconds.

SPECIFICATIONS

MATERIAL Lens — Polycarbonate; Spacer — Nylon, (U.L. Listed plastics).

DESIGN Square lens, standard and low profile, fresnel rings and striated lines.

MOUNTING Mounts thru front of panel. Mounting holes should be deburred but not chamfered.
T1 size (SMQ 250) mounts in a .171+/-.002 (4.34mm) hole on 1/4" centers. Panel thickness from 1/16" to 1/8".
T1 3/4 size (SQL 360) mounts in a .250+/-.002 (6.35mm) square punched hole on 3/8" centers. Panel thickness from 1/16" to 1/8".
T1 3/4 size (SQB 400) mounts in .250+/-.002 (6.35mm) round hole on 3/8" centers. Panel thickness from 1/32" to 1/4"; (for panels less than 3/16", optional spacer SPC 125 is available).
Standard metal or plastic washers can be used to increase panel thickness if necessary.

PUNCH SOURCES Porter Precision, Cincinnati, OH; Strippet, Houdaille Ind., Akron, NY; Unipunch Products, Buffalo, NY; Wiederman Co., King of Prussia, PA

ORDERING CODES

SQL 360 RTP

MODEL
SMQ 250 (T1 Size) L/Profile
SQB 400 (T1 3/4 Size) L/Profile
SQL 360 (T1 3/4 Size) Std. Hgt.
SPC 125 (Spacer for SQB 400)

COLOR

RTP Red Transparent	BTP Blue Transparent
ATP Amber Transparent	YTP Yellow Transparent
GTP Green Transparent	CTP Clear Transparent

OEM PRICES

QUANTITY	100	500	1000
SMQ 250	.18	.15	.12
SQL 360	.22	.18	.15
SQB 400	.19	.16	.13
SPC 125	.03	.027	.023

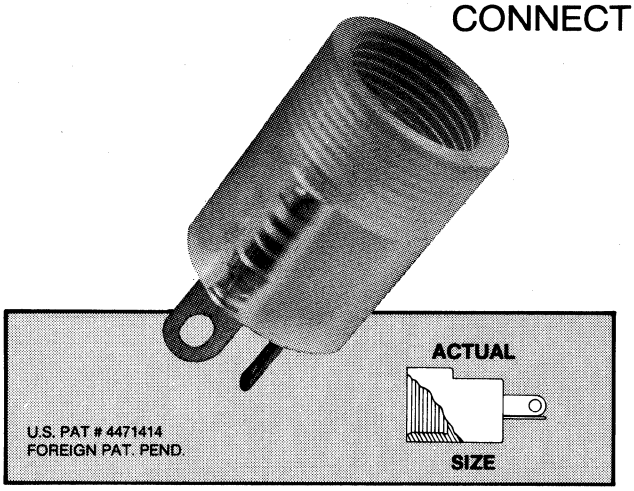
All colors can be combined for price advantage per line item. For higher quantity pricing contact VCC. Prices subject to change without notice.

MINIATURE INDICATORS

VISUAL COMMUNICATIONS COMPANY, INC.
7920-G Arjons Drive San Diego, CA 92126 U.S.A. IN CA (619) 549-6900
FAX (619) 549-3520 Toll Free (800) 522-5546

CONXRITE®

SIMPLIFIED METHOD FOR CONNECTING PANEL MOUNTED T1 3/4 LEDs



DESIGN — CONXRITE has a molded plastic body with self-contained 1/4 watt resistor. When an external resistor is required or desired, CONXRITE is available without the built-in resistor.

VERSATILITY — CONXRITE, with or without the ballast resistor, can be used on circuits from 3 to 28 volts. Panel thickness can vary from 1/32 to 1/4 inch. Makes positive connection with either CLIPLITE (CLF 280, CLB 300), CUBELITE (SQB 400) lens/mounts or clip & ring mount.

INSTALLATION — CONXRITE requires no assembly tools and provides a simple, fast, press-fit connection. Eliminates direct hard-wiring with potential heat damage to the LED during final assembly.

COST-EFFECTIVENESS — CONXRITE enables pre-assembly of wiring harness precluding the need for hard-wiring directly to the LEDs. Permits easy replacement of defective LEDs in final test and field service. CONXRITE helps lower labor costs.

SPECIFICATIONS

MATERIAL: Housing - Polypropylene (natural).
Terminals - Phosphor bronze, tin plated.
Resistor - 1/4 watt resistor values provides current limiting to 28 volts.

MOUNTING: Mates with CLF 280 and CLB 300 CLIPLITE, SQB 400.
CUBELITE and the clip portion of the clip and ring mount. See specs on the CLIPLITE and CUBELITE.
Panel Thickness - CLF 280 and clip mount, .110 (2.79mm) max; CLB 300 and SQB 400, .250 (6.35mm) max. (panels less than 3/16", SPC 125 spacer available).
Soldering - Caution, excessive heat applied to contacts may cause damage to the plastic body.
Hole Size - All mounts .250 +/-.002 (6.35mm). Hole should be deburred but not chamfered.
NOTE: Trim LED leads to .275 +/-.010 (6.99mm).

ORDERING CODES

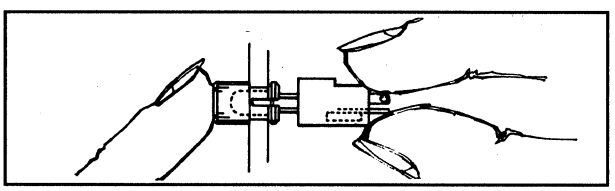
CNX 310 012

MODEL _____

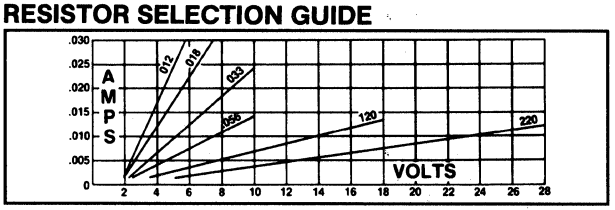
RESISTOR CODE _____

CODE	VALUE	CODE	VALUE
000	NO RESISTOR	056	560 OHMS
012	120 OHMS	120	1200 OHMS
018	180 OHMS	220	2200 OHMS
033	330 OHMS		

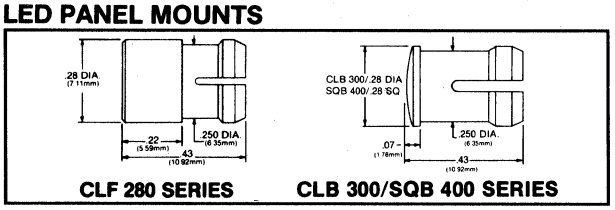
EASY INSTALLATION



RESISTOR SELECTION GUIDE



LED PANEL MOUNTS



CLF 280 SERIES **CLB 300/SQB 400 SERIES**

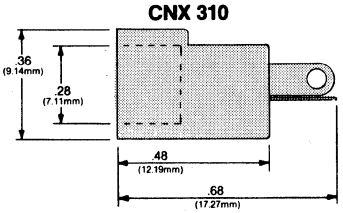
OEM PRICES

QUANTITY	100	500	1000
CNX 310 Without Resistor	.55	.47	.39
CNX 310 Without Resistor	.72	.62	.52

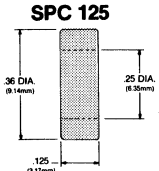
All units and values can be combined for price advantage. For higher quantity pricing contact VCC. Prices subject to change without notice.

OUTLINE DRAWING

CNX 310

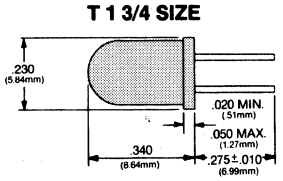


SPC 125



RECOMMENDED LED

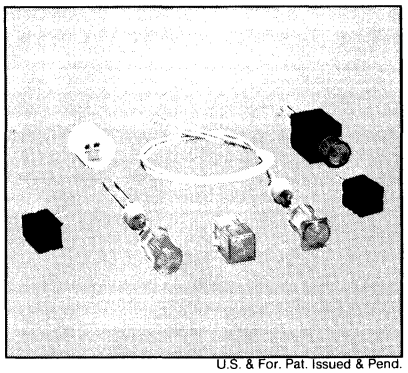
T 1 3/4 SIZE



VCC MINIATURE INDICATORS

VISUAL COMMUNICATIONS COMPANY, INC.

7920-G Arjons Drive San Diego, CA 92126 U.S.A. IN CA (619) 549-6900
FAX (619) 549-3520 Toll Free (800) 522-5546



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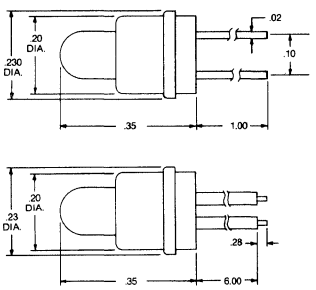
OUTLINE DRAWINGS



USE WITH

CLB 300	CNX 310 000
CLF 280	PCR 740
SQB 400	PCH 330
SQL 360	PCV 340

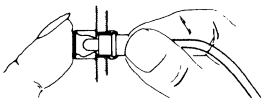
CLIPLITE® ROUND CUBELITE® SQUARE / INCANDESCENT INDICATORS

FEATURES

- Installs with finger pressure — no tools — takes only 6 seconds
- Provides 180 degrees of visibility using transparent lenses
- Bi-Pin or wire lead lamps easily installed or replaced
- Produces a brighter display than LEDs — provides extremely long life

SIMPLE TWO-STEP INSTALLATION

1 Snap lens into panel hole.



2 Holding lens firmly to panel, insert lamp into lens mount from the back. Installs in just 6 seconds.

SPECIFICATIONS

LAMPS Aged and selected, Bi-Pin base or 6" insulated wire leads. Voltages 5v, 14v and 28v. IC compatible lamp also available.

MOUNTING Lamps have special base for use with VCC's lenses, connectors and PCB mounts.

LENSES CLIPLITE (round), CUBELITE (square), standard and low profile, mount in .250 hole, panels from 1/32" to 1/4" thickness.

CONNECTORS CONXRITE, provides a fast press-fit connection to lamps mounted in CLIPLITE & CUBELITE lenses.

PCB MOUNTS/SOCKETS P-C-LITE, methods of attaching lamps vertically and horizontally to PCBs. See CLIPLITE, CUBELITE, CONXRITE and P-C-LITE data.

ORDERING CODES

05 020 PIN

LAMP VALUES

VOLTS	AMPS	MSCP	LIFE HRS.
05	020	.02	25,000
05	060	.05	100,000
14	040	.14	16,000
28	024	.15	16,000

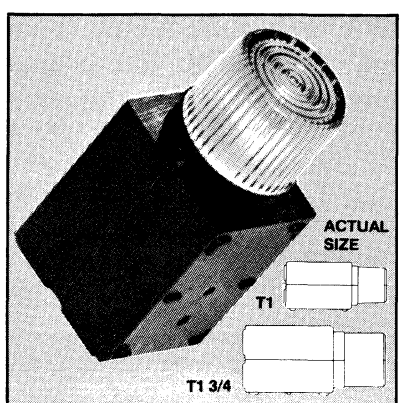
LAMP BASE

W6 (6" WIRE LEADS)
PIN (BI-PIN)

OEM PRICES

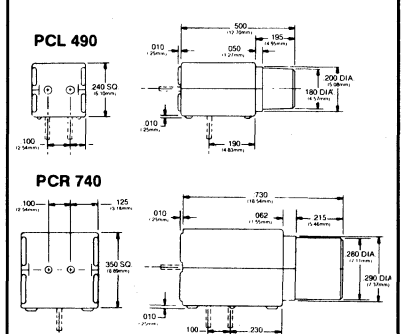
QUANTITY	1	50	100	500	1000
05 020	1.14	1.03	.92	.80	.69
05 060	1.07	.96	.86	.75	.65
14 040	1.37	1.23	1.10	.96	.83
28 024	2.24	2.02	1.80	1.57	1.35

For higher quantity pricing contact VCC.
Prices subject to change without notice.



U.S. & For. Pat. Issued & Pend.

OUTLINE DRAWINGS



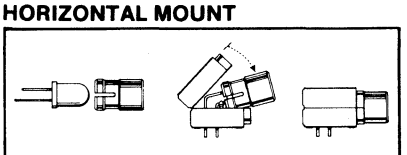
RECOMMENDED LEDs
See Cliplite Lens Data Page.

P-C-LITE® PCB MOUNTS FOR T1 & T1 3/4 LEDs

FEATURES:

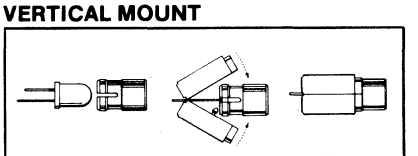
- Wave solders horizontally or vertically without special jigs or fixtures
- Stabilizes LED during packaging and physically protects after assembly
- Mounts flush, recessed or fully extended thru display panel without attachments
- Height compatible with switches and other circuit board mounted components
- Increases LED apparent brightness and viewing angle up to 180 degrees
- Guards against IC damage by electrostatic discharge transmitted thru exposed LED

HORIZONTAL MOUNT



Snap LED into lens — insert LED leads through holes in mount base — close mount, bending leads into position.

VERTICAL MOUNT



Snap LED into lens — insert LED leads through holes in mount — close mount.

SPECIFICATIONS

BODY — General purpose nylon (black).

LENS — Plycarbonate. Flat top design using fresnel rings and striated lines.

MOUNTING — P C Board horizontally or vertically on .100 inch hole centers.

(PCL 490) Panel thickness from 1/64" to 3/16" thru a 7/32" clearance hole.

(PCR 740) Panel thickness from 1/32" to 9/32" thru a 5/16" clearance hole.

Permits full projection to flush mounting of the lens portion thru the panel.

LED Standard LEDs. See Cliplite Lens Data Page for dimensional infomation. No attempt should be made to bend a lead with a stepped thickness.

ORDERING CODES

PCL 490 RTP

MODEL
PCL 490 (T1 SIZE)
PCR 740 (T1 3/4 SIZE)

COLOR

RTP Red Transparent	YTP Yellow Transparent
ATP AmberTransparent	CTP Clear Clear Transparent
GTP Green Transparent	BTP Blue Transparent

OEM PRICES

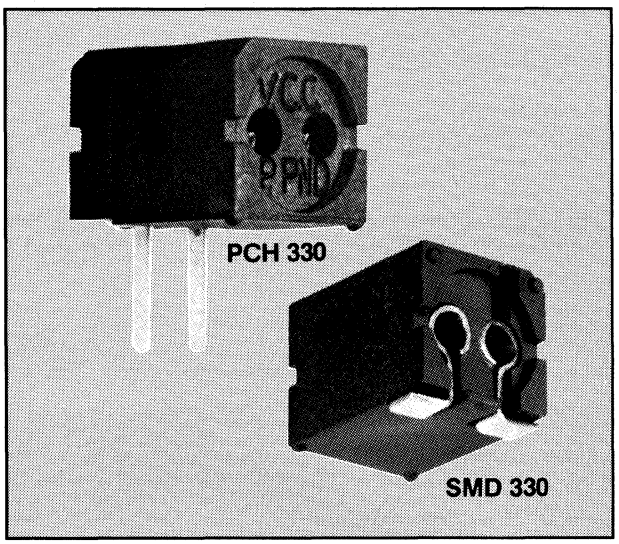
QUANTITY	100	500	1000
PCL 490	.38	.32	.26
PCR 740	.41	.35	.28

All colors can be combined for price advantage per line item. For higher quantity pricing contact VCC. Prices subject to change without notice.

VCC MINIATURE INDICATORS

VISUAL COMMUNICATIONS COMPANY, INC.
7920-G Arjons Drive San Diego, CA 92126 U.S.A. IN CA (619) 549-6900
FAX (619) 549-3520 Toll Free (800) 522-5546

P-C-LITE® CIRCUIT BOARD SOCKETS FOR LEDs



US & FOREIGN PAT. ISSUED & PEND.

APPLICATION — P-C-LITEs are used as circuit board mounting sockets for status, logic, fault, detection lights. Also used for back panel lighting, front panel function lights and mounting of photodetection type devices.

VERSATILITY — P-C-LITEs are relampable, no direct soldering to LED. PCH and SMD series mount horizontally, PCV series mounts vertically. The PCV can be installed on one side of the PCB while the LEDs are inserted from the reverse side of the board.

DESIGN — P-C LITEs are manufactured from UL listed thermoplastics. LEDs can be inserted from either end of these sockets. Unique contact design permits automatic adjustment to the various sizes and shapes of LED leads. Also accommodate IR emitters, phototransistors and incandescent bi-pin lamps.

INSTALLATION — P-C-LITEs are wave soldered (PCH/PCV) or surface mounted (SMD) to PCB along with other components. Sockets are provided with polarity identification. Molded standoffs permit easy board cleaning. Lock-type security for component leads in high vibration and shock environments.

SPECIFICATIONS

MATERIALS: HOUSING - U.L. listed thermoplastic (black).
CONTACTS - Phosphor bronze, tin plated.

MOUNTING: PCH Series - Thru hole, horizontal mounting sockets, .035 (.89mm) holes on .100 (2.54mm) centers.
(see pattern on next page)

SMD Series - Surface mount, horizontal mounting sockets, .060 (1.52mm) X .060 (1.52mm) component pad size.
(see pattern on next page)
SMD 330 available on tape/reel.

PCV Series - Thru hole, vertical mounting sockets, .035 (.89mm) holes on .100 (2.54mm) centers with optional .060 (1.52mm) holes for opposite side mounting. Same side mounting, delete the .060 holes.
(see pattern on next page)

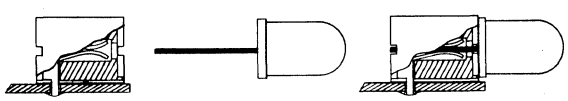
SPACER - Bivar, Series 908 nylon spacers or equal.

LED DATA: Type - T1 or T1 3/4 sizes.
Leads - Min. .017 (.43MM) round or square. Max. .030 (.76mm) thickness - .040 (1.02mm) width.

LED LEAD DIMENSIONS

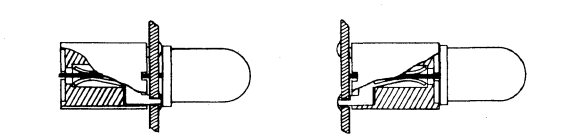
MINIMUM - .017 (.43mm) round or square shape.
MAXIMUM - .030 (.76mm) thickness - .040 (1.02mm) width

HORIZONTAL MOUNT PCH & SMD SERIES



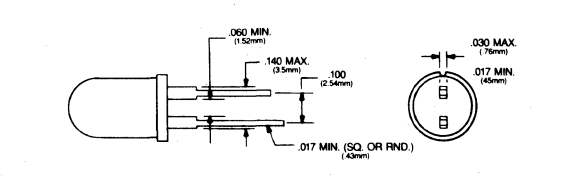
Insert LED - trim LED or bend LED leads for security.

VERTICAL MOUNT PCV SERIES



Opposite Side Mounting | Same Side Mounting

LED LEAD DIMENSIONS



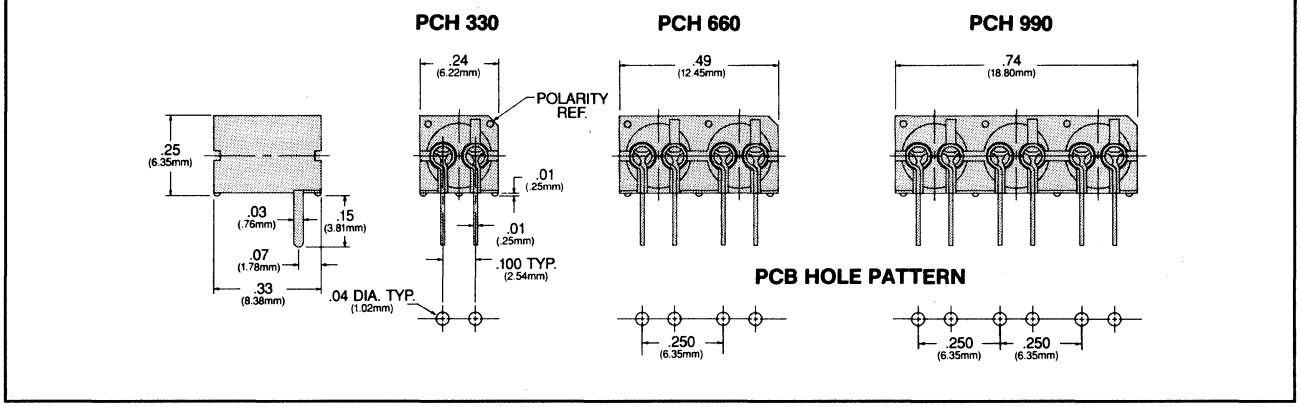
VCC MINIATURE INDICATORS

VISUAL COMMUNICATIONS COMPANY, INC.

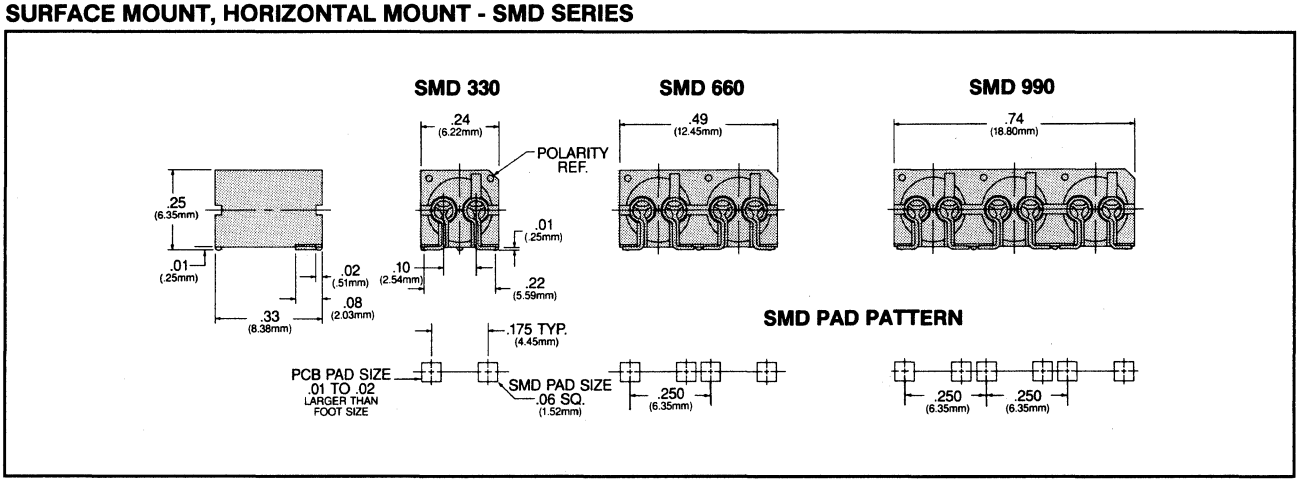
7920-G Arjons Drive San Diego, CA 92126 U.S.A. IN CA (619) 549-6900
FAX (619) 549-3520 Toll Free (800) 522-5546

P-C-LITE® OUTLINE DRAWINGS & ORDERING CODES

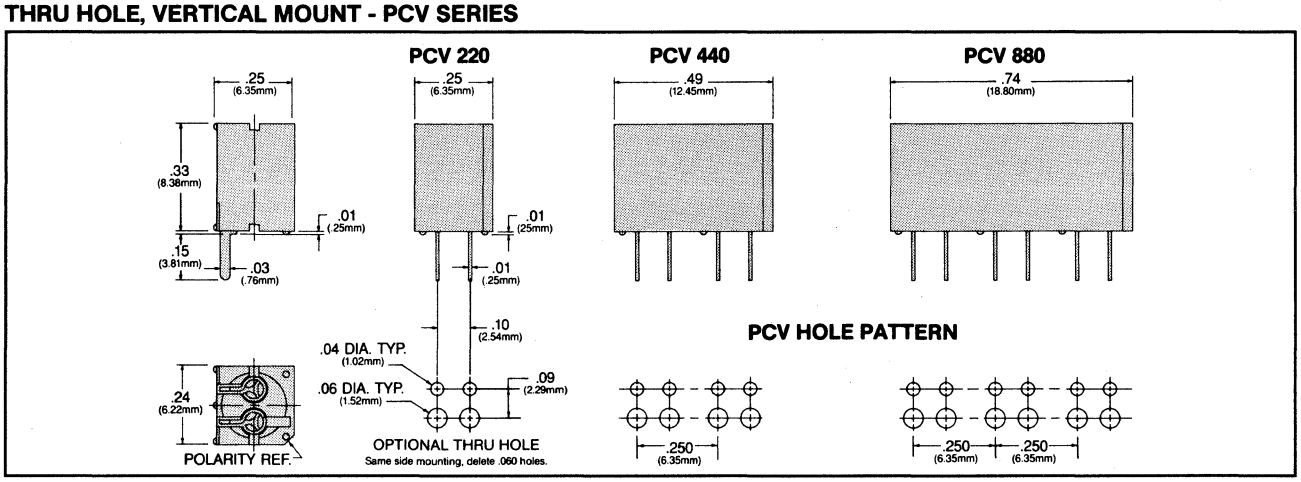
THRU HOLE, HORIZONTAL MOUNT - PCH SERIES



SURFACE MOUNT, HORIZONTAL MOUNT - SMD SERIES



THRU HOLE, VERTICAL MOUNT - PCV SERIES



OEM PRICES											
QUANTITY	100	500	1000		100	500	1000		100	500	1000
PCH 330	.47	.41	.36	SMD 330	.47	.41	.36	PCV 220	.47	.41	.36
PCH 660	.70	.62	.53	SMD 660	.70	.62	.53	PCV 440	.70	.62	.53
PCH 990	1.09	.96	.84	SMD 990	1.09	.96	.84	PCV 990	1.09	.96	.84

For higher quantity pricing contact VCC. Prices subject to change without notice.

DATA LINKS

Receivers

Manufacturer	Starting EEM Page No.	Unidirectional	Bidirectional	Light Source	Bit Rate (NRZ)	Rise time/Fall time (ns) (typical)	Operating Temperature
Dymec Inc.	B•1206		√	LED	100K Baud	30V/µs max	0°C - 30°C
Interoptics	B•1214	√	√	650nm, 850nm	100KB/sec-20Mb/sec		-40°C - +100°C
Litton Poly-Scientific	B•1208	√					
Meret Corp.	B•1215			PIN, APD	Analog to 2GHz up to 200Mb/sec		0°C - 55°C
Optelcom Inc.	B•1216	√	√		6Hz - 75MHz Analog D.C. to 20Mb/sec Digital		-20°C - +60°C
Ross Engineering	B•1217	√		LED 850nm	20Mb/sec	35	0°C - 40°C
Sharp Electronics/ Microelectronics Div.	B•1218	√ √	√ √	LED Laser Diode	8Mb/sec 32Mb/sec	30	-20°C - +70°C -20°C - +50°C

Transmitters

Manufacturer	Starting EEM Page No.	Unidirectional	Bidirectional	Light Source	Bit Rate (NRZ)	Rise Time/Fall Time (ns) (typical)	Operating Temperature
Dymec Inc.	B•1206		√	LED	100K baud	30V/µs max	0°C - 70°C
Interoptics	B•1214	√	√	650nm, 850nm LED	100Kb/sec - 20Mb/sec	6	-40°C - +100°C
Litton Poly-Scientific	B•1208	√					
Meret Corp.	B•1215			LED, Laser	Analog to 2GHz up to 200Mb/sec		0°C - 55°C
Optelcom Inc.	B•1216	√	√	LED, Laser	6Hz - 75MHz Analog D.C. to 20Mb/sec Digital		-20°C - +60°C
Ross Engineering	B•1217	√		LED 850nm	20Mb/sec	35	0°C - 40°C
Sharp Electronics, Microelectronics Div.	B•1218	√ √	√ √	LED Laser Diode	8Mb/sec 32Mb/sec	30	-20°C - +70°C -10°C - +50°C

CABLE

Loose Tube

Manufacturer	Starting EEM Page No.	General Purpose			Heavy Duty (Direct Burial)			Telecommnications (Aerial)			Multipurpose		
		All Glass		PCS	All Glass		PCS	All Glass		PCS	All Glass		PCS
		Single Mode	50–100 Micron	200 Micron	Single Mode	50-100 Micron	200 Micron	Single Mode	50–100 Micron	200 Micron	Single Mode	50–100 Micron	200 Micron
Interoptics	B•1214	√	√	√	√	√	√	√	√	√	√	√	√

Tight Buffer

Manufacturer	Starting EEM Page No.	Standard			Plenum			Breakout		
		All Glass		PCS	All Glass		PCS	All Glass		PCS
		Single Mode	50–100 Micron	200 Micron	Single Mode	50-100 Micron	200 Micron	Single Mode	50–100 Micron	200 Micron
Interoptics	B•1214	√	√	√	√	√	√	√	√	√

CONNECTORS

Manufacturer	Starting EEM Page No	Style (Diamond, SMA, NTT, DIN47256, etc.)	Single Mode	Multi-mode	Inner diameter range	Connecting Loss (dB)
Interoptics	B•1214	(all)	√	√	125µ - 128µ	0.3dB typ.
Litton Poly-Scientific	B•1208		√			

DIODES

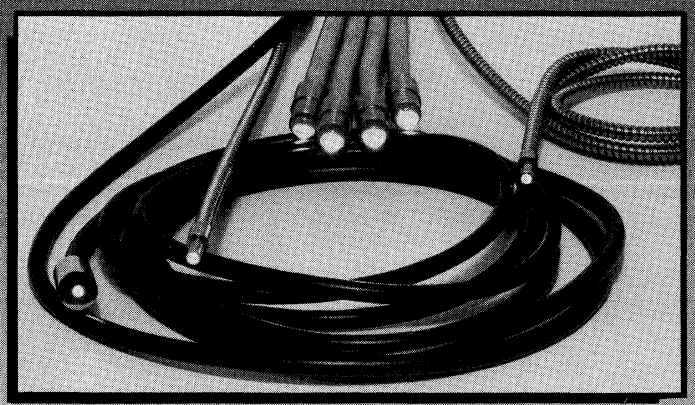
Manufacturer	Starting EEM Page No.	Wavelength (nm)	Output Power (mW) Typical	Rise time/Fall time (ns) (Typical)	Type
Dymec Inc.	B•1206	820	30µW	6	LED, GaAlAs
Interoptics	B•1214	650, 850	5 - 10µW	6	LED, GaAlAs
Meret Corp.	B•1215	820, 1300			
Optelcom Inc.	B•1216	850, 1300	-16dBm		LED, Laser
Sharp Electronics, Microelectronics Div.	B•1218	660, 780	1, 3	100, 1	GaAlAs

TWENTY YEARS OF EXPERIENCE

Fiberoptic Systems, Inc.

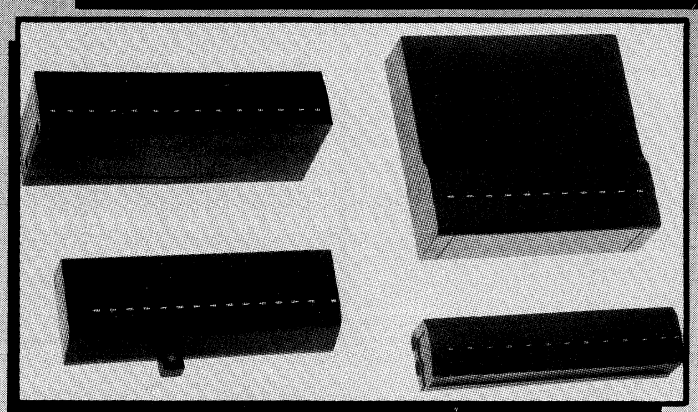
manufactures a broad range of custom-designed, high loss, short distance fiber optics-based products with diverse applications. We will work with you in the concept and design of any device that involves optical sensing or transmission and will manufacture single prototypes or large production runs. Most prototypes are shipped within one week of design completion.

Our sales engineers are available to answer all inquiries immediately.



■ *Randomized Light Guides*

Sophisticated, creative custom light guides and scanning devices for every need...



■ *Reflective Multi-Channel Custom Read Heads*

FREQUENT APPLICATIONS FOR FSI PRODUCTS:

REFLECTIVE READERS
- Single or multichannel
- Bar code readers
- Lottery ticket readers
- Pattern recognition
- Edge detectors

ILLUMINATION
- QC and inspection
- Signalization
- Custom microscope lights
- Optical curing (UV light)
- Surgical illumination

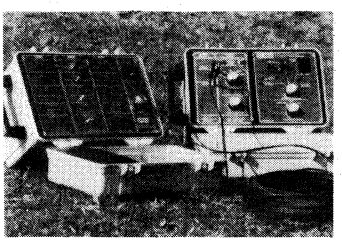
PHOTOELECTRIC CONTROLS
- Microfiche
- Missing parts detection
- Automatic inspection
- Sorting
- Fracture detection

Fiberoptic Systems, Inc.

4680-B East Los Angeles Avenue • Simi Valley, California 93063

(805) 583-2088 **FAX: (805) 583-4018**

To Solve HV Isolation, EMI/RFI, Follow Our 5 Step Procedure &



It's never been easier to solve system integration and interconnection problems using fiber optic links and modems. With this easy-to-use technology, you can determine what link or modem you need simply from the tables on these pages. This 5 step procedure will lead you to the right model every time. Select:

Analog (Link)
1. Signal Bandwidth (Input)
2. Transmission Distance
3. Usage
4. Power Source
5. Signal Amplitude (Output)

Digital (Modem)
1. Interconnect
2. Data Protocol
3. Transmission Distance
4. Power Source
5. Key Features

If you'd like more information about a specific link or modem, or if you have requirements that are not addressed by one of these products, assistance is only a telephone call away.

Analog Instrumentation Links

1 Signal Bandwidth	2 Transmission Distance	3 Usage
DC to 1MHz	1,000 Meters	Bench/Lab/Stand-alone
		OEM/PC Board Mount
	500 Meters	Field Instrument
DC to 10kHz	1,000 Meters	OEM/PC Board Mount
	500 Meters	OEM/PC Board Mount
		Bench/Lab/Stand-alone
	50 Meters	OEM/PC Board Mount
Current Loop	1,000 Meters	OEM/Industrial

Digital Communication Modems

1 Interconnect	2 Data Protocol	3 Transmission Distance
Computer to Computer Computer to Peripheral SCADA to SCADA Electronic Meter to Processor	RS232C, 485 and others	2,000 Meters
Computer to Telephone Line SCADA to Telephone Line Electronic Meter to Telephone Line	RS232C	1,000 Meters

DYMEC *Quality In...*
- High Resolution Data Conversion
- Analog Custom Manufacturing & Engineering
- Measurement & Control Using Analog Fiber Optics

& Ground Loop Problems Easily... Call DYMEC at (617) 729-7870.

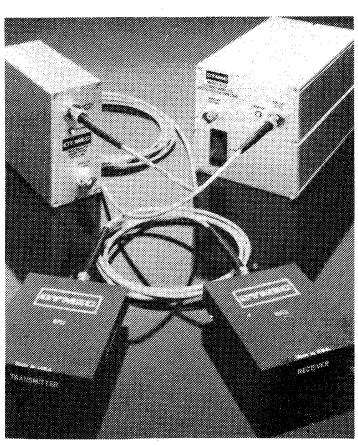
4 Power Source	5 Signal Amplitude	Order Model Transmitter/Receiver
±15V, +5V DC	±1V, ±5V,±10V Single-ended ±1V, ±5V,±10V Differential	6711/6712 6713/6712
115VAC	±1V, ±5V,±10V Single-ended ±1V, ±5V,±10V Differential	6721/6722 6723/6722
220VAC	±1V, ±5V,±10V Single-ended ±1V, ±5V,±10V Differential	6731/6732 6733/6732
±15V, +5V DC	±1V, Single-ended ±5V, Single-ended ±10V, Single-ended ±1V Differential ±5V Differential ±10V Differential	5711/5712 5714/5715 5717/5718 5719/5712 5720/5715 5721/5718
Internal Battery, 12VDC or 115VAC	±10V, ±30V,±120V or 1KVAC, Differential	AIS™ Series One™
±15V, +5V DC	±1V Single-ended ±5V Single-ended ±10V Single-ended ±1V Differential ±5V Differential ±10V Differential	5601/5602 5604/5605 5607/5608 5614/5602 5615/5605 5616/5608
+5.5V to +15V DC; 3.6mW	±500mV, Single-ended	5611/5612
Self-Powered (4500 Hr. Battery Pack)	±500mV, Single-ended	5651/5652
+11.5V to +20V DC	±1V, ±0.5V,+1V , +2V	5661/5662
+11.5V to +20V DC (Optional Battery Pack Available)	±1V, ±5V, ±10V Single-ended; 1-Ch ±1V, ±5V, ±10V Single-ended; 2- Ch ±1V, ±5V, ±10V Single-ended ; 3- Ch ±1V, ±5V, ±10V Single-ended; 4- Ch	6611/6621 6612/6622 6613/6623 6614/6624
loop powered; transmitter ±15V; receiver	4-20mA Current Loop In/Out	5911/5912

NOTE
Transmitters and receivers within these model families may be intermixed with regards to power source, usage, and/or signal amplitude. Example: A ±1VFS, board-mount transmitter (5711) may be connected to a ±10V output, AC powered, stand-alone receiver (6732).

SEE NOTE

SEE NOTE

4 Power Source	5 Key Features	Order Model Transmitter/Receiver
Computer Port Optional AC Wall Adapter	Complete Isolation Complete EMI/RFI Immunity Complete Data Security Transparent Operation	5810 Series
Computer Port Battery Power Pack Optional AC Wall Adapter Optional Solar Power	Full-function Hayes® Modem Complete Isolation Complete EMI/RFI Immunity Transparent Operation	Iso-Modem™ (Data only) or Iso-Comm™ (Voice/Data)



DYMEC INCORPORATED ❒ 8 Lowell Avenue ❒ Winchester, MA 01890
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DYMEC

Litton

Poly-Scientific

Fiber Optic Products
1213 North Main Street
Blacksburg, Virginia
24060-3100

800-336-5917, FAX 703-953-1841
TWX 710-875-3694

From Fiber Optic Components to Complete System Engineering Capabilities... We Speak the Language of Light

Building on thirty years of experience in the design and manufacture of precision, miniature electronic assemblies, Litton Poly-Scientific has become a recognized supplier for a broad range of fiber optic components and systems. From simple point-to-point links to complex data bus or LAN networks, our expertise covers a wide variety of digital and analog data transmission systems for military, industrial and commercial applications.

We can work to your specifications or design and manufacture systems or sub-systems to meet your specific requirements.

Our active components include transmitters, receivers, transceivers and repeaters in traditional, hybrid and rack-mounted versions. Passive components include WDMs, low loss couplers, fiber optic rotary joints and extensive experience with various fiber types, cable harnesses and connectors.

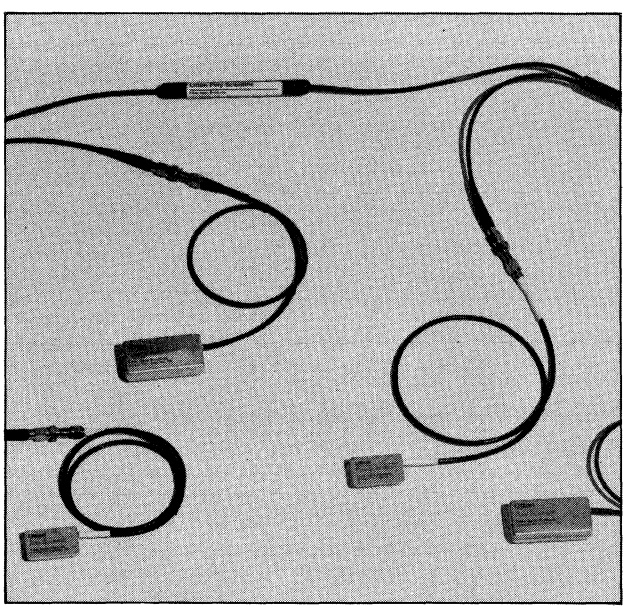
The following pages are designed to give you an overview of our product and systems capabilities.

Fiber Optic Data Bus and Sensor Systems for Land, Sea, Air and Space Applications

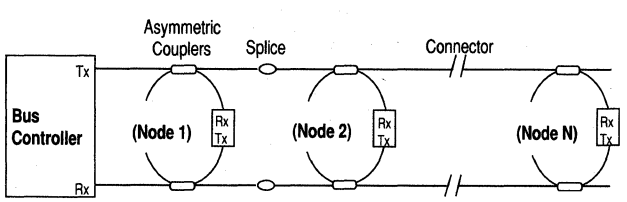
Because of the inherent advantages of fiber when compared to hardwire communication networks, Litton has pioneered the research and development of single and dual fiber linear data bus technology. Recent progress in improving both active and passive components for access on and off the bus has resulted in the viability of this topology for a variety of large system applications. For each node, our hybridized digital transmitters and receivers feature high launch power, superior sensitivity and wide dynamic range. The extremely low excess loss of our bi-directional couplers has dramatically increased the number of system taps.

When compared to token ring or star topologies, a linear bus offers many unique advantages. From the standpoint of installation, modification and future growth, the simple architecture of the linear bus makes it a more cost-effective option. The star requires home-runs of fiber from a central location to each node. If the star is damaged, it is highly probable that a significant portion of the bus will become inoperative. In addition, the star is labor and material intensive. Although the ring (particularly those involving token passing protocols) addresses these concerns, it retains the potential for data transfer problems. These include accumulated jitter, additive effects of error and bypassing failed devices on the bus.

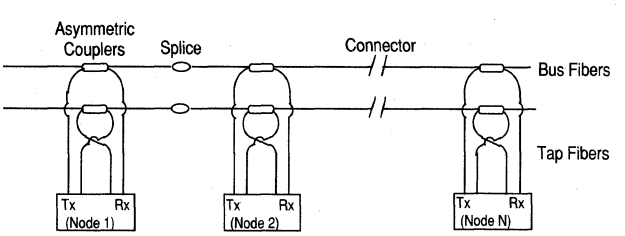
We are familiar with a wide variety of data bus topologies including MIL-STD-1773, ARINC 629 (DATAC), and HSDB. Let us put our experience and expertise to work for your next system application.



MIL-STD-1773 Single Fiber Linear Data Bus



Dual Fiber Linear Data Bus



Call us toll-free at **800-336-5917** (in Virginia, call 703-953-4751) for more information.

Litton

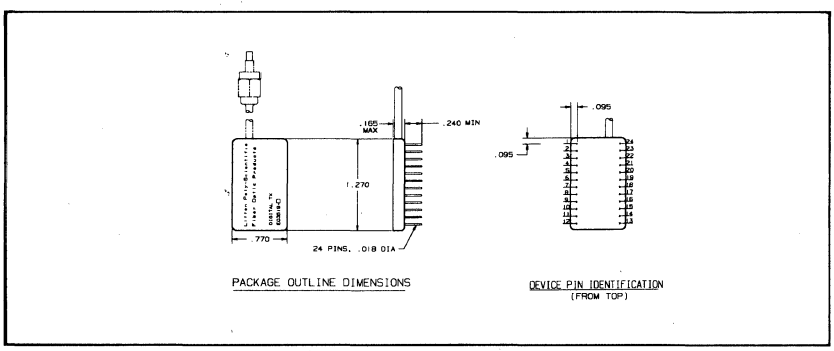
Poly-Scientific

Fiber Optic Products
1213 North Main Street
Blacksburg, Virginia
24060-3100

800-336-5917, FAX 703-953-1841
TWX 710-875-3694

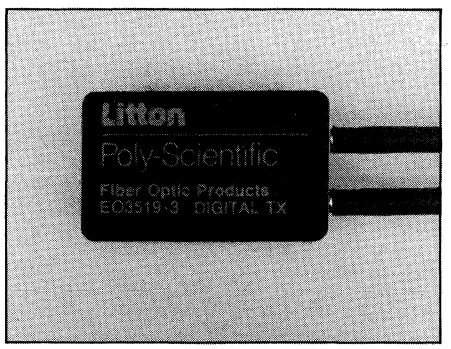
Miniature, Hybridized Transmitters and Receivers for Point-To-Point and Data Bus Applications

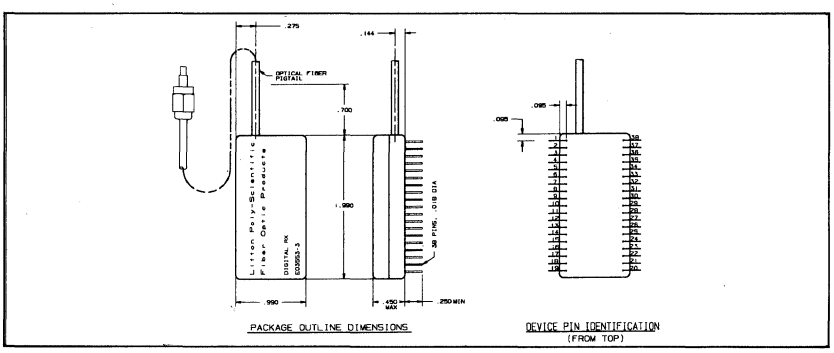
AC or Edge-coupled with data rates up to 50 Mbps Manchester. Transmitters with high launch power, and receivers with superior sensitivity and broad dynamic range. TTL and ECL compatible (interface circuits may be required). Qualifiable to MIL-STD-883. Due to ongoing development, specifications are subject to change.



PACKAGE OUTLINE DIMENSIONS

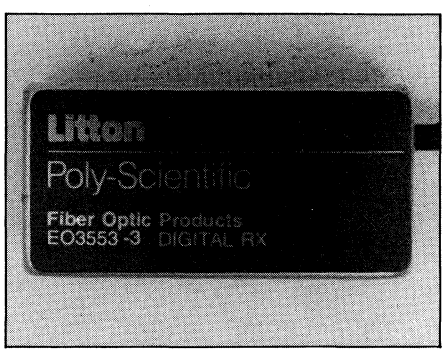
DEVICE PIN IDENTIFICATION (FROM TOP)





PACKAGE OUTLINE DIMENSIONS

DEVICE PIN IDENTIFICATION (FROM TOP)



Type	Data Rate	Part No.	Electrical Interfaces	Dynamic Range (min)	Peak Launch Power Into 100μ Fiber	Peak Rx Sensitivity (min)	Wavelength	Supply Voltage Requirements	Special Features
Hybrid Digital Tx	DC to 50 Mb/s Manchester Encoded	EO3519-X *	+/- 3V differential	N/A	-7dBm	N/A	850nm	+/- 5	
Hybrid Digital Rx AC coupled	50 Mb/s Manchester Encoded	EO3546-1 **	ECL	20dB	N/A	-34dBm 10^{-9} BER	850nm	+/- 5 +/- 15	• 16 bit preamble required for Burst Manchester
Hybrid Digital Rx AC coupled	20 Mb/s Manchester Encoded	EO3546-2 **	ECL	20dB	N/A	-36dBm 10^{-9} BER	850nm	+/- 5 +/- 15	• 16 bit preamble required for Burst Manchester
Hybrid Digital Rx Edge coupled	Up to 2 Mb/s Manchester Encoded	EO3553-1 **	TTL	20dB	N/A	-42dBm 10^{-9} BER	850nm	+/- 5 +/- 15	• Fanout 5 LS loads • DATAC compatible • Burst Manchester
Hybrid Digital Rx Edge coupled	Up to 1 Mb/s Manchester Encoded	EO3553-2 **	TTL	20dB	N/A	-42dBm 10^{-9} BER	850nm	+/- 5 +/- 15	• MIL-STD-1773 Compatible • Fanout 5 LS loads • Burst Manchester
Hybrid Digital Rx Edge coupled	Up to 4 Mb/s NRZ	EO3553-3 **	TTL	20dB	N/A	-42dBm 10^{-9} BER	850nm	+/- 5 +/- 15	• Fanout 5 LS loads • Burst Manchester
Hybrid Digital Rx Edge coupled	Up to 20 Mb/s NRZ	EO3553-4 **	TTL	20dB	N/A	-35dBm 10^{-9} BER	850nm	+/- 5 +/- 15	• Burst Manchester
Hybrid Digital Rx Edge coupled	Up to 50 Mb/s Manchester Encoded	EO3553-5 **	ECL	20dB	N/A	-28dBm 10^{-9} BER	850nm	+/- 5 +/- 15	• Burst Manchester

* -X denotes LED type, number of LEDs, launch power and fiber type.
** dash numbers will vary depending on fiber type, fiber length, number of detectors and connector type.

Call us toll-free at **800-336-5917** (in Virginia, call 703-953-4751) for more information.

Litton

Poly-Scientific

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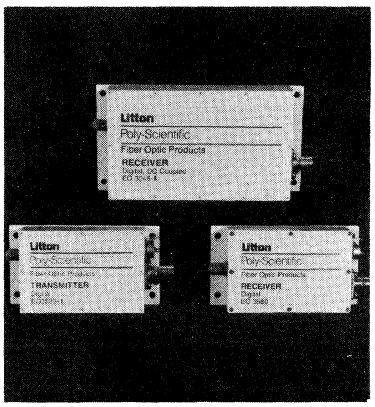
1213 North Main Street
Blacksburg, Virginia
24060-3100

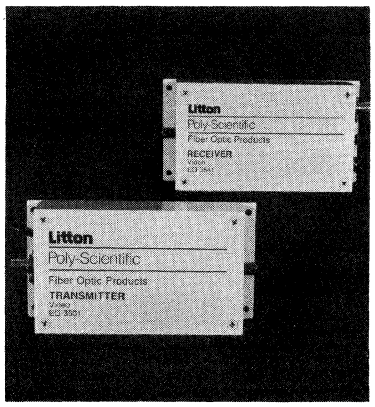
800-336-5917, FAX 703-953-1841
TWX 710-875-3694

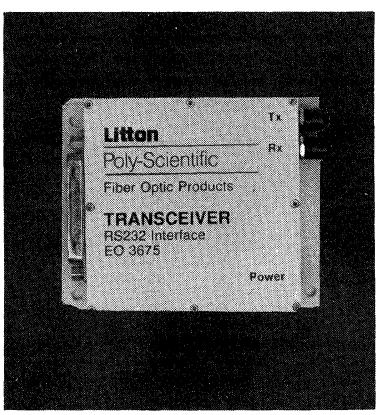
Traditional Transmitters and Receivers for Standard or Custom Applications

Many of our transmitters and receivers are custom-built according to the special needs of our customers. Listed below are representative examples. A variety of packaging and connector options are available. Transmitters and receivers available with 1300nm sources and detectors.

- **Analog systems**
- **Digital systems**
- **Video systems**
- **RS 232 and RS 422**







Type	Data Rate	Part No.	Electrical Interfaces	Dynamic Range (min)	Peak Launch Power Into 100μ Fiber	Peak Rx Sensitivity (min)	Wavelength	Supply Voltage Requirements	Package Dimensions	Special Features
Video Tx	Link Bandwidth 5Hz-10 MHz	EO3501-1	RS 170	N/A	-10dBm Flat Field	N/A	850nm	110 VAC power supply included	1"x5"x3"	For use with EO3541-1
Video Rx		EO3541-1	RS 170	8dB	N/A	-32dBm	850nm	110 VAC power supply included	1"x5"x3"	For use with EO3501-1
Digital Tx	DC-50Mb/s NRZ	EO3520	50 ohm Terminated 3V max	N/A	-10dBm	N/A	850nm	+/- 5	1"x3"x2"	For use with EO3560 or EO3548
Digital Rx	100 Kb/s to 50 Mb/s NRZ	EO3560	TTL	15dB	N/A	-32dBm 10^{-9} BER	850nm	+/- 5	1"x3"x2"	For use with EO3520
Digital Rx Edge Coupled	Up to 12 Mb/s NRZ	EO3548-1 *	TTL	20dB	N/A	-35dBm 10^{-9} BER	850nm	110 VAC power supply included	1"x5"x3"	
Digital Rx Edge Coupled	Up to 12 Mb/s NRZ	EO3548-2	TTL	8dB	N/A	-45dBm 10^{-9} BER	850nm	110 VAC power supply included	1"x5"x3"	APD detector
RS 232 Tx/Rx	DC to 100 Kb/s NRZ	EO3675	RS 232	25dB	-10dBm	-34dBm 10^{-9} BER	850nm	110 VAC power supply included	1"x3"x3"	One pair constitutes a set
RS 422 Tx/Rx	DC to 100 Kb/s NRZ	EO3674	RS 422	25dB	-10dBm	-35dBm 10^{-9} BER	850nm	110 VAC power supply included	1.3"x3"x3"	• Suitable for star coupler (LAN) • DTE or DCE • One pair constitutes a set

* Lower data rates are available with improved sensitivity.

Litton

Poly-Scientific

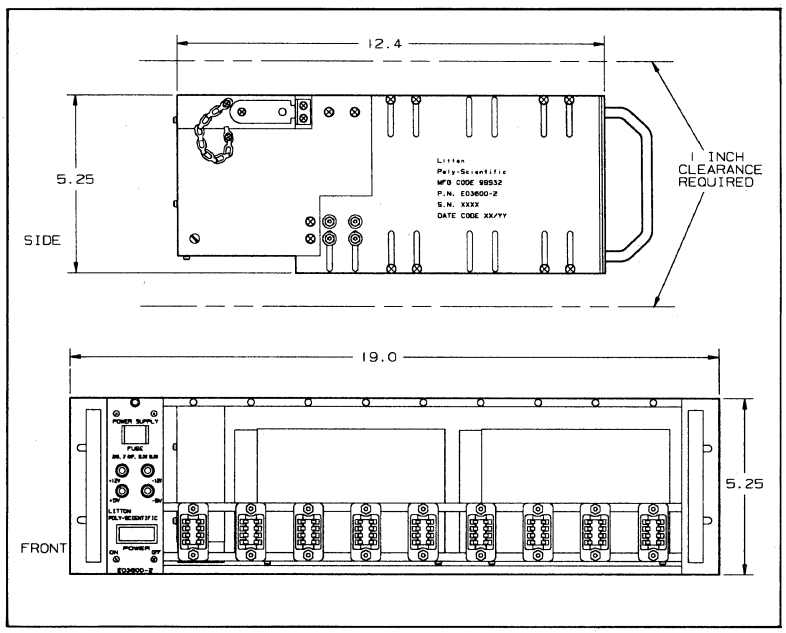
Fiber Optic Products
1213 North Main Street
Blacksburg, Virginia
24060-3100

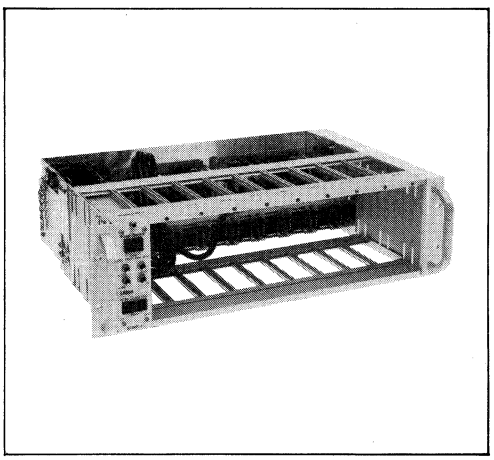
800-336-5917, FAX 703-953-1841
TWX 710-875-3694

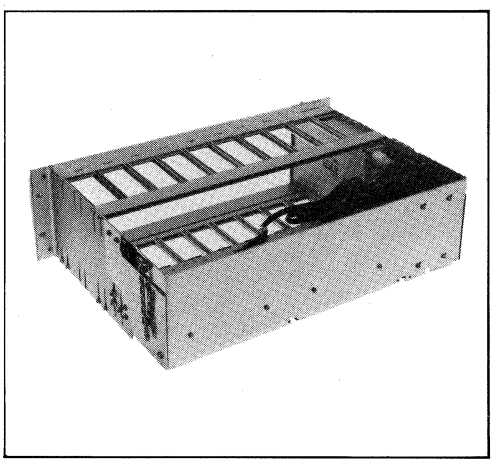
Rack-Mounted Transmitter and Receiver Systems

Many of our traditional components are available in modular, 19" rack-mounted versions.Ten bays can accommodate up to eighteen standard transmitters and receivers plus a common power supply. Connected to a 110 VAC outlet, it has a master on/off switch and a fuse for protection from overloads.

All connections (electrical and optical) are on the backplane of the modules. SMA receptacles for optical interfaces and BNC connectors for the electrical interface are standard. Other connector interfaces are available upon customer request.







Type	Data Rate	Part No.	Electrical Interfaces	Peak Launch Power Into 100μ Fiber	Peak Rx Sensitivity	Dynamic Range	Wavelength	Supply Voltage Requirements	Special Features
Digital Tx/Rx Edge Coupled	Up to 12Mbps	EO3603-1	50ohm terminated 3V max	-10dBm	-35dBm	20dB	850nm	+/- 12	1 Tx + 1 Rx per module
Video Tx	Link Bandwidth 5Hz - 10MHz	EO3606-1 *	RS 170	-10dBm Flat Field	N/A	N/A	850nm	+/- 12	
Video Rx		EO3608-1 *	RS 170	N/A	-32dBm	8dB	850nm	+/- 12	
Digital Tx/Tx	DC - 50Mb/s NRZ	EO3609-1	50ohm terminated 3V max	-10dBm	N/A	N/A	850nm	+/- 5	2 Tx's per module
Digital Rx/Rx Edge Coupled	50Mb/s Manchester	EO3633-1	TTL	N/A	-28dBm	15dB	850nm	+/- 12 +/- 5	2 Rx's per module
Digital Tx/Tx	DC - 50Mb/s Manchester	EO3635-1	50ohm terminated 3V max	-10dBm	N/A	N/A	850nm	+/- 5	2 Tx's per module
Dual Channel RS 232	DC - 100Mb/s NRZ	EO4304-1	RS 232	-16dBm (50 μ)	-38dBm	25dBm	1300nm	+/- 12	

* 1300nm options available. Consult factory.
Note: EO3600-2 Rack Enclosure/Power Supply required for above modules.

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Blacksburg, Virginia
24060-3100

800-336-5917, FAX 703-953-1841
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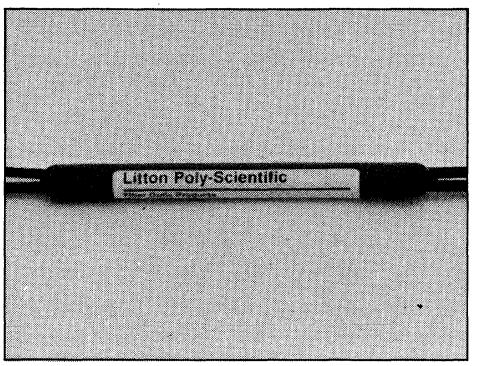
Low-Loss, Bi-Directional Couplers

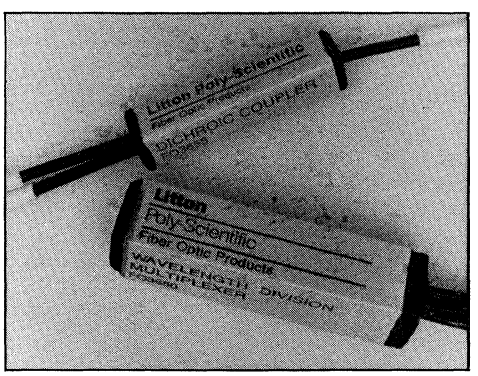
Our multi-mode symmetric and asymmetric couplers can be used in "stand-alone" or linear data bus applications. Designed for use in harsh environments, couplers without connectors will operate in temperatures ranging from -60° to 200° C. Various fiber sizes and types in a variety of split ratios are available. Single mode couplers available upon request.



Part No.	Type	Pigtail Length	Excess Loss	Split Ratio Tolerance	Package Size	
					Length	Diameter
FO3666	Asymmetric	≥ .5 meter	Typically ≤ .2dB	N/A	4.0"	.375"
FO3668	Symmetric 50/50	≥ .5 meter	A ≤ 1.0dB B ≤ 1.5dB	A +/- 5% B +/- 8%	4.0"	.375"
FO3669	Symmetric 90/90	≥ .5 meter	A ≤ .5dB B ≤ 1.0dB	A +/- 3% B +/- 5%	4.0"	.375"
FO3662	Symmetric Custom	Please call for more information.			4.0"	.375"

Wavelength Division Multiplexers

As their name implies, WDMs enable multiple channels of analog and/or digital data to be multiplexed, transmitted over a single fiber and demultiplexed at the other end of the data link. Our standard WDM configurations will perform either as multiplexers or demultiplexers.



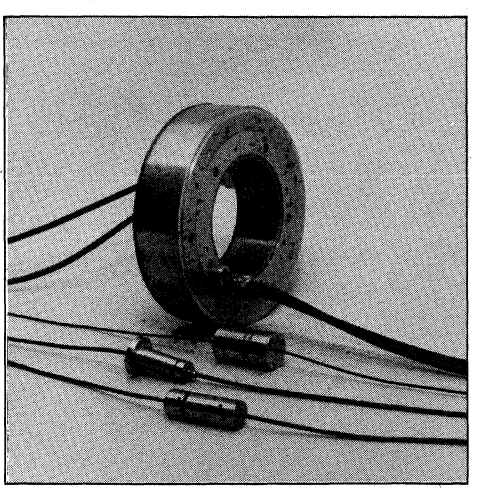
Part No.	Type	Fiber Size	Pigtail Length	Channel Capacity	Wave-length Range	Typical Insertion Loss	Crosstalk Isolation	Operating Temperature Range	Package Size		
									L	W	H
FO3650	Diffraction Grating	100/140 standard; others available	1 meter standard	6	400-1600nm	4dB	-30dB	-60° to 125°C	3.01"	0.75"	0.75"
FO3652	Diffraction Grating	100/140 standard; others available	1 meter standard	15	400-1600nm	4.5dB	-30dB	-60° to 125°C	3.3"	1.5"	1.5"
FO3655	Dichroic Filter	100/140 standard; others available	.5 meter standard	2	850/1300nm	1.5dB	≤30dB	-60° to 125°C	4.0"	Diameter .375"	

Fiber Optic Rotary Joints (FORJ)

A FORJ provides the same unlimited rotational freedom for fiber optic systems that the slip ring has long provided for electrical systems. Custom built and standard FORJs are available in two distinct types:

On-Axis FORJ: a compact totally passive single fiber device which occupies the centerline of rotation.
Off-Axis FORJ: a multi-channel active/passive device with 4" bore. Our ownspecial repeaters are required. Data rate up to 50 MBits/sec.

In addition to the standard parts below Poly-Scientific specializes in custom designs to meet your requirements in fiber size, wavelength, pigtail lengths, connectors and mounting requirements.



FORJ Type	Part No.	Outside Diameter	Length	Fiber Size (μm)	Wavelength (nm)	Pigtail Length Each End (m)	Connec-tion	Insertion Loss
On-Axis Multi-Mode	FO3585-1	.75"	2.16"	50/125	800 - 900	1	None	50/125 is 2.5 ± .5dB
	FO3585-2	.75"	2.16"	100/140	800 - 900	1	None	100/140 is 1.75 ± .25dB
	FO3585-23	.75"	2.16"	50/125	800 - 900	1	906 SMA	200/230 is 1.75 ± .25dB
	FO3585-24	.75"	2.16"	100/140	800 - 900	1	906 SMA	
	FO3585-22	.75"	2.16"	200/230	800 - 900	1	906 SMA	
On-Axis Single-Mode	FO3581	1.26"	3.45"	10/125	1300	10	None	10/125 is 2.5 ± .5dB
	FO3588	1.26"	3.68"	10/125	1180 - 1580	10	None	
Off-Axis	FO3595 (1-5 Channels)	7.8"	1.5" to 3.0"	N/A	N/A	1 to 10m	906 SMA BNC	N/A

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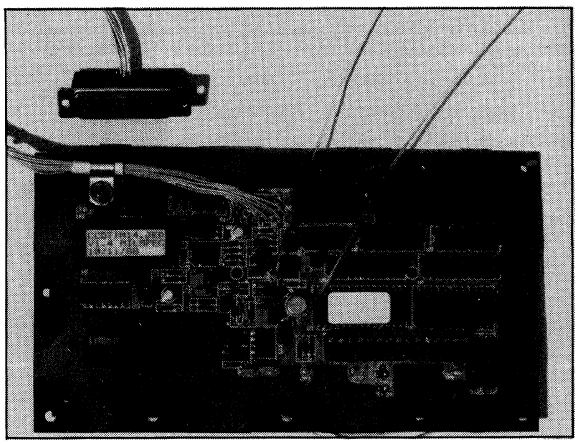
Fiber Optic Sensor Systems Using a Common Sensor Interface

In some cases a data bus represents only a partial solution to the needs of the fiber optic system designer. Our work with data bus and sensor technology gives us the ability to configure a total, turn-key approach to your specific system requirements.

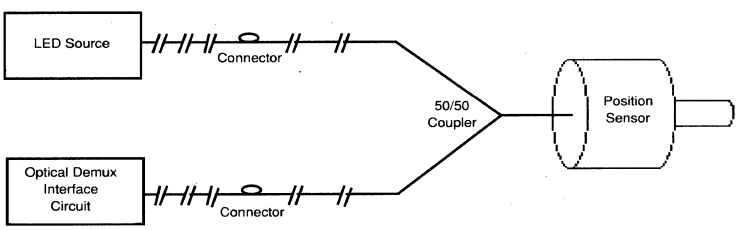
The combination of a common interface for different sensors and the ability to optically multiplex several sensors has system cost, size, weight and maintainability advantages. Utilizing common optical modulation as the foundation, our system uses passive fiber optic sensors based on the principle of wavelength division multiplexing. WDM sensors can be adapted to measure position, pressure, temperature and small displacements.

The system consists of a broadband source, power splitter, sensor(s), optical demultiplexer, and detection and decode electronics. Connected by dual fibers, the interface electronics are usually located some distance from the sensor(s).

As much of our current development efforts focus on aircraft networks, we are familiar with harsh environment and MIL-SPEC system applications.

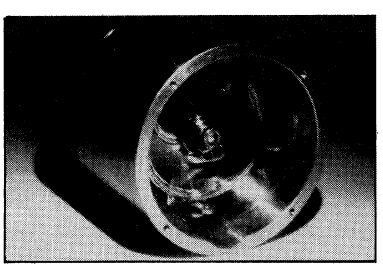


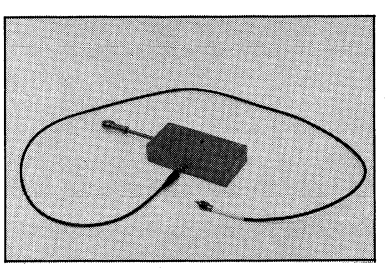
Fiber Optic Sensor System Block Diagram



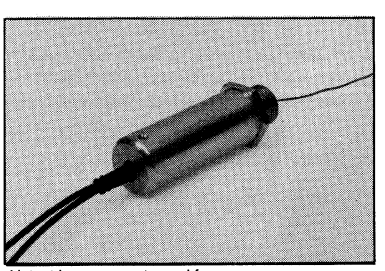
Optical Sensors

Environmental (pressure, temperature, etc.) and position (rotary and linear) sensors are available or can be designed and manufactured to meet your specific needs. Please contact us with your requirements for additional information on components or complete sensor systems.





Part No.	Type	Max Insertion Loss	Min I/O Ratio	* Wavelength Output Range	* Channel Pitch Nominal	* Channel Width Nominal	* Fiber Type	Coding Type	Coding Format	* Resolution/ Travel	* Package Size
FO3571	Linear Position Transducer	11dB	10dB	720-950nm	19nm	9.8nm	50/125 step index NA .22	absolute	Gray Code	Up to 12 bits / Up to 7 inches stooke	2" x 4" x .87"
FO3577	Rotary Position Transducer	11dB	10dB	720-950nm	19nm	9.8nm	50/125 step index NA .22	absolute	Gray Code	Up to 12 bits / Up to 360°	1.645" x 1.86" (OD)



***Note:** Values given for these parameters are application-dependent. Other values are possible. Consult factory for custom designs and latest improvements, and for custom pressure, temperature sensor systems.

Call us toll-free at **800-336-5917** (in Virginia, call 703-953-4751) for more information.

INTEROPTICS

ONE OF THE **PURDY** GROUP OF COMPANIES

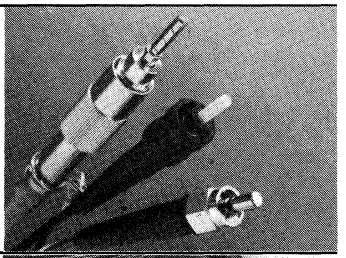
OPTO/LINK

INTEROPTICS offers a wide range of fiber optic products for telecom, datacom, precision instrument, industrial, medical, and military applications.

Here are just some of the products INTEROPTICS can supply for your fiber optic needs:

CONNECTORS, ADAPTERS, AND RECEPTACLES

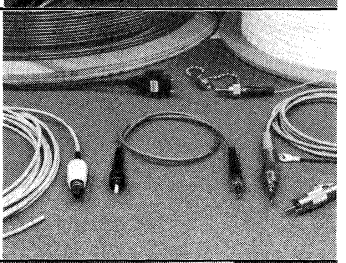
Diamond	DIN-47256
FC/NTT	ST
SMA	Biconic



CABLES AND CABLE ASSEMBLIES

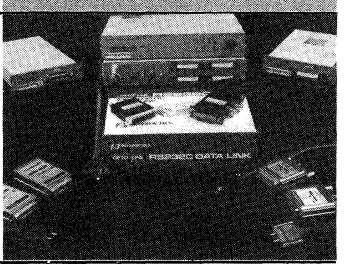
Standard pigtails and patchcords.
Custom versions on cable or fiber.
Special assemblies on customer supplied devices.

Buffered fiber	Multifiber
Simplex	Singlemode
Duplex	Multimode



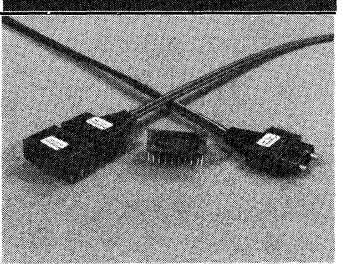
NETWORKING PRODUCTS

RS 232 and RS 422 modems
RS 232 master/slave port expander systems
RS 232 to GPIB converters
GPIB IEEE488 Bus expander systems
Centronics Bus extenders



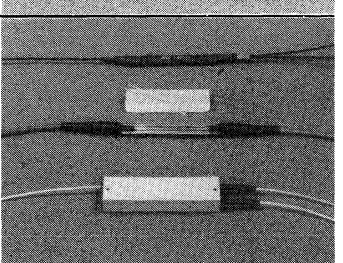
DATA LINKS

TTL transmitters, receivers, and transceivers
Data rates from DC to 20 Mb/s.
Systems from connectorless plastic fiber to connectorized glass cable.
Distances from 5 to 3500 meters.



SPECIALTY PRODUCTS

A complete line of couplers from 1 x 2 to 32 x 32
A complete elastomeric splicing system.
WDM's—wavelength divisional multiplexers (800/1300 nm and 1300/1530 nm).



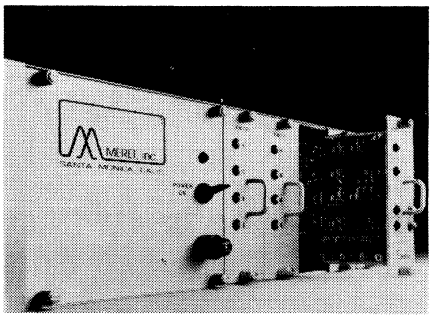
TERMINATION EQUIPMENT

A complete line of termination tooling.
Available as parts or in a complete kit.
Convex polishing machines and special ferrule viewing systems.

INFORMATION Let us supply you with our expertise in fiber optics.

If you have any comments or questions, or if you just want to know how fiber optics can work for you, please contact us at INTEROPTICS.

770 AIRPORT BOULEVARD BURLINGAME, CA 94010 TEL (415) 347-7727 • FAX (415) 340-1670 MCI/TLX 677-1439 (PURDY UW) TWX (910) 374-2353



FIBER OPTIC COMMUNICATIONS

FROM OPTO-HYBRIDS TO COMPLETE SYSTEMS

MERET, Inc., a leader in optical communications since 1975 offers a wide range of components, subsystem assemblies and complete turnkey systems for fiber optic communications

CCTV

FEATURES:
Small Hybrid Package
Simple Operation
High Density Packaging
Stand Alone AC Packaging

APPLICATIONS:
Surveillance
Security Networking
Robotics
Tele-Conferencing

Model	BW	Wavelength	Loss budget	Distance	SNR
284TV	6Hz-5MHz	820 nm	17 dB	4 km	46 dB
285TV	6Hz-10MHz	820 nm	13 dB	3 km	46 dB
28511TV	6Hz-10MHz	820 nm	20 dB	6 km	46 dB
213511TV	6Hz-10MHz	1300 nm	12 dB	10 km	46 dB
214511TV	6Hz-10MHz	1300 nm	21 dB	<20 km	46 dB

HI-RESOLUTION VIDEO

FEATURES:
Up to 120MHz Bandwidth
RGB on One Card
Automatic Gain Option
820nm or 1300nm Systems

APPLICATIONS:
Computer Graphics
Medical Imaging
Flight Simulation
Tempest Networks

Model	BW	Wavelength	Loss budget	Distance	SNR
288TV	6Hz-35MHz	820 nm	4 dB	1 km	46dB
28811TV	6Hz-35MHz	820 nm	14 dB	4 km	46dB
26811TV	6Hz-50MHz	820 nm	12 dB	3 km	46dB
26911TV	6Hz-120MHz	820 nm	7 dB	0.5km	46dB
213911TV	6Hz-120MHz	1300 nm	9 dB	5 km	46dB

ANALOG SYSTEMS

FEATURES:
Bandwidth to 1 GHz
LED or LASER Sources
Simple Operation
820 or 1300 nm
Rack Mount or Stand Alone Packaging

APPLICATIONS:
IF / RF Communications
Ultra-Hi Resolution Graphics
Instrumentation
EMP Testing
Satellite Entrance / Exit link

Model	BW	Wavelength	Loss budget	Distance	SNR
27020	10Hz-40kHz	820 nm	18 dB	4 km	60 dB
24802	DC-400kHz	820 nm	18 dB	6 km	60 dB
259-20	20Hz-140MHz	820 nm	1 dB	0.5 km	46 dB
2139-20	20Hz-140MHz	1300 nm	5 dB	5 km	44 dB
2149-400	20Hz-400MHz	1300 nm	9 † dB	10 km	48 dB
2149-1000	1kHz-1GHz	1300 nm	5 † dB	5 km	46 dB

DIGITAL SYSTEMS

FEATURES:
Data Rates to 150 MB / s
LED or LASER Sources
RZ or NRZ Capability
820 or 1300 nm
Easy Installation and Operation

APPLICATIONS:
Data Buses
Point to Point Links
Tactical Communications
Peripheral Remoting

Model	Data Rate	Wavelength	Loss Budget	Distance	BER
RS232-LS	DC-19.2 kB/s	820 nm	4dB	1 km	10E -9
481	DC- 5 MB/s	820 nm	8dB	2 km	10E -9
4811	DC-5 MB/s	820 nm	20 dB	5 km	10E -9
485	DC-10 MB/s	820 nm	4dB	1 km	10E -9
4145-11	DC-20 MB/s	1300 nm†	50 dB	20 km	10E -9
4595	DC-150 MB/s	820nm	3dB	0.5 km	10E -9

Military and Specialty Systems

- Ruggedized / Field Deployable / Hardened Systems
- Multi-Media - Digital & Analog Systems
- Battery Powered Transmitters
- Wavelength Division Multiplexing for Multiple Signals on One Fiber
- High Quality Video Plus Audio or Data on One Fiber (Model FM +1)

† on single mode fiber

all loss budgets are given for 50 μ fiber unless single mode (†) is specified

Turnkey Fiber Optic Systems

MERET can supply complete multi-channel systems in cage rack mount configurations. Using MERET hybrid modules, up to 24 channels of analog, video or digital data can be housed in a single standard 19- inch cage, together with all the necessary decoupling, power supplies, fuses, switches, indicators and alarms. Applications include multi-channel remote surveillance video systems with digital data links for camera control, data communications systems, RGB video with sync for computer graphics and CAD / CAM. MERET turnkey systems are supplied with ruggedized multi-channel cable. Field installation service and customer training are also available.

MERET, inc.

Specialists in Optical Communications

1815 24th STREET, SANTA MONICA, CA 90404
(213) 828-7496 • TELEX: 65-2468

optelecom
The Optical Communication Company

Fiber Optic Communication Products

Optelecom is the complete Fiber Optic equipment source offering total solutions and custom application design for all your needs.

SYSTEM 5000 TIME DIVISION MULTIPLEXER

High performance TDM able to combine multiple channels of full duplex voice and data over dual channel fiber optic cable. Modular 19″ rack mountable chassis. Optional redundant power supply. Choice of standard electrical and optical connectors. 4 km range with 50/125µm fiber at 850nm. 10 km range with 50/125µm fiber at 1300nm.

ECONOMUX

Stand alone multiplexers designed for applications where cost and size must be constrained without sacrificing performance. 4 km range.

Models 4408, 4416, 4432 Economux. Multiplex up to 64 channels of async or sync data. 19″ rack mountable or stand alone. Fiber-In/Fiber-Out version also available. Sub-channel I/O optically compatible with Model 4131 and 4141 modems.

DIGITAL MODEMS

Fiber optic modems for async and sync operation at distances up to 4 km, using DB25 male or female electrical connector.

Model 4131. Single channel. RS232. Up to 56 Kb/s. 2 km range. Powered by EIA control lines. Compatible with Model 4141. TEMPEST accredited version available.

Model 4141. Single channel. RS232. 56 Kb/s. 3 km range. Powered by AC adapter. Compatible with Model 4131.

Model 4260. Async rates up to 64 Kb/s. 3 km range. 12 selectable clock rates to 57.6 Kb/s. Full RS232 handshaking capability. Model 4261 has 4 km range.

HIGH SPEED DIGITAL INTERFACES

Stand alone and 19″ rack mount packaging available for applications requiring high speed digital transmission.

Models 424X and 504X. Models 504X are System 5000 compatible cards. Models 424X are stand alone packages. Available in full duplex configurations. RS422A, TTL, MIL-STD-188-114 formatted versions. Async NRZ data up to 20 Mb/s. Clock and data up to 5 Mb/s encoded over single fiber. 3 km range.

ANALOG VIDEO AND AUDIO INTERFACES

Permit conversion of a variety of analog signals for transmission over fiber optic cables. Handle signal types from voice to high bandwidth RGB video. 1.5 to 3 km range achievable, depending on model.

Models 3250 and 3251. Stand alone package. 6 Hz to 30 MHz, depending on model. BNC electrical connector. Automatic Gain Control (AGC) available. Model 3255 Optimized for voice frequency response.

Models 5050 and 5051. System 5000 compatible cards. 6 Hz to 30 MHz, depending on model. BNC electrical connector. Automatic Gain Control (AGC) available. Model 5055 Optimized for voice frequency response.

Models 3252, 5052. Up to 110 MHz pixel rate RGB video transmission system for use with high resolution video systems. Available in stand alone version and System 5000 compatible card.

Model 3452. Up to 110 MHz pixel rate RGB + multichannel data for keyboard printer, etc.

Fiber Optic Telephone System. Consult factory.

SPECIALTY AND LAN INTERFACES

Optelecom has developed a variety of fiber optic interfaces to address specific industry standards and proprietary Local Area Networks (LANs). Most models available in stand alone version and System 5000 compatible card.

* Most products available in 850nm and 1300nm versions. SMA or ST™ optical parts available.

Optelecom... First for all your Fiber Optic needs.

OPTELECOM, INC. 15930 Luanne Dr., Gaithersburg, MD 20877 • 301/840-2121 • Fax 301/948-6357

FIBER OPTIC AMPLIFIERS AND TRANSMISSION SYSTEMS ANALOG WIDEBAND DC-1MHz & DC-10MHz

SPECIFICATIONS

INPUT VOLTAGE RANGES:
Switch selectable with 1 megohm 30 PF input.
0-±1VPK, ±10VPK, ±100VPK, ±1000VPK,
or ±0.1VPK, ±1VPK, ±10VPK, ±100VPK

OUTPUT VOLTAGE

DC-1MHz	DC-10MHz
0-±10VPKDC-1MHz into 10 Kohms or more	0-±10VPK into 50 ohms

BASIC ACCURACY:

DC-1MHz	DC-10MHz
0.3%DC	0.25%DC
0.5%1Hz-400Hz	0.5%1Hz-400Hz
3%400Hz-100KHz	3%400Hz-5MHz
10%100KHz-1MHz	–3db 10MHz

TRANSMISSION DISTANCE:

DC-1MHz	DC-10MHz
1Kilometer	Over1000feet

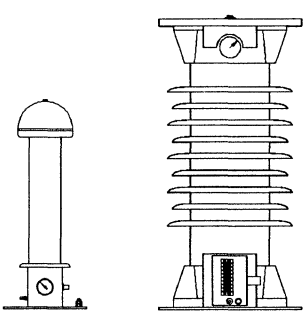
Signaltransmission notaffectedbyshock, vibration orchangeinlight intensity.

POWER REQUIREMENTS:

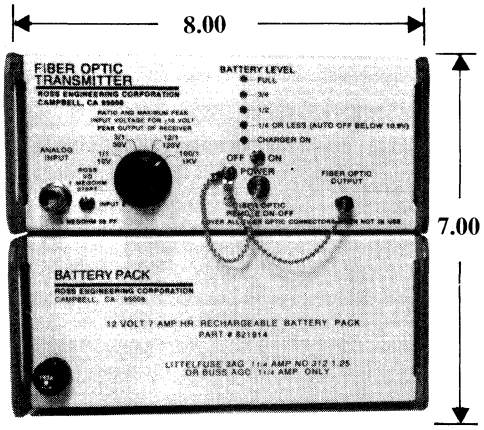
Transmitter:
115V/230V 50/60Hz and 12V DC powered, with integral charger. Optional remote on/off controlled by fiber optic cable.
Standard battery provides 8-15 hours of operation between charges, longer available.
Also isolated power source available for continuous operation without integral battery from power source at ground potential.

Receiver:
115V/230V 50/60Hz or 12V DC powered.

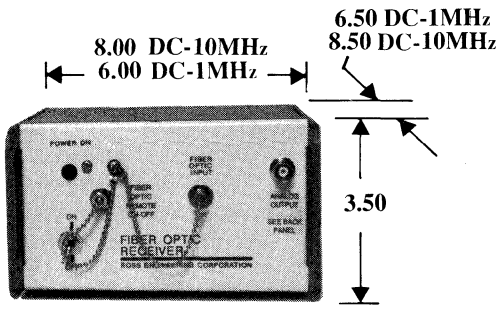
Voltage input range can be extended in 15KV increments to 900KV PK by Ross Engineering Corporation's wide band voltage dividers.



VD60 KV INDOOR **VD120 KV OUTDOOR**

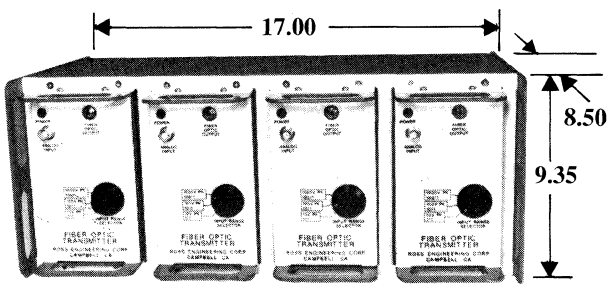


AC/DC POWERED TRANSMITTER WITH 12V DC 8-15HR. BATTERY PACK



AC POWERED RECEIVER

DIMENSIONS IN INCHES



4 CHANNEL FIBER OPTIC SYSTEM ALSO AVAILABLE :

Each channel is independent, self-contained, and removable for separate operation. Powered by 115V/230V 50/60Hz.

ROSS ENGINEERING CORP.
540 Westchester Drive, Campbell, CA 95008
(408)377-4621, TLX85-8840, TWX910-590-8033
FAX(408)377-5182

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

SHARP Optoelectronics

Laser Diodes

Laser Diodes

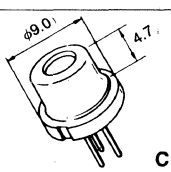
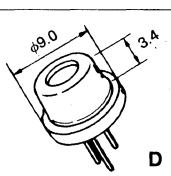
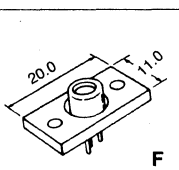
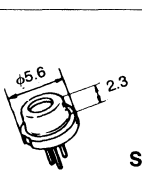
Sharp's laser diodes use a double hetero junction of gallium, aluminum and arsenide compound (GaAlAs). Long life and high reliability are realized by use of our original VSIS structure (V-channeled Substrate Inner Stripe).

Features

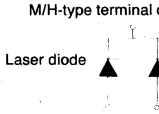
- High power type, low noise type, wide temperature ranges and short wavelength type are included in the scope of products.
- High precision package. PIN photodiodes are built in, and optical power output control is easy.
- The line-up is full, from the ultra compact (ϕ5.6 mm packages) type to the single positive power supply p/w type.
- Long life, high reliability.
- Stable single transverse mode, low threshold current.

Model No.	Wavelength (nm)	Optical power output (mW)		Features	Main applications
		TYP.	MAX.		
LT030 Series	750	3	5	Short wavelength	High-speed laser printers, Bar code readers
LT031 Series		7	10	Short wavelength	High-speed laser printers
LT020MC	780	3	5	General use	Measuring instruments, Bar code readers
LT021 Series		10	15	High power	High-speed laser printers, Medical apparatus
LT022 Series		3	5	Low noise	CD-ROMs, Fiber Optic Communication
LT023 Series		3	5	Low noise (Multi-mode)	VD players, Analog devices, Fiber Optic Communication
LT022/023 WIDE TEMP. Series		3	5	Low noise Wide Temperature (– 30 to 85°C)	Fiber Optic Communication Factory Automation Equipment
LT024 Series		20	30	High power	Optical disk memories, Magneto-optical disk systems
LT026 Series		3	5	Small astigmatism	General use laser printers
LT027 Series		7	10	General use	Medium-speed laser printers
LT080MD		3	5	Stabilized wavelength	Measuring instruments, Laser printers, Bar code readers
LT091MD		14	20	2 channels*	High speed laser printers
LT010 Series	810	3	5	General use	Measuring instruments, Fiber Optic Communications
LT016 Series		30	40	High power	YAG laser excitation, Optical disk memories, Magneto-optical disk systems
LT015 Series	830	30	40	High power	Optical disk memories, Optical memory cards, Medical Apparatus
LT090 Series		80	100	High power (3 channels)	Medical apparatus, Optical range finders
LT011MS	840	3	5	Long wavelength	Fiber Optic communications

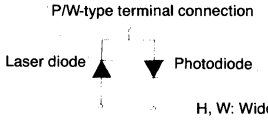
*Independent channel control

Package (mm)					
Wavelength (nm)	Maximum optical power output (mW)	C	D	F	S
750	5	—	LT030MD	LT030MF	—
	10	—	LT031MD	LT031MF	—
780	5	LT020MC	—	—	—
	15	LT021MC	LT021MD	LT021MF	—
	5	LT022HC/MC	LT022MD/PD/WD	LT022MF	LT022HS/MS/WS/PS
		LT023MC	LT023MD	LT023MF	LT023HS/MS/WS/PS
	30	—	LT024MD/PD	LT024MF	—
	5	—	LT026MD	LT026MF	LT026MS/PS
	10	—	LT027MD	LT027MF	—
	5	—	LT080MD	—	—
	20	—	LT091MD	—	—
810	5	LT010MC	LT010MD	LT010MF	—
	40	—	LT016MD	LT016MF	—
830	40	—	LT015MD/PD	LT015MF	—
	100	—	LT090MD	LT090MF	—
840	5	—	—	—	LT011MS

M/H-type terminal connection



P/W-type terminal connection



H, W: Wide Temperature Version

SHARP ELECTRONICS CORP., Micro Electronics Div., Sharp Plaza, Mahwah, NJ 07430-2135•201/529-8757 • Telex: 426903 (SHARPAM MAWA) • Fax: 201/529-8759

SHARP Optoelectronics

Fiber Optic Data Link/ Laser Receptacle/Photodiode Receptacle

Laser diodes with high frequency modulator*

	Model No.	LT015R10	LT024R10
Description	Laser diode	LT015MD (830nm, MAX 40mW)	LT024MD (780nm, MAX 30mW)
	S/N	MIN. 65dB, TYP. 80dB	
	Oscillation frequency	TYP. 250MHz	
	Supply voltage	+5V (High frequency modulator)	
	Power consumption	MAX 50mA (High frequency modulator)	

*For laser noise reduction in optical memory application.

Laser receptacle

	Model No.	GP0F50T
Description	Laser diode	LT022MS (780nm)
	Connector	FC type
	Light output	MAX. 0.25mW (*)

* Initial value. From the end of fiber (GI 50/125, length = 1m, the other end is conneted to this receptacle)

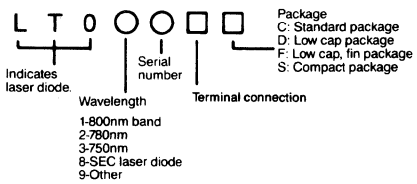
Photodiode receptacle

	Model No.	GP0F50R
Description	Photodiode	PIN photodiode
	Connector	FC type
	Sensitivity	TYP. 0.3mA/mW (*)

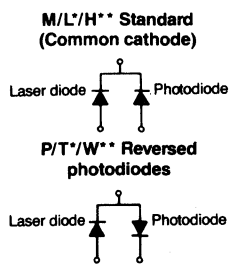
* Initial value. V_R = 5V, P_{IN} = 0.1mW, λ = 780nm.

Relationship of Wavelength, Optical Power Output, and Noise

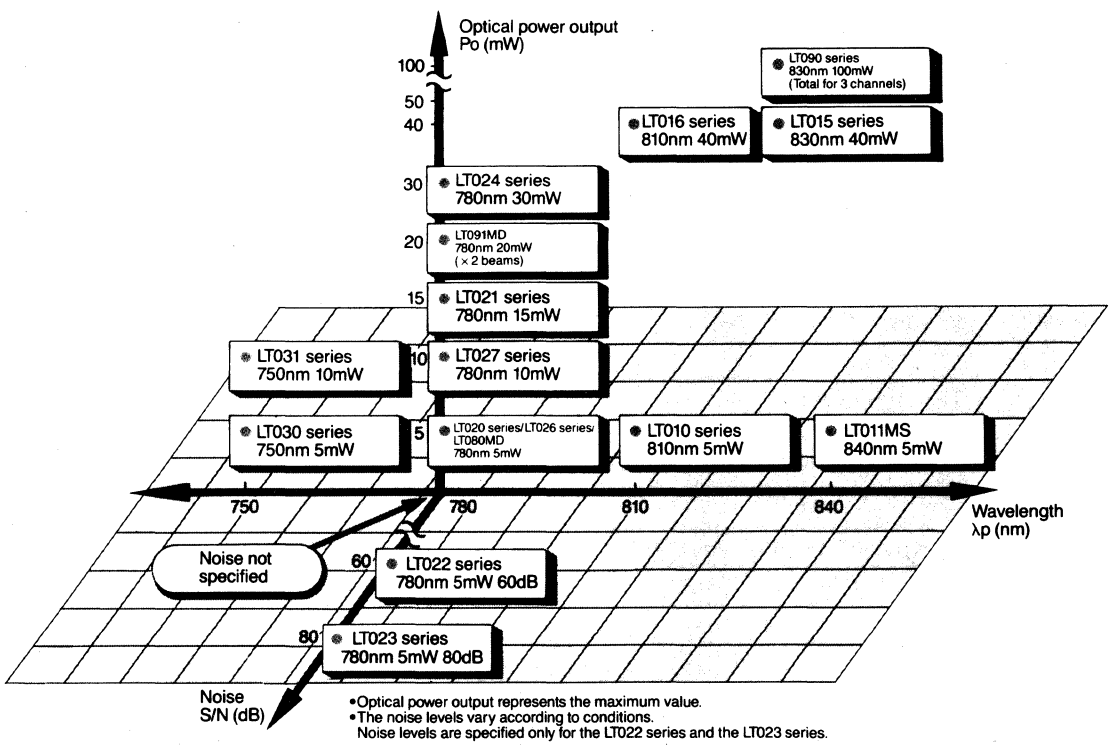
Numbering System



Terminal Connection



*L and T-type are Buried-VSIS laser diodes.
**H and W-type are wide temperature laser diodes.



•Optical power output represents the maximum value.
•The noise levels vary according to conditions. Noise levels are specified only for the LT022 series and the LT023 series.

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- Originators of Skew-Wound Coreless Micromotors.
- Patented and Licensed the World Over.

- **Coreless DC motors:** (PG. **B**•1280)
  - .1-30 W continuous output power
  - .01-7.09 oz -in. max. continuous torque
  - Speeds up to 16,000 RPM.
- **PMDC motors:** (PG. **B**•1281)
  - 4-430 W continuous output power
  - .91-415 oz-in. max. continuous torque
  - Custom windings available up to 180 VDC.
  - Speeds up to 6,000 RPM.
- **Precision gearheads:** (PG. **B**•1282-1283)
  - Diameters from 10mm-120mm (.39-4.72 in.)
  - Continuous output torque to 96 ft-lb.
  - Bidirectional operation in ratios up to 1,000,000:1

ALSO AVAILABLE:

- Tacho-Generators ..... See **D**•2246
- Optical Encoders ..... See **B**•1966
- Magnetic Encoders ..... See **B**•1966
- Precision Gearheads ..... See **B**•1282-1283
- Motor-Tachometers ..... See **D**•2246
- Shaft Couplings ..... See **D**•2246
- Zero Back Lash Gearing ..... See **B**•1282
- Brushless Motors ..... Call for Latest Data
- Control Systems ..... Call for Latest Data
- Brakes & Clutches ..... Call for Latest Data

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MOTORS AND DRIVES

Manufacturer	Starting EEM Page No.	DC Motors					AC Motors			Speed Reducers
		Brushless	Brush-Type	Torque	Servo	Stepper	Induction	Synchronous	Torque	
ARX/Airpax Inc.	B•1224	√		√	√					
Automotion Inc.	B•1234	√								
Barber-Colman Co./Motor Div.	B•1235		√		√		√	√	√	√
Bodine Electric Co.	B•1236		√	√		√			√	
Canon U.S.A. Inc.	B•1237	√	√		√	√				√
Clifton Precision	B•1238	√	√	√	√					
Crouzet Controls Inc.	B•1239		√	√		√		√	√	
Eastern Air Devices	B•1240	√	√	√	√	√	√	√	√	√
Eltrol Corp.	B•1241	√	√	√	√					
ETI Systems	B•1242			√	√				√	
Hathaway /Motion Control Div.	B•1253	√	√	√	√					√
Hurst Manufacturing	B•1254			√		√		√	√	
Industrial Drives	B•1258	√	√		√		√			
Inland Motor	B•1260					√				
Mabuchi Motor America Corp.	B•1277	√	√	√				√	√	
Maxon Precision Motors	B•1278	√			√					
MFM Technology Inc.	B•1279	√		√	√	√				
Micro Mo Electronics	B•1280	√	√		√			√		
Motor Technology	B•1284	√	√		√			√		√
NMB Technologies	B•1288	√				√				
Oriental Motors U.S.A.	B•1290		√	√		√	√	√	√	√
Pittman	B•1295	√	√		√					√
Powr-Ups Corp.	B•1298	√	√	√	√	√		√	√	√
SAIA Inc.	B•1300	√				√		√		√
Servo-Tek Products Co.	B•1302	√	√	√						√
Shinano Kenshi Corp.	B•1303	√	√		√	√	√			√
Stock Drive Products	B•1305	√	√	√	√	√	√	√	√	√
Superior Electric Co.	B•1306	√		√		√		√	√	√
Supervexta	B•1293			√		√				√
Synektron Corp.	B•1308	√		√	√					
Techno/Designatronics	B•1310	√			√	√				
Vernitech	B•1316						√	√	√	√
Vernitron Controls	B•1313	√		√	√					

ROTATING COMPONENTS

Manufacturer	Starting EEM Page No.	Capsule Slip Rings	Power Slip Rings	Pancake Slip Rings	Power Capsule Slip Rings	General Purpose Slip Rings	Flat Slip Ring Assemblies	Vehicle Slip Rings
Airflyte Electronics Co.	B•1228	√	√		√	√	√	√
Fabricast	B•1246		√	√		√	√	
Graphite Metallizing Corp.	B•1252						√	
Litton Poly-Scientific	B•1267	√				√	√	√
Maxon Precision Motors	B•1278						√	
Micro Mo Electronics	B•1280	√						

Manufacturer	Starting EEM Page No.	Rotary Switches	Separate Rotors & Brush Blocks	Encoders	Power Cartridge Type Brushes	Motorized Potentiometers
Airflyte Electronics Co.	B•1228	√	√	√		
ETI Systems	B•1242	√				√
Fabricast	B•1246		√			
Graphite Metallizing Corp.	B•1252		√		√	
Hathaway /Motion Control Div.	B•1253			√		
Litton Poly-Scientific	B•1267				√	
Maxon Precision Motors	B•1278			√		
Micro Mo Electronics	B•1280			√		
Powr-Ups Corp.	B•1298					√
Servo-Tek Products Co.	B•1302			√		
Stock Drive Products	B•1305			√		
Vernitech	B•1316	√		√		√

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES
TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 89/90 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1404, **B**•1090, **C**•1119 **D**•1156
AC Power Supplies, Product Selection Guide ..... **D**•2156
ASCII Code ..... **D**•1080
Batteries, Product Selection Guide .... **D**•1447
Batteries & Fuel Cells, Characteristics ..... **D**•1450
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide . **A**•1002
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1197
Conductors, Maximum Current Capacity of Copper & Aluminum ... **A**•2272, **C**•1316
Connectors, Miniglossary ..... **C**•1271
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1339
DC Power Supplies, Product Selection Guide ..... **D**•1537
Delay Lines, Product Selection Guide ..... **A**•1503
Dielectrics, Thermal Conductivity ..... **B**•1916
Discrete Semiconductors, Product Selection Guide ..... **A**•2154
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1041
EBCDIC Code ..... **D**•1086
Encapsulation, Miniglossary ..... **C**•1124
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide ..... **C**•1631
Fiber Optics, Miniglossary ..... **B**•1185
Fiber Optics, Product Selection Guide ..... B•1204
Filters, Power, Product Selection Guide ..... **A**•1642
Filters, Signal, Product Selection Guide ..... **A**•1683
IC Master ..... **A**•1740
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1210
Interconnection Systems, Product Selection Guide ..... **C**•1702
Keyboards & Keypads, Product Selection Guide ..... **B**•1854
Lamps, Lights, & Indicators, Product Selection Guide ..... **B**•1126
Logofinder & Trademark Directories ... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1776
Military Qualified Products List ..... **B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1221
Opto Semiconductors, Miniglossary ..... **A**•2169
Oscilloscopes, Product Selection Guide ..... **D**•1426
Panel Hardware, Product Selection Guide ..... **C**•1583
Panel Meters, Analog & Digital, Product Selection Guide ..... **D**•1376
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **A**•2078
Power Supplies, Miniglossary ..... A•2276, **D**•1541
Power Supplies, AC, Product Selection Guide ..... **D**•2156
Power Supplies, DC, Product Selection Guide ..... **D**•1537
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1351
Relay Contact Forms ..... **B**•1450
Relays, Electromechanical, Miniglossary ..... **B**•1414
Relays, Product Selection Guide ..... **B**•1411
Resistor Color Codes ..... **A**•1952
Resistors, Product Selection Guide ... **A**•1867
Servo Components, Miniglossary ..... **B**•1266
SI Units, Basic Guide To, ... **A**•1434, **B**•1472, **C**•1692, **D**•1386
Solenoids, Product Selection Guide ... **B**•1655
Switches, Product Selection Guide .... **B**•1673
Symbols—International Authorities ..... **A**•1454, **B**•1064, **C**•1104, **D**•1166
Thermal Components, Product Selection Guide ..... **B**•1886
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1916
Thyristors/High Power Diodes, Miniglossary ..... **A**•2211
Timers, Miniglossary ..... **B**•1492, **D**•1140
Trademark & Logofinder Directories ... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1928
Transformers, Product Selection Guide ..... **A**•2215
Voltage Drop Nomograph ..... **A**•2262, **C**•1469, **C**•1960 **D**•1718
Wire & Cable, Product Selection Guide ..... **C**•1755
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1343, **C**•1759

AEROFLEX
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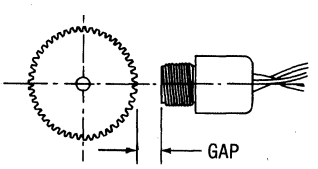
ELECTROMECHANICAL/OPTICAL DIVISION

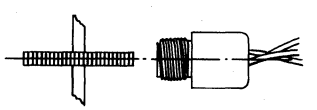
SPEED INDEPENDENT MAGNETIC PICKUPS

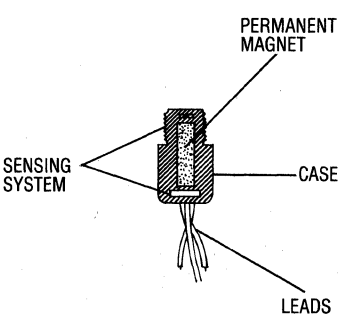
- Contactless Limit Switches
- Velocity and Position Sensing
- Counting, Indexing, and Timing Functions

The Aeroflex Laboratories family of *SPEED INDEPENDENT MAGNETIC PICK-UPS* are devices which have output voltage amplitudes that are independent of the rate of movement of the target. Common magnetic pick-ups have an output amplitude which is a function of the time-rate-of-change of flux; the Aeroflex pick-up is independent of the rate-of-change of the flux. The Aeroflex pick-ups excel in slow target motion applications and often can replace optical systems. The pick-ups' upper frequency limit is approximately 20 Khz for extremely fast target motion.



SENSOR-TARGET POSITIONING





BASIC CONSTRUCTION
B12E SERIES

THEORY OF OPERATION

The unit contains a pair of magnetoresistors and a permanent magnet. Some sensors also have conditioning circuitry encapsulated within the unit. The sensing system differentially compares the magnetic field distribution over the sensitive face of the pick-up. As a magnetic material such as cold rolled steel or the 400 series stainless steels are moved past the pickup a differential field is produced which is sensed by the pickup.

The B12E series has no conditioning circuitry and will give an analog output proportional to the flux seen by each magnetoresistor. If no target is present the differential will be zero as it will if a large target such as a flat piece of steel is placed over the sensor.

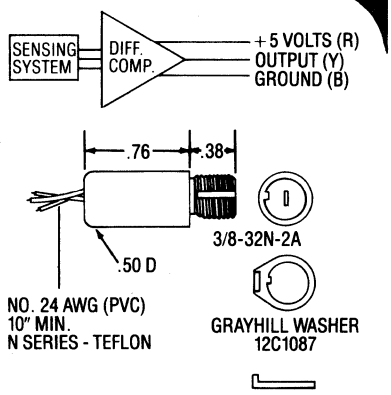
The B12L series has additional self contained circuitry which converts the analog signal to a switched output compatible with logic circuits. These pick-ups eliminate the problems associated with low signal transmission levels in high noise environments. The rise and fall times are approximately 600 and 100 nanoseconds respectively.

TARGETS

Almost any conceivable or convenient shape can be used for a target if it is a magnetic material. The variations can include slots in a disc, screw heads, etched foils, or gear teeth.

Your Complete Source for FLIR Scanners, Stabilization Custom Brushless DC Motors and Controllers,

B12L-5 SERIES



The series B12L-5 pick-ups have self contained conditioning electronics. The output is TTL compatible and normally sits at +4.9 volts in the absence of a target. When the target is near the face of the sensor the output drops to +0.3 volts where it remains until the target is removed. The output is a NPN transistor with a 1.8 K ohm collector resistor.

The pick-up operates with a + 5 volt supply at approximately 15 ma.

The operating temperature of the unit is +5 to +55 degrees C. Operation at 1/2 the gap distance specified in Table I will increase the operating temperature range to −20 to +75 degrees C. A wider operating temperature range unit with a −40 to +120 degrees C range is also available and is designated with an "H" in the part number (B12LH-5).

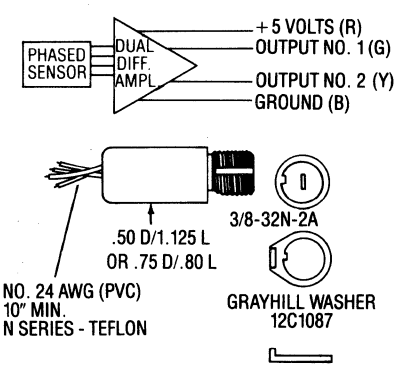
A center tapped version of the pick-up is also available which will allow the use of smaller targets. These are designated by the use of a CT in the part number (B12L-CT).

The housing is an aluminum filled epoxy that is resistant to moisture, oil and most common solvents.

TABLE I: MAXIMUM GAPS AS A FUNCTION OF GEAR

MODEL \ GEAR PITCH	8	16	20	24	32	48	64	72	96	120
B-12L-5	.100	.075	.070	.060	.050					
B-12L-5CT				.045	.035	.025	.015	.012	.010	.004
B-12LH-5	.100	.075	.060	.050	.035					
B-12LH-5CT				.035	.030	.020	.012	.010		

B13L-5 SERIES



The B13L series is a dual version of the B12L series. It is intended for use where two phase related outputs (90 degrees) are required. When coupled to a FlipFlop gate arrangement, directional sensing is possible.

GEAR PITCH	PHASE ACCURACY	MAX GAP	MODEL NUMBER
24	±4°	.025	B13L-5-24
32	±5°	.020	B13L-5-32
48	±8°	.015	B13L-5-48
64	±10°	.012	B13L-5-64

ORDERING INFORMATION:

B – — – –

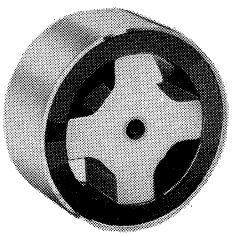
- **12** Single Channel Sensor
- **13** Dual Channel Sensor
- **L** with Internal Electronics
- **E** No Electronics
- **H** Extended Temperature Range
- **#** Nominal Power Supply Voltage
- **CT** Center Tap for High Resolution
- **#** Diametrical Pitch of Gear Target (If Known)

and Tracking Pedestals, Electromechanical Actuators, Torque Motors, AC Motors, Blowers and Fans

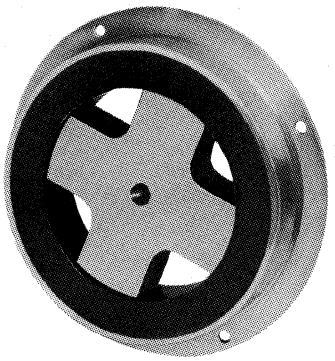
AEROFLEX
LABORATORIES INCORPORATED
An ARX Company
35 South Service Road, Plainview, N.Y. 11803
Tel: 516-694-6700 • FAX: 516-694-6771
ELECTROMECHANICAL/OPTICAL DIVISION

BRUSHLESS WIDE ANGLE DC TACHOMETERS

- Maximum Winding Temperature 155° C
- No Ripple Torque
- No Friction Torque

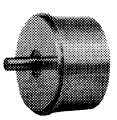


TQ25
(Pancake Mounting, with optional V-groove)

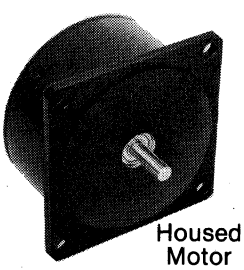


TQ34
(Flange Mounting)

Basic Part Number	Output Sensitivity (v/rad/sec)	Resistance at 25°C (Ohms)	Rotor Inertia (oz. in. sec²)	Pancake Dimensions O.D. (inch)	Thick. (inch)	I.D. (inch)	Performance Curve (Letter)
TG10Y-58	.03	210	1.6×10^{-5}	1.000	.350	.125	A
TG10Y-59	.06	390	4×10^{-5}	1.000	.700	.125	A
TG18W-56	.09	550	2.4×10^{-4}	1.718	.350	.187	C
TG18W-57	.24	1025	4.8×10^{-4}	1.718	.700	.187	C
TG18-54	.17	520	3.2×10^{-4}	1.718	.350	.250	D
TG18-55	.39	980	6.7×10^{-4}	1.718	.700	.250	D
TG25W-9	.7	920	2.1×10^{-3}	2.500	1.000	.250	C
TG25W-10	.35	850	9×10^{-4}	2.500	.500	.250	C
TG34W-5	1.0	1000	4.2×10^{-3}	3.313	.625	.375	C
TG34-41	1.5	825	9.1×10^{-3}	3.375	.725	.375	D
TG40W-5	1.2	335	2×10^{-2}	4.000	.850	.375	A
TG40W-3	2.5	535	4×10^{-2}	4.000	1.500	.375	A
TG52W-5	4.5	1100	1.1×10^{-1}	5.125	1.500	.750	A
TG52-7	3.7	360	1.4×10^{-1}	5.187	1.250	.984	D

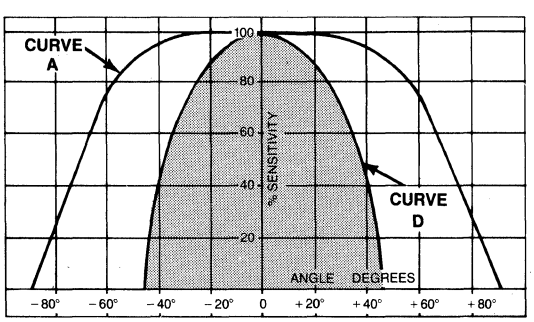


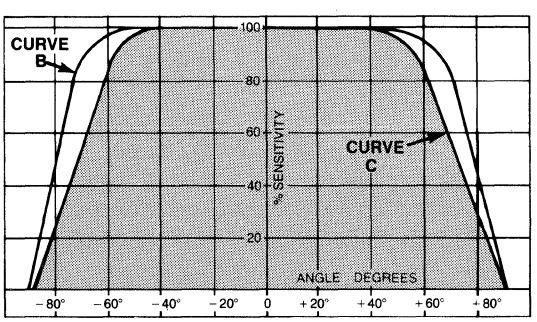
TQ10Y
(In Housing)



Housed Motor

PERFORMANCE CURVES





CUSTOM DESIGNS ARE WELCOMED!!! OUR TORQUE MOTOR ENGINEERS ARE AVAILABLE TO DISCUSS YOUR UNIQUE REQUIREMENTS...GIVE US A CALL!

Your Complete Source for FLIR Scanners, Stabilization Custom Brushless DC Motors and Controllers,

BRUSHLESS WIDE ANGLE (Limited Rotation) DC TORQUE MOTORS

PARTIAL LISTING

P/N	PEAK TORQUE	CONT TORQUE	ANGULAR EXCURSION	TORQUE SENSITIVITY	MOTOR CONSTANT	WEIGHT	O.D.	WIDTH	I.D.	PERFORMANCE CURVE
	IN-OZ	IN-OZ	DEGREES	IN-OZ/AMP	IN-OZ/ SQRT WATTS	OZ	INCH	INCH	INCH	LETTER
TQ10Y-10	1.3	0.5	120	2.5	.32	1	1.000	.350	.125	A
TQ10Y-1	6	1.5	120	7.6	.57	2	1.000	.700	.125	A
TQ18W-30	3	1.8	120	3.9	.65	3	1.718	.350	.187	B
TQ18W-35	8	4	120	2.2	1.39	4	1.718	.700	.187	C
TQ18-25	5.6	3	50	9	1.16	3	1.718	.350	.250	D
TQ18-47	18	8	50	10	2.0	4	1.718	.700	.250	D
TQ25W-2	15	8	120	15	1.94	4	2.500	.500	.250	B
TQ25W-1	33	16	120	18	2.9	7	2.500	1.000	.250	C
TQ25-6	30	10	50	12	3.79	6	2.500	.500	.250	D
TQ25-2	80	25	50	27	6.75	12	2.500	1.000	.250	D
TQ34W-1	35	25	120	18.3	4.25	13	3.313	.625	.375	C
TQ34W-12	80	60	120	28	6.6	21	3.313	1.125	.375	C
TQ34-14	80	28	50	80	6.88	16	3.375	.600	.375	D
TQ34-4	130	40	50	45	9.0	16	3.375	.725	.375	D
TQ40W-4	150	60	120	12	9.2	30	4.000	.850	.375	A
TQ40W-1	260	120	120	34	17	51	4.000	1.500	.375	A
TQ52W-1	240	211	90	59	23.6	80	5.125	1.500	.750	A
TQ52-2	500	192	20	109	31.5	80	5.187	1.250	.984	D
TQ64W-5	806	460	90	75	49.5	256	6.235	2.300	2.000	A
TQ64-1	864	634	30	75	57.5	256	6.375	2.300	1.187	D
TQ74W-5	806	288	110	184	47.5	160	7.310	1.440	1.000	A
TQ74W-6	1500	980	110	119	80	432	7.310	3.440	1.000	A
TQ74-4	633	307	30	63	48.3	128	7.375	1.160	.812	D
TQ74-2	1344	864	30	127	74	304	7.380	2.290	.812	D
TQ82W-1	768	480	120	92	36	192	8.190	1.380	.820	C
TQ120-2	4224	3450	40	394	260	784	12.50	2.250	1.380	D
TQ140W-1	3450	3260	120	326	143	960	14.000	3.000	1.500	C

Ordering Information

Aeroflex Torque Motors are most commonly furnished as pancake devices without housings, shafts or bearings. The pancake configuration permits the maximum flexibility in allowing the user to integrate the Torquer into his own housing and bearing system of the load.

Optional mounting configurations such as flange, synchro clamp and complete housing with single or double ended shaft, spring return, detent mechanisms, etc. are available. *When ordering, please indicate the mounting wanted by adding one of the following letters after the basic part number:*

P—Pancake S—Synchro H—Housing F—Flange

For example: The pancake styled TQ18-25 would read TQ18-25P.

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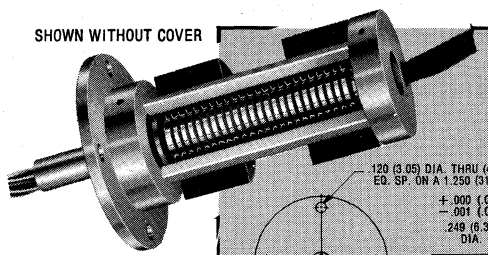
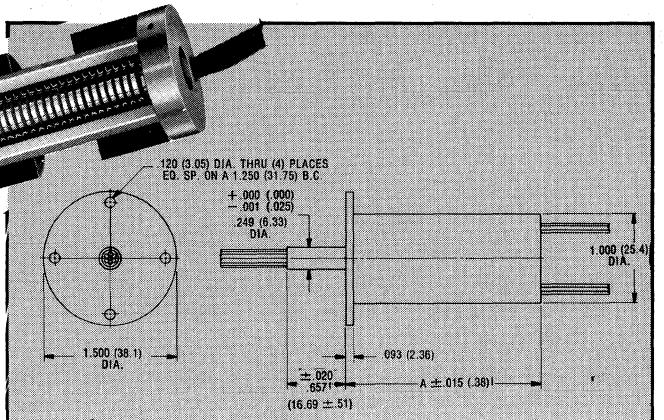
Airflyte ELECTRONICS CO.

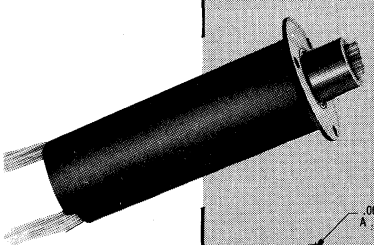
CAPSULE SLIP RING ASSEMBLIES

SHOWN WITHOUT COVER



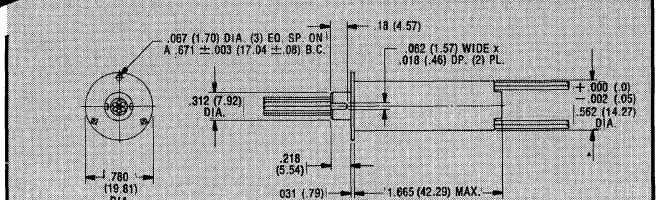
CAY-110
UP TO **30** RINGS

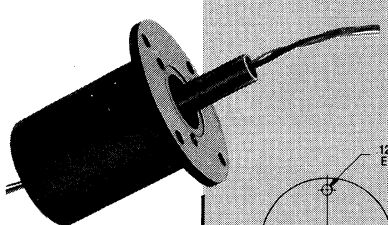




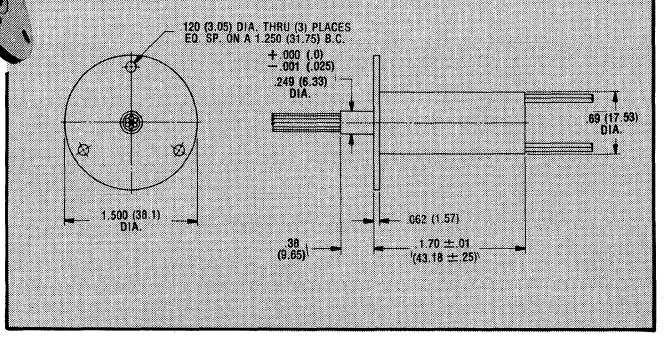
CAY-604
UP TO **40** RINGS

No. of Rings	Inches "A"	Milli-Meters
4-12	1.48	37.6
13-24	2.20	55.9
25-30	2.56	65.0





CAY-245
UP TO **20** RINGS



These Slip Ring Assemblies have found wide use in gyro gimbal and instrument applications. The fully enclosed and tested assemblies feature fine diameter gold alloy brushes mated to compatible gold alloy rings for excellent noise characteristics at low torque levels. Although miniature in size, the assemblies are surprisingly rugged and are able to withstand most military environmental specifications.

Units have been fully tested to the environmental parameters listed below, proving their ruggedness and reliability. All units are factory tested before shipment and a copy of the test data is available with each unit upon request.

The units shown here are only a sample of those available which include a 50 ring capsule of .685 diameter.

SPECIFICATIONS

MECHANICAL

1. Rings: Gold alloy
2. Brushes: Gold alloy wire, spring temper
3. Ball Bearings: Stainless steel, shielded
4. Shaft: Stainless steel
5. Housing: Anodized aluminum
6. Rotation: Bi-directional

ELECTRICAL

1. Current: Signal level to 1 amp maximum
2. Voltage: Micro-volts to 110 volts rms
3. Dielectric Strength: 500 volts rms (all combinations)
4. Leadwire: #30 AWG teflon insulated, 15″ long minimum
5. Noise: ±5 micro-volts per ma

ENVIRONMENTAL

1. Temperature Shock: +85°C for 1 hour and immediately transferred to −55°C for 1 hour
2. Shock: 18 shocks, 20 "g" with duration of 11 ±1 ms (MIL-E-5272C, Procedure V)
3. Vibration: MIL-STD-202B, Method 204, test condition B
4. Altitude: 50,000 ft. and −55°C
5. Humidity: MIL-E-5272C, Procedure III (95% R.H. @ 120°F for 360 hours)

ORDERING INFORMATION

CAY-□□□ □□

No. of Rings

Model

	CAY-110	CAY-604	CAY-245
MECHANICAL			
Torque	1.0 in.-oz. max. (24 rings)	1.0 in.-oz. max.	0.5 in.-oz. max. (20 ring assembly)
Speed	500 rpm max.	200 rpm max.	200 rpm max.
Life	10^8 revs. min.	5×10^6 revs. min.	10^7 revs. min.
ELECTRICAL			
Contact Resistance Variation	5 milliohms max. at max. speed	20 milliohms max. at max. speed	5 milliohms max. at max. speed
No. of Rings	30 max.	40 max.	20 max.

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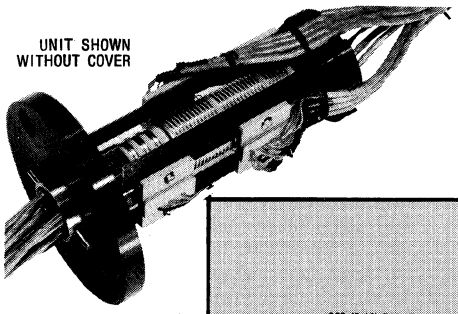
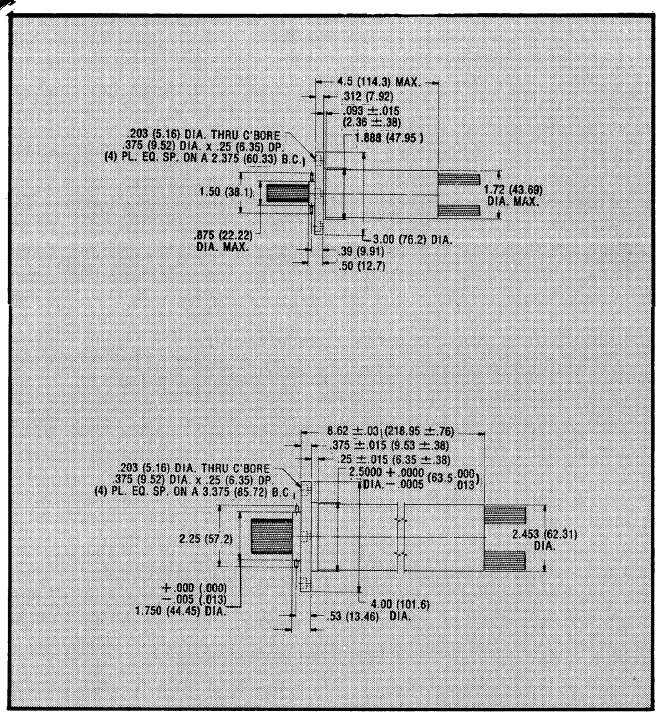
Airflyte ELECTRONICS CO.

CAPSULE SLIP RING ASSEMBLIES



CAY-150
UP TO **48** RINGS



CAY-1120
UP TO **90** RINGS

These assemblies, specially designed for gyro-rate table and centrifuge applications, have found wide use because of their versatility and compact size. The standard assembly, can be supplied (at slight extra cost) with internally shorted rings for double and triple current ratings, and with single, double and triple shielded wire. Featuring gold alloy wire brushes and compatible gold alloy rings, these assemblies are manufactured from proven production tooling at a very nominal cost. Special assemblies with switching circuits and others with non-standard materials for use in severe environments are available.

SPECIFICATIONS

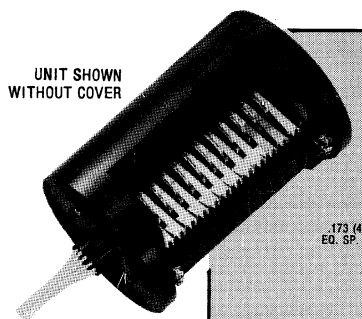
MECHANICAL

1. Rings: Gold alloy
2. Brushes: Gold alloy wire, spring temper
3. Ball Bearings: Stainless steel
4. Shaft: Stainless steel, type 303
5. Housing: Anodized aluminum
6. Rotation: Bi-directional

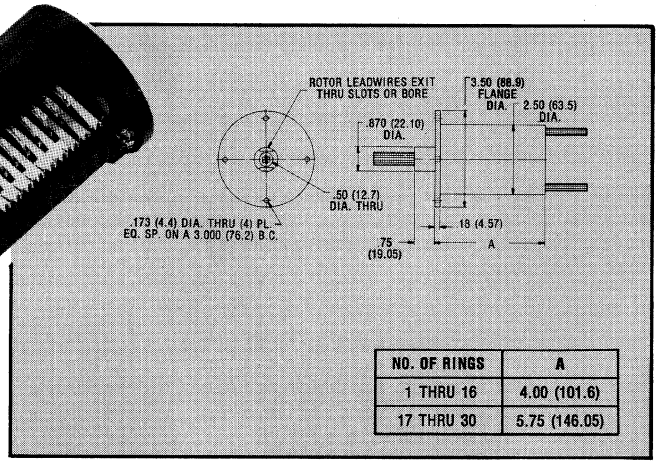
ELECTRICAL

1. Current: Signal level to 2.0 amps
2. Voltage: 400 vdc maximum
3. Dielectric Strength: 1000 Volts rms (all combinations)
4. Contact Resistance:
   A. Less than 8 milliohms @ 200 rpm
   B. Less than 2 milliohms @ 10 rpm
5. Leadwire: #28 awg 18″ long

	CAY-150	CAY-1120
Torque	.125 in.-oz. per ring	.18 in.-oz. per ring
Speed	600 rpm max. — intermittent	100 rpm max.
Life	2000 hrs. @ 100 rpm	1000 hrs. @ 100 rpm



CAY-1030
UP TO **30** RINGS



NO. OF RINGS	A
1 THRU 16	4.00 (101.6)
17 THRU 30	5.75 (146.05)

• LONG LIFE • HIGH SPEED

SPECIFICATIONS

1. Rings: Coin silver
2. Brushes: Silver graphite, two per ring
3. Ball Bearings: Stainless steel, shielded
4. Shaft: Anodized aluminum
5. Housing: Anodized aluminum
6. Torque: .03 in.-lb. per ckt. approx.
7. Speed: Up to 5000 rpm
8. Life: 5000 hrs. at 100 rpm
9. Rotation: Bi-directional
10. Current: 5 amps max. per ring
11. Voltage: 250 Volts DC max.
12. Dielectric Strengths: 500 VRMS (all combinations)
13. Contact Resistance: 10 milliohms max. (excluding wires)
14. Noise: 10 milliohms max.
15. No. of Rings: 30 max.
16. Leadwire: #22 AWG, 24″ lg., both ends

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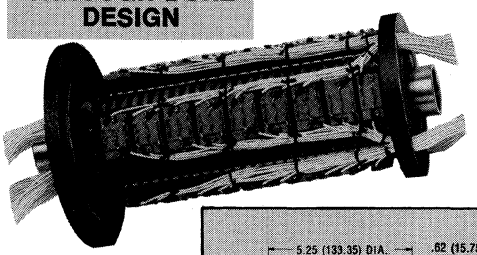
Airflyte ELECTRONICS CO.

POWER CAPSULE SLIP RING ASSEMBLIES

"THROUGH-BORE" DESIGN

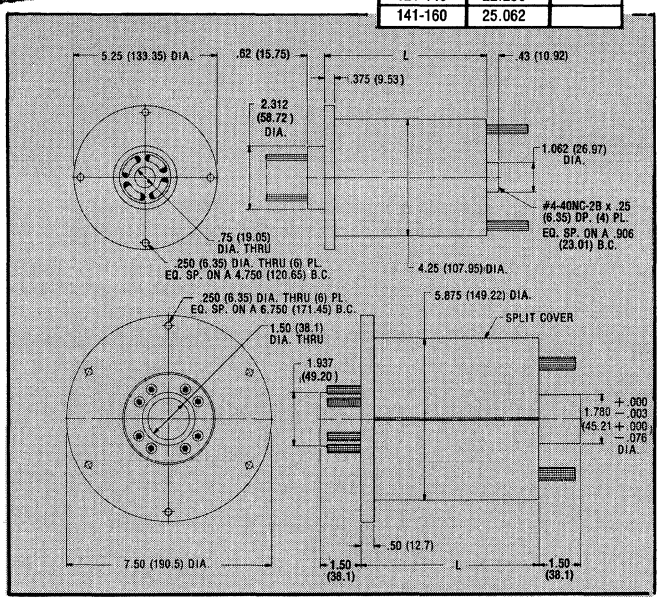


UNIT SHOWN WITHOUT COVER

DAY-705
UP TO **160** RINGS

DAY-710
UP TO **120** RINGS

No. of Rings	DAY-705 "L" ±.025"	DAY-710 "L"
10-20	5.375	4.725
21-40	8.187	6.700
41-60	11.000	8.675
61-80	13.812	10.650
81-100	16.625	12.625
101-120	19.437	14.600
121-140	22.250	
141-160	25.062	



DAY-705

These slip-rings are built to your order using many standard components which have proven themselves over many years of reliable operation. The "platter-type" design includes one coin silver ring on each side of each molded sub-assembly; and, leaf type silver graphite brushes which are molded in an insulating block and perfectly matched to the face of each ring. Inasmuch as the assemblies are the stack-up type, we are able to custom build them to your specifications—using our standard components—with a very minimum lead time required.

DAY-710

Similar in construction to our DAY-705, this platter type unit features two coin silver rings on each side of each platter for greater package density, and a "through bore" design which can be used for the passage of fluid or gas lines.

SPECIFICATIONS

MECHANICAL

1. Rings: Coin silver
2. Brushes: Silver graphite
3. Ball Bearings: Stainless steel, shielded
4. Shaft: Anodized aluminum
5. Housing: Anodized aluminum
6. Speed: 500 rpm maximum
7. Rotation: Bi-directional

ELECTRICAL

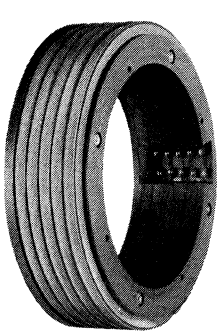
1. Voltage: 0 to 150 Volts AC or DC
2. Dielectric Strength: 500 Volts rms (all combinations)

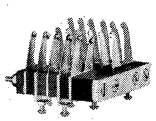
	DAY-705	DAY-710
Torque	½ in.-oz. per circuit	¾ in.-oz. per circuit
Life	3000 hrs. @ 100 rpm	2500 hrs. @ 100 rpm
Current	5 amps max. per circuit	5 amps max. per circuit
Contact Resistance Variation	8 milliohms peak @ max. speed	10 milliohms max.

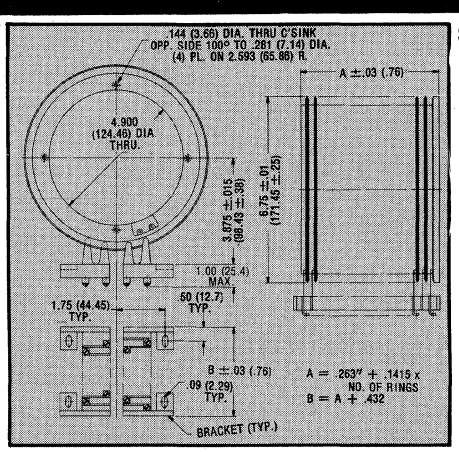
FLAT RING ASSEMBLIES & MATCHING BRUSH BLOCKS

CAY 94

- General purpose
- "Stack-up capability (up to 200 rings or more
- Low noise
- Long life







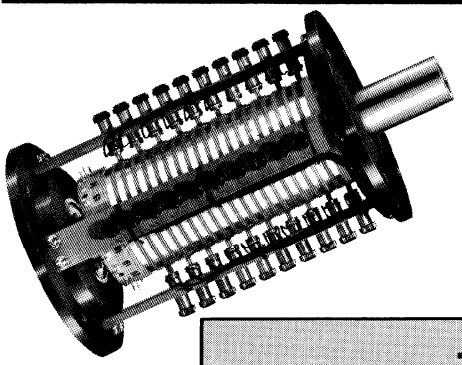
SPECIFICATIONS

1. Rings: Coin silver
2. Brushes: Silver graphite (two per ring)
3. Brush Leafs: Beryllium copper
4. Insulation: Phenolic
5. Leadwire: Available upon request
6. Speed: 750 rpm max.
7. Life: 1000 hours @ 100 rpm
8. Current: 5 amps per rings; 10 amps per ring when 4 brushes are used
9. Voltage: 300 VRMS
10. Dielectric Strength: 500 Volts rms (all combinations)
11. Insulation Resistance: 10 megohms minimum at 500 VDC
12. Noise: The contact resistance change in each circuit shall be less than .005 ohms at maximum speed
13. Units with less than 11 rings have one bracket per brush block

NEW HOOK ROAD, BAYONNE, NEW JERSEY 07002 201-436-2230 TWX-710-729-4489 FAX 201-436-6024

Airflyte ELECTRONICS CO.

POWER CAPSULE SLIP RING ASSEMBLIES



CAY-125

A general purpose, off-the-shelf slip ring assembly especially applicable for strain gage and thermocouple measurements where rotating detector circuits must be brought out to stationary measuring equipment.

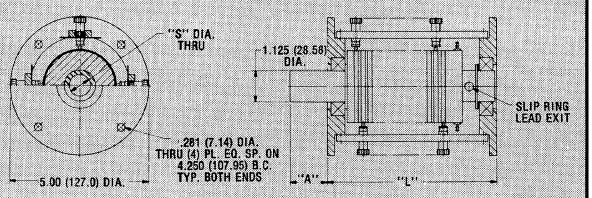
CAY-755

The standard cartridge, (AHW-16), has been used for many years on our CAY-125 assembly and is now available with the CAY-755 which is also drawn, or individually, for use on any ring which is a minimum of 1/8" wide. The silver graphite brushes, coil springs, caps and holders may be purchased individually or as an assembly and are all available from stock.

CAY-125
UP TO **30** RINGS

CAY-755
UP TO **30** RINGS

. . . AS AN ASSEMBLY

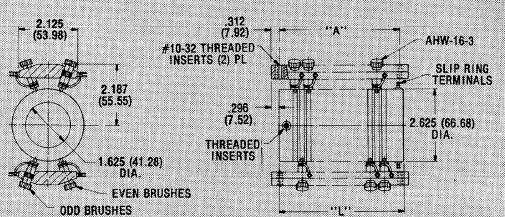


NOTES:
To determine "L" dimension use the following formula:

$$\text{"L"} = 2.62\ (66.55) + \frac{\text{(NO. OF RINGS)}}{4}$$

"S" = .750 (19.05) or 1.000 (25.4)
"A" = .750 (19.05) or 1.000 (25.4)

. . . OR AS SEPARATES



NOTES:
To determine the "L" and "A" dimensions, use the following formulas:

$$\text{"L"} = 1.093\ (27.76) + \frac{\text{(NO. OF CIRCUITS)}}{4}$$

"A" = "L" — .218 (5.54)
†Two identical brush blocks are supplied with each CAY-755 assembly.
†REPLACEMENT PARTS
Cartridge Assembly: AHW-16
Spring: AHW-15
Holder: AHW-14
Cap: AHW-13
Silver Graphite Brush: ABR-12-1

SPECIFICATIONS

MECHANICAL

1. Rings: Coin silver
2. Brushes: Spring loaded silver graphite, two per ring
3. Torque: 0.2 in-lbs. per ring
4. Speed: 5000 rpm maximum
5. Life: 1000 hours minimum @ 500 rpm
6. Rotation: Bi-directional

ELECTRICAL

1. Current: 10 amps per circuit with two brushes per ring
2. Voltage: 0-250 Volts AC or DC
3. Dielectric Strength: 500 Volts rms (all combinations)
4. Contact Resistance Variation: 10 milliohms maximum at maximum speed
5. No. of Rings: 30 maximum

ENVIRONMENTAL

1. Operating Temperature: 0° to 200°F
2. Humidity: 85%

ORDERING INFORMATION

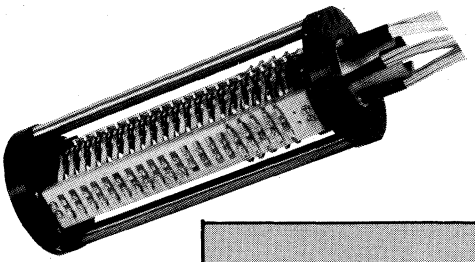
CAY- □□□ □□ □

Model
No. of Rings
Special Variations

NEW HOOK ROAD, BAYONNE, NEW JERSEY 07002 201-436-2230 TWX-710-729-4489 FAX 201-436-6024

Airflyte ELECTRONICS CO.

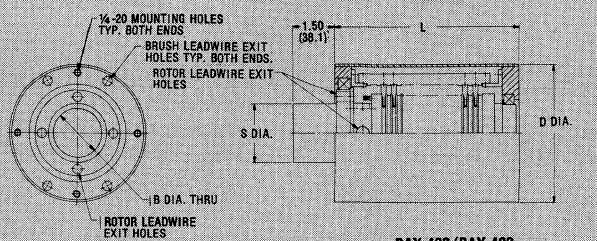
MULTI-PURPOSE SLIP RING ASSEMBLIES



These assemblies, designed for use in commercial equipment, have been used in applications ranging from thermocouples to the transmission of medium power. They feature coin silver rings, silver graphite brushes, convenient terminals on both the slip ring and brush blocks, and a rotor design which allows the leadwires to be exited through the shaft bore, or under the bearing when a shaft clearance hole is required. The wide variety of sizes and configurations available, including "in-between" shaft diameters, allows the designer to select a standard assembly for his application, eliminating time consuming and costly design charges.

... AS AN ASSEMBLY

DAY-490/499
UP TO **50** RINGS

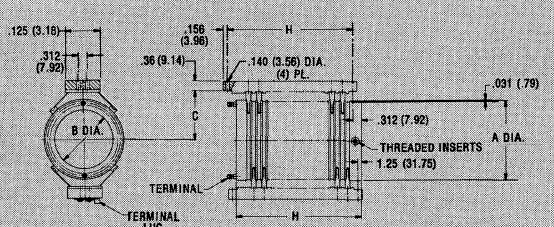


DAY-490/DAY-499

No. of Rings	Inches "L"	Milli-Meters
6-10	4.88	123.95
11-20	6.75	171.45
21-30	8.63	219.2
31-40	10.50	266.7
41-50	12.38	314.45

... OR AS SEPARATES

CAY-731/740
UP TO **50** RINGS



To determine "H" dimension use the following formula:
"H" = .750 + .1875 x (No. of Rings)

SPECIFICATIONS

MECHANICAL

1. Frame: Anodized aluminum (DAY-490/DAY-499 only)
2. Rings: Coin silver
3. Brushes: Silver graphite, two per ring
4. Leafs: Beryllium copper
5. Insulation: Epoy or laminated plastic

ELECTRICAL

1. Current: 10 amperes per circuit (20 amperes available at extra cost)
2. Voltage: 250 Volts maximum AC or DC
3. Dielectric Strength: 750 Volts rms (all combinations)
4. Insulation Resistance: 50 megohms minimum at 500 VDC
5. Contact Resistance Variation: 10 milliohms maximum at maximum speed
6. No. of rings: 50 maximum

ENVIRONMENTAL

1. Operating Temperature: 0 to 250°F
2. Humidity: 95% maximum

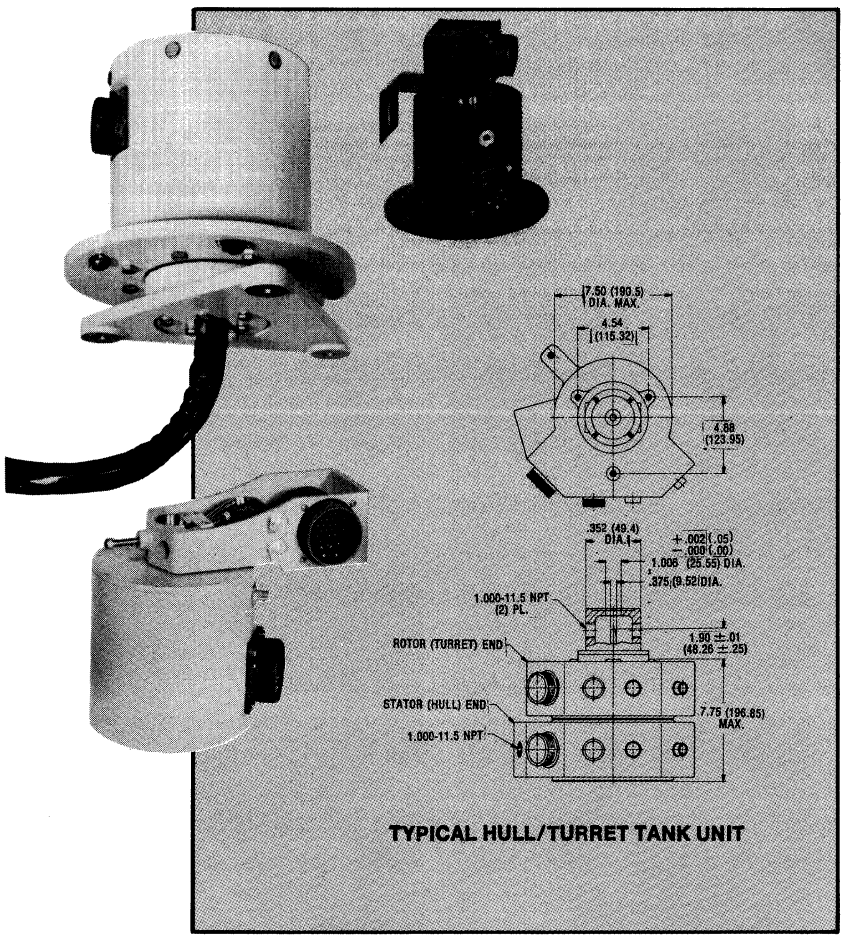
For use when bearing mounted assemblies are not practical, the CAY-731/CAY-740 should be specified.

Part No.	Max. Speed RPM	Min. LIFE 10^4 Rev.	Max. Torque Per Ring lb.-in.	Max. Torque Per Ring gm-cm	DAY-490/DAY-499 "B" Dia. in.	"B" Dia. mm	"D" Dia. in.	"D" Dia. mm	"S" Dia. in.	"S" Dia. mm	CAY-731/CAY-740 "A" Dia. in.	"A" Dia. mm	"B" Dia. in.	"B" Dia. mm	"C" Dia. in.	"C" Dia. mm
DAY-490/CAY-731	5000	50	.21	240	1.00	25.4	4.00	101.6	1.250	31.75	1.875	47.63	1.250	31.75	1.447	36.75
DAY-491/CAY-732	4000	40	.30	350	1.75	44.45	5.00	127.0	2.125	53.98	2.750	69.85	2.125	53.98	1.829	46.46
DAY-492/CAY-733	3000	30	.40	460	2.75	69.85	6.50	165.1	3.125	79.38	3.750	95.25	3.125	79.38	2.281	57.94
DAY-493/CAY-734	2500	25	.50	580	3.75	95.25	7.50	190.5	4.125	104.8	4.875	123.8	4.125	104.8	2.822	71.68
DAY-494/CAY-735	2000	20	.61	700	4.75	120.7	8.50	215.9	5.125	130.2	5.875	149.2	5.250	133.4	3.307	84.00
DAY-495/CAY-736	1500	15	.71	820	5.75	146.1	9.50	241.3	6.125	155.6	7.000	177.8	6.250	158.8	3.857	97.97
DAY-496/CAY-737	1500	15	.82	950	6.75	171.5	10.50	266.7	7.125	181.0	8.000	203.2	7.250	184.2	4.342	110.3
DAY-497/CAY-738	1000	10	.92	1060	7.75	196.9	11.50	292.1	8.125	206.4	9.000	228.6	8.250	209.6	4.837	122.9
DAY-498/CAY-739	1000	10	1.02	1180	8.75	222.3	13.00	330.2	9.125	231.8	10.000	254.0	9.250	235.0	5.332	135.4
DAY-499/CAY-740	750	7.5	1.12	1290	9.75	247.7	14.00	355.6	10.125	257.2	11.000	279.4	10.250	260.4	5.827	148.0

NEW HOOK ROAD, BAYONNE, NEW JERSEY 07002 201-436-2230 TWX-710-729-4489 FAX 201-436-6024

Airflyte ELECTRONICS CO.

VEHICLE SLIP RING ASSEMBLIES



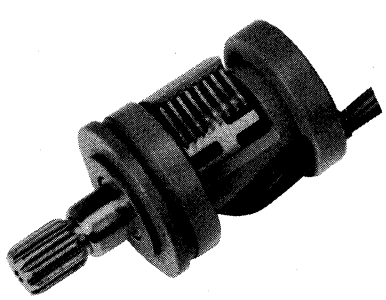
TYPICAL HULL/TURRET TANK UNIT

Airflyte Electronics has experience in the design and manufacture of assemblies for personnel carriers, tanks and other military vehicles. We have built slip rings for periscopes, turrets and commander stations. These assemblies range in size from 6″ or less in outside diameter to slip rings with clearance holes larger than 28″. This type of assembly is characterized by its rugged construction, usually has two high power rings, several low power and up to 50 signal rings. Illustrated are several of the configurations we have built in production quantities.

SPECIFICATIONS

1. Voltage: from 28 VDC to 208 VAC
2. Current: from 1 amp to 600 amps
3. Frequency: DC to 100 MHz
4. Speed: Usually about 20 rpm
5. Noise: Less than 10 mΩ peak to peak
6. Hydraulics: 3000 psi operating
7. Pneumatics: 1500 psi operating
8. Torque: 15 ft.-lb. max. (no hydraulics)
9. Life: 3000 hrs.
10. Environmental: Vibration, shock, etc. per MIL SPEC
11. Terminations: Connectors & fittings customer compatible

ENCODERS & SWITCHES



Airflyte encoders and rotary switches feature drum construction with solid gold alloy conducting segments embedded in epoxy and machined flush. Brushes are multi-strand, spring-temper gold-alloy. As small as ½″ diameter.

ENCODERS

Special encoders with BCD, Gray, True Binary or non-standard codes are available. Units supplied with or without logic circuitry.

SWITCHES

When close accuracy, repeatability and size are important, specify Airflyte rotary switches for timing and positioning applications. Successfully replaces snap action switches and cams. Pre-set to eliminate installation time. Zero hysteresis.

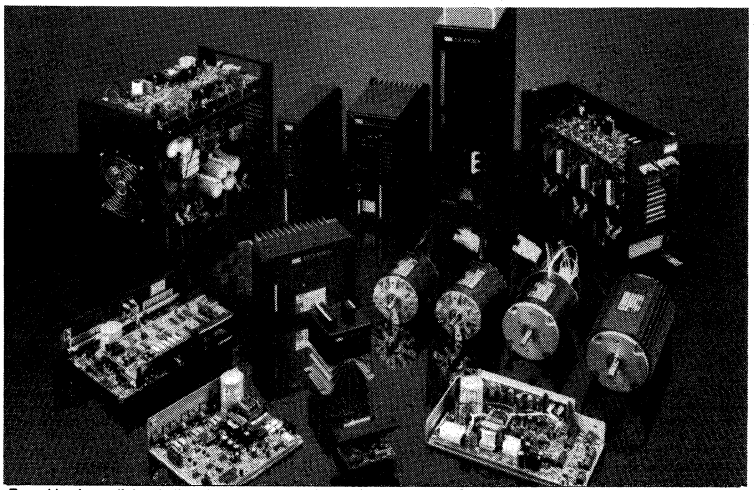
NEW HOOK ROAD, BAYONNE, NEW JERSEY 07002 201-436-2230 TWX-710-729-4489 FAX 201-436-6024

AUTOMOTION

Brushless DC Motors & Controls

313 / 662-7771
Fax: 313/662-3707

AFFORDABLE BRUSHLESS DC SOLUTIONS



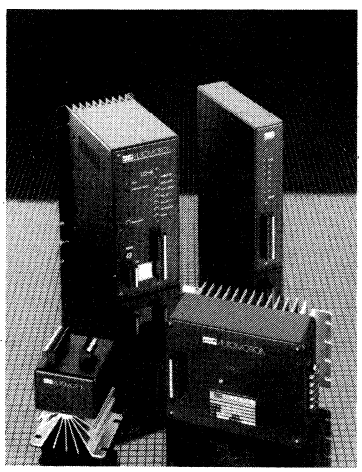
Everything from off-the-shelf packaged motors and controls to ground-up OEM custom solutions. All at affordable prices.

At Automotion, we research, engineer, design, and manufacture DC brushless motor controls. And that's it. Because of our focus, we believe we can provide the best DC brushless motor control available anywhere. And, because of our focus, we can provide these controllers at affordable prices.

Not only is our price tag small, our product is small. The LC family of controllers provides more power and function, in a compact package, because of our advanced design. That means your motor application need not suffer from an oversized or overpriced control.

We are also happy to work with you on a custom basis to design a specific control for your specific needs. And even help you find the right motor for your application.

Because at Automotion, only two things count: our customers and meeting their DC brushless motor control needs.

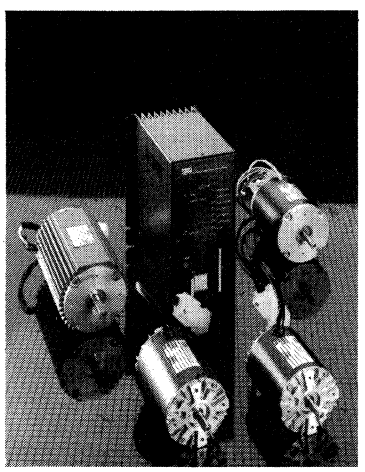


STANDARD PRODUCT

Consider the LC family of controllers from Automotion. They are compatible with any 3-phase WYE or DELTA wound DC brushless motor, and are efficiently designed to fit the tightest space requirements. And they offer some pretty impressive advantages, like instantaneous start/stop and forward/reverse, dynamic braking, and analog or digital PWM speed control in voltage ranges from +7 to 320 DC. At prices starting under $200.

Packaged low voltage versions feature a protective cover, heat sink, and quick disconnect wiring terminations that conform to NEMA type 1 requirements.

Each high voltage model is available as either an open frame unit for OEM use, or packaged in a NEMA 1 rated metal enclosure with integral heat sink, diagnostic LEDs, and quick disconnect terminlals.

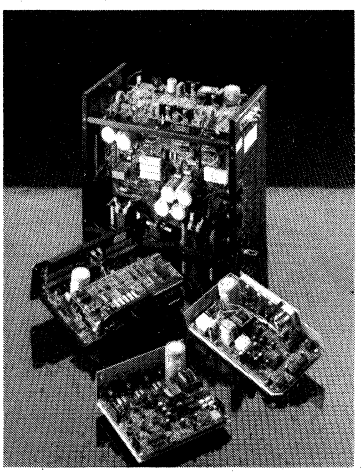


AUTOPAC™ PACKAGE.

The "AUTOPAC", a general purpose industrial grade DC brushless motor and control package, is available in standard, "off-the-shelf" ratings beginning at 1/10 HP @ 1800 RPM. Most units are rated up to 5000 RPM, maximum, with optional higher RPM designs available upon request.

The AUTOPAC family uses our advanced design of PWM drive technology coupled to a precision fractional horsepower PM DC brushless motor to produce a highly efficient, powerful, and very versatile package that is surprisingly affordable.

The DC brushless motors offered, built to Automotion's demanding standards, feature: dynamically balanced rotors, built-in, high-temperature Hall Effect sensors, Class H insulation system, and precision ground shafts.



CUSTOM

Based upon the same proven reliable, advanced PWM drive technology as our standard family, our custom series demonstrates the significant flexibility of Automotion in the design and manufacturing of cost effective custom driver solutions for our OEM customers.

Starting with the basic four quadrant H bridge driver, OEM's can select from a long list of Automotion I/O, operating and protection options to build just as much of a driver solution as the application requires. As a result, OEM customers get the brushless DC control capability they need, at a price and size that their application can justify.

Made with pride in the USA.

P.O.Box 7746 • Ann Arbor, Michigan 48107-7746

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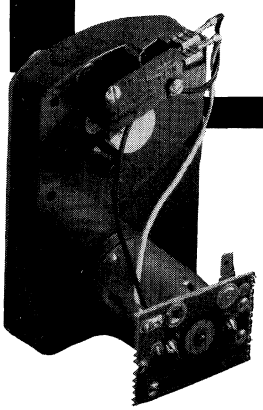
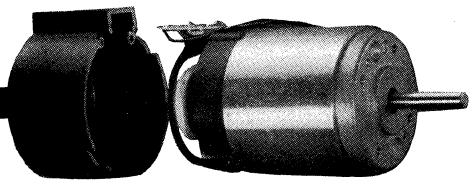
BARBER COLMAN COMPANY
a Siebe company

BARBER-COLMAN
subfractional motion control



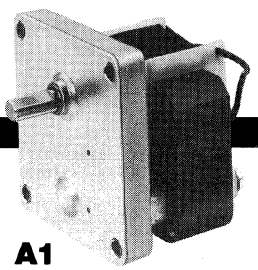
NEW PRODUCTS



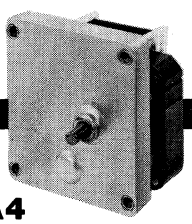
D26
DC gearmotor
6–24 Volts
Low cost plastic gearbox
Torque to 7 lb-in.
Optional features:
- Control circuits
- Limit switches
- Many shaft configurations

MYMM
Long life high torque DC motor
Stall torque to 125 oz-in.
EMI filtering
Optional features:
- Optical encoders
- Gear boxes

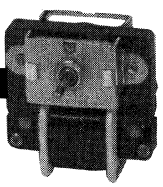
AC MOTORS



A1
Torque to 60 lb-in.
Speed 11–800 RPM

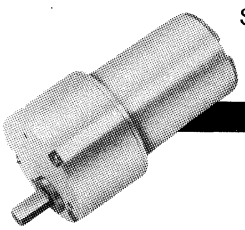


A4
Torque to 60 lb-in.
Speed 1–800 RPM

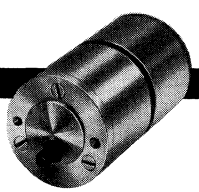


YAA
Rated HP to .005
Small and compact

DC MOTORS

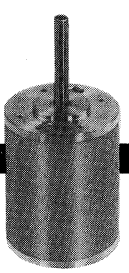


EYQE
Torque to 11 lb-in.
1.5" max. dia.



CYHC
Torque to 15 lb-in.
2.0" max. dia.

EYQM
6–32 VDC
1.18" dia.
2.16" max. length



CYHM
6–36 VDC
2.0" dia.

Our manufacturing experience and engineering content assure consistent quality — from simple drive motors to sophisticated "motion control packages." Our motors are available with multiple types of companion gearheads and may be combined with options like magnetic tachs, optical encoders, ball bearings and electrical filtering for exact start-stop and speed control. *For detail application assistance and pricing, contact our office at the address below.*

Barber-Colman Company
MOTOR DIVISION

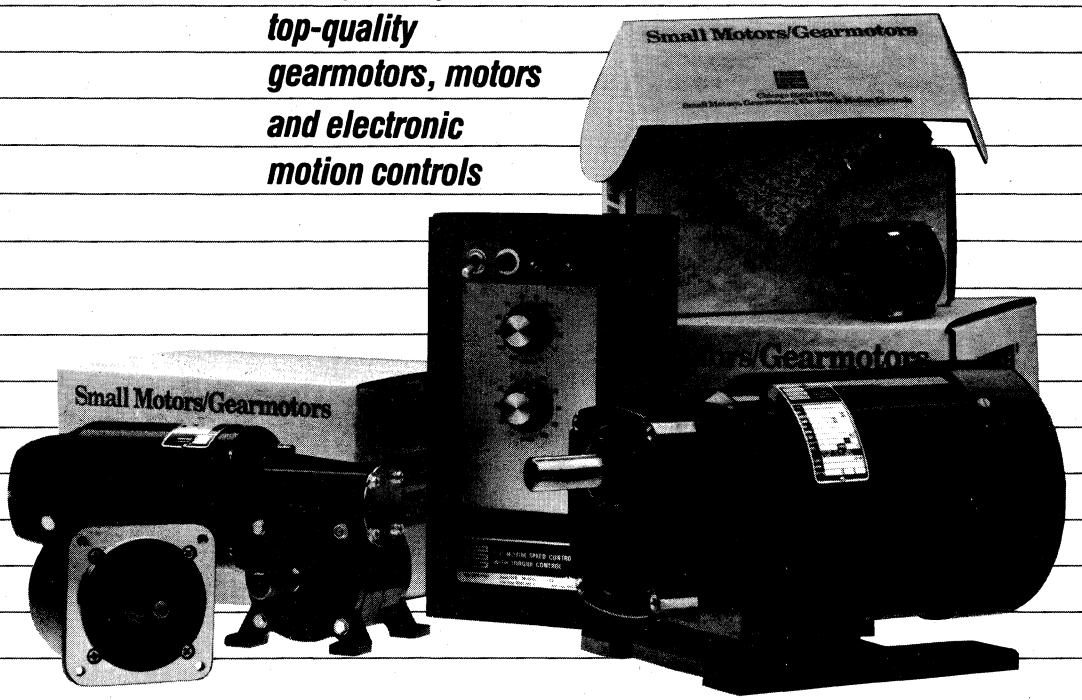
P.O. Box 7040
555 Colman Center Drive
Rockford, IL U.S.A. 61125-7040

Toll Free: 1-800-237-2537
Telex: 4330183 BC EC

M-104 LITHO IN U.S.A.

With 500 models available from stock . . .

Bodine makes it easy to buy top-quality gearmotors, motors and electronic motion controls



Bodine offers you the industry's widest line of top quality small gearmotors, motors and electronic motion controls available off-the-shelf. And wide selection and local availability are just the start of your Bodine benefits.

Bodine gives you the high reliability you need for critical applications. High-quality components and materials, realistic ratings, and manufacturing excellence produce exceptionally consistent performance and long life. It's most economical to buy products you can rely on!

Bodine gives you all the help you need to select the right gearmotors, motors and motion controls. Comprehensive technical literature is augmented by expert application engineering assistance. Customers both large and small rely on our guidance as well as on our products. It's logical to buy a product you know will perform properly!

Choice. Immediate availability. Dependability. Consistency. Technical assistance. It's the easy buy, because everything you want is built right in.

Bodine top-quality stock gearmotors, motors and electronic motion controls are available through 103 stocking Distributors and Authorized Service Centers in the USA, Canada and Europe. Modifications and specials are available through your local Manufacturer's Representative or from the factory. Ask for Stock Catalog S or European Voltage Stock Catalog SME.

BODINE®
ELECTRIC
COMPANY

2500 W. Bradley Place
Chicago, IL 60618 U.S.A.
Tel: (312) 478-3515
Telex: 25-3646

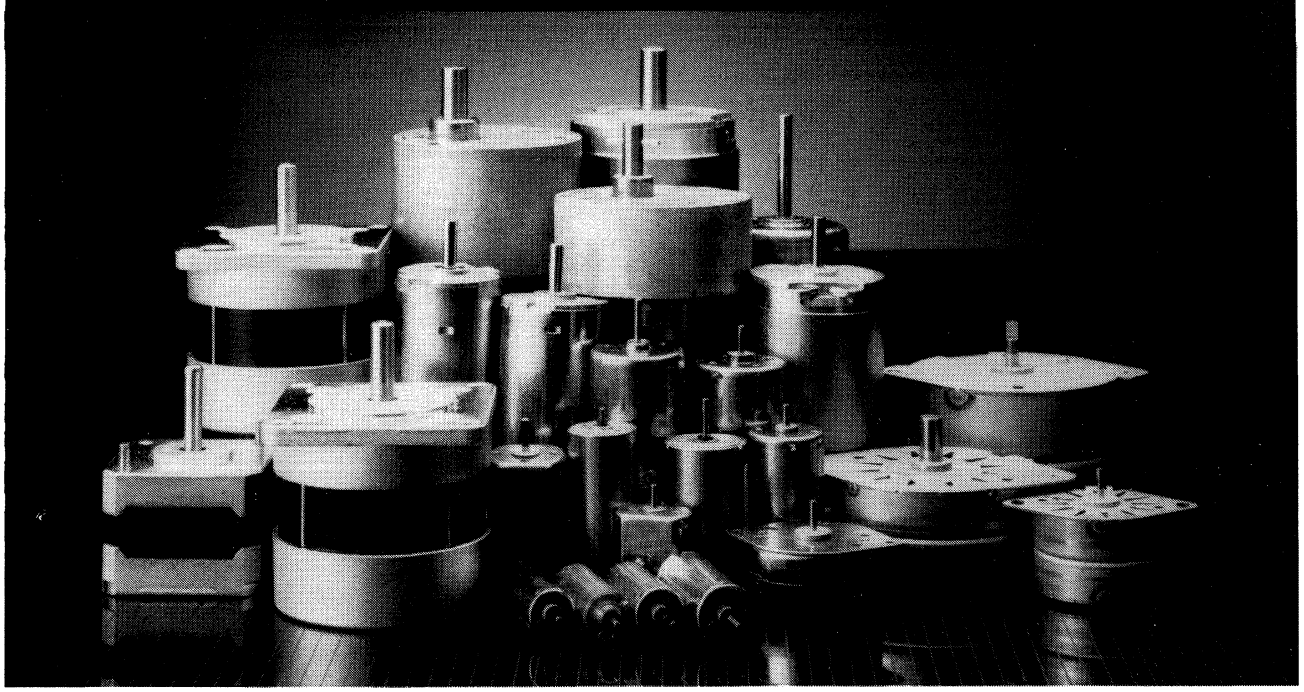
Mini-guide to stock products

- 400 USA/Canadian models, plus 100 European voltage models
- New 24 VDC gearmotors and motors
- Parallel shaft gearmotors: AC, DC; up to 341 Lb.-in. torque
- Right-angle shaft gearmotors: AC, DC; up to 340 Lb.-in. torque
- Motors: 10 and 30 AC, DC, universal; HP 1/2000 to 1/2; dia. 2.27″ to 6.00″
- 1.8° DC stepper; 72 RPM HY-Sync™; instrument, torque, floppy disc motors
- Matched SCR and Thyristor DC speed/torque controls for PM and shunt wound drives; DC stepper controls
- Synchronous and non-synchronous, split phase, permanent split capacitor, shunt wound, PM, series wound
- All stock products U.L. construction recognized, many CSA-certified and VDE-approved
- Other models and modifications available built-to-order in small or large quantities

Bodine Electric Company 1986

Quality in Motion

Everything in Small DC Motors



Canon. Your one reliable source...

BRUSHLESS

- Inner and outer rotor types
- Axial and radial gap types
- 30mm to 90mm diameter
- 25 to 700 g-cm starting torque

GEARMOTORS

- Over 100 different combinations
- Ratios from 5:1 to 3000:1
- 25 to 20,000 g-cm rated torque
- 1.3 to 830 rpm
- 6 to 24 VDC
- Concentric or offset shaft

IRON CORE

- Over 70 models
- 12mm to 52mm dia.
- 12 g-cm to 9000 g-cm starting torque
- Integral AC tach, optical encoder
- Ball or sleeve bearings on some models

STEPPERS

- Low in cost, high in performance.
- Step angle 0.9, 1.8, 7.5 and 15 degrees
- 35mm to 60mm diameters
- Non grain-oriented, radial grain-oriented, and multi-pole grain-oriented magnets

CORELESS

- 12mm to 40mm dia.
- 28 to 45 g-cm starting torque
- Ball bearings available on some models

BRUSHLESS DC BOX FANS

- Low cost • High air flow
- Long life • Brushless
- Low mechanical noise
- 12 and 24V models
- 40mm to 120mm size
- Ball bearing smoothness and 3-wire systems available.

Ask about enhancement options available in OEM quantities

Canon

CANON U.S.A. INC. Components Division

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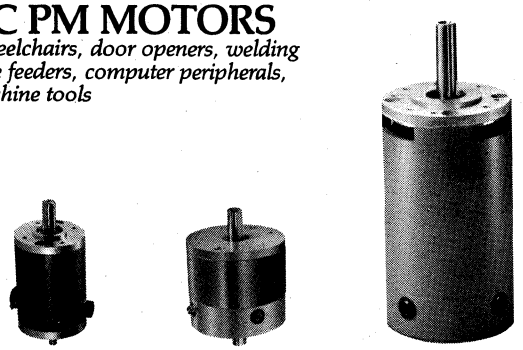
Santa Clara Office: 4000 Burton Drive, Santa Clara, CA 95054 • (408) 986-8780 • FAX: (408) 986-1557

Dependability in Motion... Fractional Horsepower Motors from Clifton Precision

DC PM MOTORS

Wheelchairs, door openers, welding wire feeders, computer peripherals, machine tools



. . . with torques from 90 to 3500 oz-in., 2 inch to 4 inch O.D. Advanced magnetic materials . . . cartridge brushes

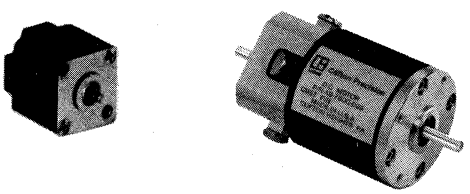
BRUSHLESS DC MOTORS

Floppy and Winchester disk drives, machine tool drives, pumps, fans, robotics

. . .with 40 to 150 mm O.D.; 1, 2, or 3 phase. Specializing in rotor/stator parts sets, with housed units also available. Will customize upon request.

MINIATURE HIGH-TORQUE DC SERVOMOTORS

Computer peripheral drives, instrument recorders, laboratory instruments, medical equipment, robotics

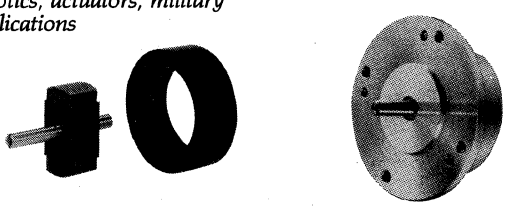


. . . with torques from 2 to 50 oz-in. .75 inch cube to 1.32 inch O.D. Cartridge brushes, Alnico or rare earth magnets

BRUSHLESS DC TOROIDAL MOTORS

— provide ripple free torque over a limited rotation without commutation.

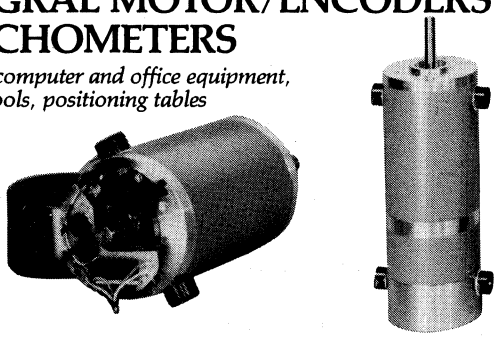
Medical scanners, ultrasound probes, robotics, actuators, military applications



. . . with torques from 2 to 214 oz-in., 1 inch to 8 inch O.D., rare earth magnets. Housed or frameless units.

INTEGRAL MOTOR/ENCODERS & TACHOMETERS

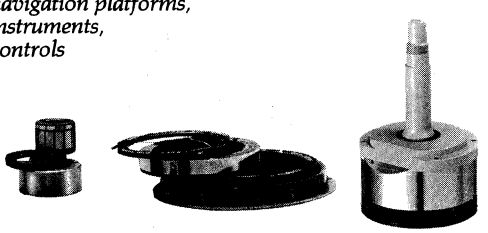
Robotics, computer and office equipment, machine tools, positioning tables



. . .for closed loop feedback: optical encoder resolution to 2500 cycles. Analog tachometers integral to motor. No assembly or alignment necessary.

DC PM HOLLOW SHAFT TORQUE MOTORS

Inertial navigation platforms, aircraft instruments, aircraft controls



. . . with torques from 6 to 2700 oz-in., 1.1 inch to 20 inch O.D. Precision tolerances, gold commutators, high reliability

Clifton specializes in custom designed products.

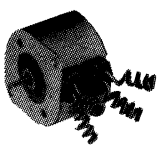
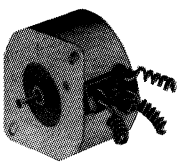
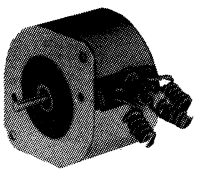
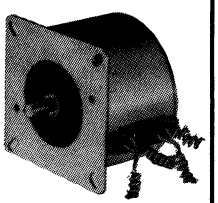
Litton

Clifton Precision

For more information contact —
Marketing Department, Clifton Precision
Marple at Broadway, Clifton Heights, PA 19018-2495
(215) 622-1000 FAX (215) 623-6344 TWX 510-669-9782

Permanent Magnet Motors

Stepper Motors - 7.5° - 2 Phase and 4 Phase

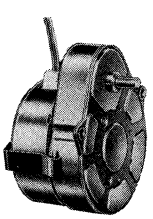
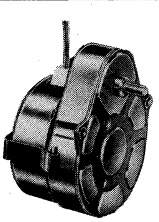
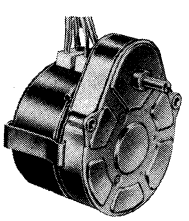
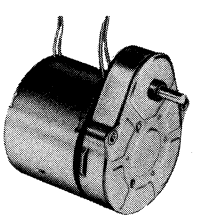
PART NUMBER	82 910.0	82 920.0	82 930.0	82 940.0
Stepper Motors				
Diameter	1.4" (35.5 mm)	2" (51 mm)	2.25" (57.5 mm)	2.55" (65 mm)
Holding Torque (2 Phase)	3.1 in. oz.	8.5 in. oz.	23 in. oz.	39 in. oz.

Reversible Synchronous Motors

Above Stepper Motor sizes are available as Reversible Synchronous Motors (300 or 450 RPM) 82 500 Series

Synchronous Gear Motors (Pear Shape)

- High Torque, instant stop
- Uni-directional or reversible
- Precision double bushing
- Standard round, flatted or knurled shaft
- UL, CSA and most European standards.
- Optional: Dual Voltage, friction or one way clutch, low temperature lubrication, etc.

Rotation	Uni-Directional		Reversible	
Torque	Standard Torque	High Torque	Standard Torque	High Torque
Part Number	82 344	82 334	82 514	82 524
Synchronous Gear Motors				
Static Torque	300 in. oz.	300 in. oz.	300 in. oz.	300 in. oz.
Dynamic Torque	75 in. oz.	75 in. oz.	75 in. oz.	75 in. oz.
Running Torque @ 1 RPM	155 in. oz.	580 in. oz.	420 in. oz.	1200 in. oz.
Power Input	2.7 w	2.8 w	2.7 w	3.5 w

Also available from Crouzet: ***Shaded Pole Gear Motors***

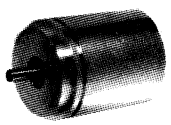
Crouzet

Crouzet Controls, Inc.
1083 State Parkway, Schaumburg, IL 60173-5419
Tel: (312) 843-2200 • Telex: 210 219 • Fax: (312) 310-8330

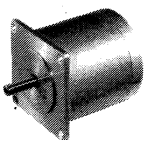
EAD EASTERN AIR DEVICES, INC.

The technological leader and problem solver in motion products

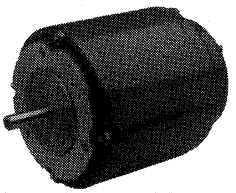
STEPPING MOTORS



Sizes 8 through 20 VR and PM stepping motors, 7.5, 10, 15, 30, 45, and 90 degree step angles with a wide range of voltage and torque ratings. Heat sinks and mechanical dampers available.

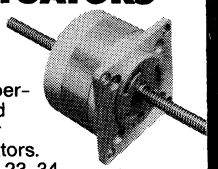


Sizes 23 ($2^{7}/_{32}$" dia.) and size 34 ($3^{3}/_{8}$" dia.) permanent magnet stepping motors with 1.8, 1.875, 5, 7.5, and 15 degree step angles. Torque ratings from 50 to 150 oz in. for size 23, and 150 to 450 oz in. for size 34.



Size 42 ($4^{3}/_{16}$" dia.) PM stepping motors with 1.8° step angles. High holding torques of 650 and 2100 oz in. High positioning accuracy of ± 3% noncumulative. Bidirectional. High speed drivers and other options.

LINEAR ACTUATORS



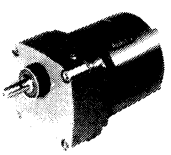
Stepper-based linear actuators. Sizes 23, 34, and 42. Linear force up to 1 ton. Linear resolution down to .000125" travel per 1.8° step. Long strokes.

INSTRUMENT MOTORS AND GEAR MOTORS

Holtzer Cabot Model M instrument motors with ratings up to 1/20 HP. Available as induction, torque, and synchronous motors in either face or foot mount. Only $2^{7}/_{8}$" sq. Popular for floppy disk drive applications.

Holtzer Cabot Model L & S instrument motors with ratings up to 1/100 HP. Available as servo, polarized synchronous, synchronous, torque, induction, and DC motors. Only $2^{5}/_{16}$" square.

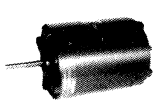
Holtzer Cabot Model L & S instrument gear motors with ratings through 150 oz. in. Available with gear reductions from 3:1 to 3600:1 in either spur or in helical gearing. Only $2^{5}/_{16}$" square.



Size 34 ($3^{3}/_{8}$" dia.) synchronous and non-synchronous gear motors. Speeds from 2 RPM to 150 RPM. Torque output up to 40 lb. in. For applications that require quiet operation and long life.

Holtzer Cabot right angle gear motors. Up to ⅛ HP in a variety of voltages, either AC or DC. Gear ratios from 6:1 to 1140:1 in either single or double reduction gear reducers.

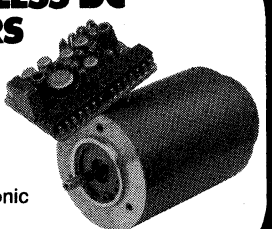
SYNCHRONOUS AND INDUCTION MOTORS



Size 34 ($3^{3}/_{8}$" dia.) and 44 ($4^{3}/_{8}$" dia.) synchronous and induction motors. 1/300 through ½ HP. 600 to 12,000 RPM. Single or dual speeds, single or dual voltage. 50/60 or 400 Hz.

Size 31 ($3^{1}/_{8}$" dia.) and size 39 ($3^{7}/_{8}$" dia.) synchronous and induction motors. 1/200 through ½ HP. 600 to 3600 RPM. Single or dual speeds. 50/60 Hz.

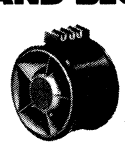
BRUSHLESS DC MOTORS



Motors, fans, blowers. Sub-FHP to ½ HP. To 20,000 rpm. With or without electronic drive circuits.

FANS AND BLOWERS

Propeller and Tubeaxial fans. Up to 12" dia. up to 1500 CFM. The EAD line of axial fans for cooling application is manufactured for continuous duty and efficient air circulation.



Vaneaxial fans. Available in $1^{1}/_{2}$", 2", and $4^{3}/_{4}$" dia. from 3 to 500 CFM at high static pressures. EAD V-Line fans are small and powerful air moving devices particularly suited to high-density electronic packages.

Centrifugal blowers. From 3 to 2000 CFM, static pressures up to 5" of water. These centrifugal squirrel cage blowers have general-purpose performance characteristics for systems with medium back pressures.

EAD Motors, Blowers, and Fans

Holtzer Cabot Instrument Motors

Janette Gear Motors, Reducers

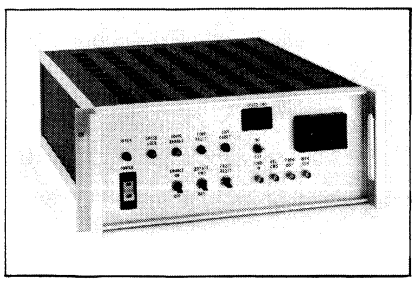
Dept. EM, 1 Progress Dr.
Dover, NH 03820
TEL: (603) 742-3330
FAX: (603) 742-9080

ELTROL
ELTROL CORPORATION

DC SERVO SYSTEMS

For applications requiring closed servo loop performance

MODEL 7-300-030-00
BRUSHLESS D.C. VELOCITY SERVO SYSTEM



The basic system includes the following:
- Brushless DC servo controller
- Brushless DC motor
- Commutation position encoder
- Incremental optical encoder

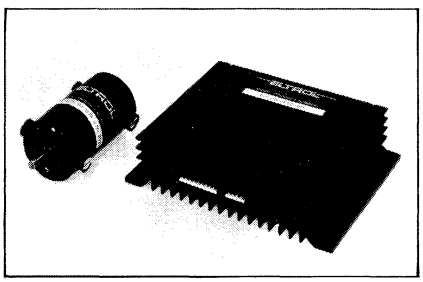
The system provides precise velocity control in a complete package: Internal D.C. power supplies, crystal reference, controls for bidirectional rotation and variable speed, digital speed readout, operating controls and status indicators.
Instantaneous speed regulation to ±.001%
Fault protection: Overtemperature, shorts to ground, shorts across motor
Current loop: High bandwidth with current limiting
Input power: 115/220VAC, 1 ϕ, 50–60 Hz

MODEL 5-156-028-00
BRUSH OR BRUSHLESS D.C. SERVO CONTROLLER

This EUROCARD provides closed loop four quadrant PWM control of motor velocity or torque. It offers maximum flexibility. Many operating features are set by pluggable jumpers. Variable compensation and gain by plug-in component carrier and trim pots simplify set up of closed loop operation.

FEATURES
- Single 24–60 volt P.S.
- Adjustable current 5–15 amps
- High efficiency 24KHZ PWM drive scheme minimizes EMI in noise sensitive applications
- Fault protection for excess temperature, speed, voltage, current, and motor stall
- Digital inputs command enable/reset, brake, and ± travel limits
- Differential amplifier for ± 10V input command
- Velocity F/B from commutation sensors, encoder, or DC tachometer

MODEL 6-120-024-00
BRUSH-TYPE LINEAR D.C. SERVO CONTROLLER



Motion control of position, velocity, or torque.
Simple adjustments for application adaptation
Peak output current: 2–10 amps
Linear operating mode: No switching EMI, high servo stiffness, no torque dead zone
Fault protection: Shorts across motor, shorts to ground, peak and time dependent continuous foldback current limits, external fault indication and reset.

The Eltrol motor-tach shown above is ideally suited to take full advantage of the servo controller's capabilities.

Eltrol Corporation is an engineering oriented firm specializing in D.C. servo systems. We provide standard, modified standard or custom designed systems to your electrical and mechanical specifications.

Write or call us today for additional information.

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ELTROL CORPORATION

20942 Osborne Street
Canoga Park, CA 91304-1846
(818) 709-0131 FAX # (818) 709-0132

ETI SYSTEMS

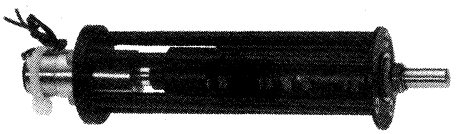
D.C. MOTORIZED POTENTIOMETERS

MOTORIZED MULTI - TURNS - 6 or 12 VDC

MC20 - 1 WIREWOUND (7/8 dia) 10 turn
RPMS AVAILABLE: ..... 0.16 to 222
RESISTANCE RANGE: ..... 10 to 200k Ω
POWER RATING: ..... 3.0 watt

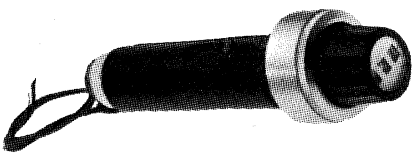
General Purpose for process control, speed control adjustors and remote control.

MC20 - 2 WIREWOUND dual gang (1- 1/4 dia) 10 turn
RPMS AVAILABLE: ..... 0.16 to 122
RESISTANCE RANGE: ..... 10 to 200k Ω
POWER RATING: ..... 3.0 watt



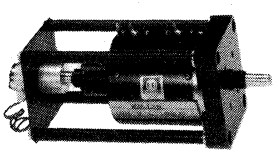
Dual Gang For Fully Fed-Back Systems.

MC20 - 3 WIREWOUND (1- 3/8 dia) 10 turn
RPMS AVAILABLE: ..... 0.16 to 50
RESISTANCE RANGE: ..... 10 to 200k Ω
POWER RATING: ..... 3.0 watt



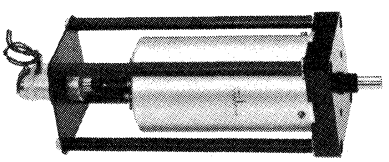
Digital Turns Counting Dial is pre-assembled and calibrated to motorpot at factory.

MC46 -1 WIREWOUND (2" sq.) 10 turn
RPMS AVAILABLE: ..... 0.16 to 65
RESISTANCE RANGE: ..... 2 to 300k Ω
POWER RATING: ..... 5.0 watt



High Resolution, increased power. 20 turns available.

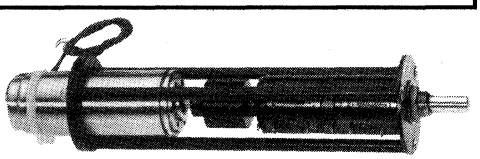
MC46 -2 WIREWOUND (2" sq.) 10 turn
RPMS AVAILABLE: ..... 0.16 to 65
RESISTANCE RANGE: ..... 0.05 to 200k Ω
POWER RATING: ..... 5.0 watt



Limit Switches at one or both ends of travel. 20 or 30 turns available.

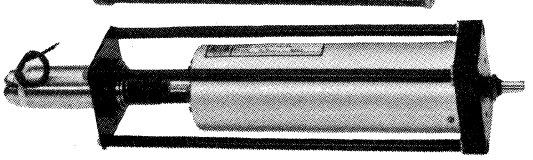
HEAVY DUTY MOTOR & GEAR - 6, 12 or 24 VDC

MC20 - 4 WIREWOUND dual gang (1- 3/8 dia) 10 turn
MC20 - 5 WIREWOUND single gang (1- 3/8 dia)
RPMS AVAILABLE: ..... 0.04 to 276
RESISTANCE RANGE: ..... 10 to 200k Ω
POWER RATING: ..... 3.0 watt



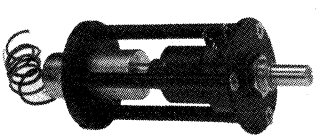
Up to 18 oz. in. torque. Required when attaching the potentiometer output shaft to another gear or mechanism.

MC46 - 4 WIREWOUND dual gang (2" sq) 10 turn
MC46 - 5 WIREWOUND single gang (2" sq.)
RPMS AVAILABLE: ..... 0.4 to 86
RESISTANCE RANGE: ..... 0.5 to 200k Ω
POWER RATING: ..... 5.0 watt



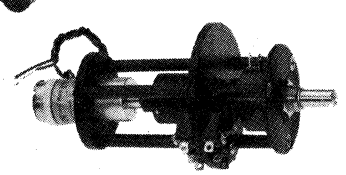
MOTORIZED SINGLE TURNS - 6 or 12 VDC

MC2E - WIREWOUND (1-1/4" dia)
RPMS AVAILABLE: ..... 0.16 to 222
RESISTANCE RANGE: ..... 500 to 100k Ω
POWER RATING: ..... 1.0 watt
Conductive Plastic element for essentially infinite resolution, longer life available.



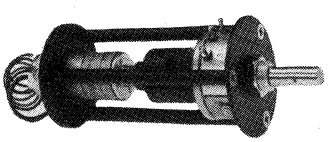
Potentiometer terminals allow *Plug on Connectors, Simplifying Harnessing.*

MC2P - 2 CONDUCTIVE PLASTIC (2" dia)
RPMS AVAILABLE: ..... 0.16 to 222
RESISTANCE RANGE: ..... 500 to 100k Ω
POWER RATING: ..... 1.0 watt



Unit has 5 amp *Snap Action Switches* at both ends of travel.

MC3W - WIREWOUND (1-3/4" dia)
RPMS AVAILABLE: ..... 0.16 to 122
RESISTANCE RANGE: ..... 50 to 50K Ω
POWER RATING: ..... 0.75 watt



Larger units available with higher wattage and conductive plastic elements.

FOR SERVO POSITIONING CONTROL CIRCUITRY, SEE OUR AD IN EEM (Control Systems & Components).
SEE OUR POTENTIOMETERS IN EEM (Potentiometers,Trimmers, Controls & Rheostats)

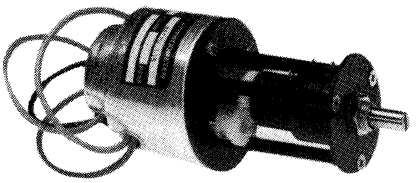
ETI SYSTEMS · 215 Via Del Norte · Oceanside, CA 92054 · TEL: (619) 757-7770 · FAX: (619) 757-2305
Division: Polaris Industrial Enterprises, Inc.

ETI SYSTEMS

A.C. MOTORIZED POTENTIOMETERS

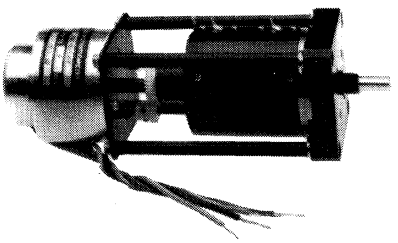
MOTORIZED MULTI - TURNS - 24 or 115 VAC

MAC2W - WIREWOUND (2" dia x 4-1/4" max)
RPMS AVAILABLE: ..... 0.5 to 15
RESISTANCE RANGE: ..... 100 to 100k Ω
POWER RATING: ..... 2.0 watt



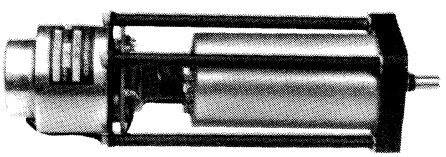
General Purpose 10 turn Wirewound el ment for excellent output stability.

MAC46 - WIREWOUND (2" sq. x 6" max)
RPMS AVAILABLE: ..... 0.5 to 15
RESISTANCE RANGE: ..... 2 to 300k Ω
POWER RATING: ..... 5.0 watt



High Wattage, high resolution.

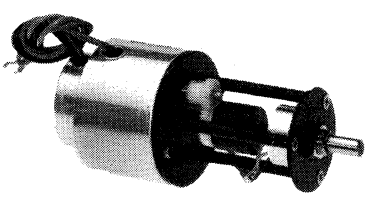
MAC4RC - WIREWOUND (2" sq x 6-13/16" max)
RPMS AVAILABLE: ..... 0.5 to 15
RESISTANCE RANGE: ..... 0.5 to 1M Ω
POWER RATING: ..... 5.0 watt



Limit Switches at one or both ends of travel. High Wattage. *With Circuit Board.*

MOTORIZED SINGLE TURNS - 24 or 115 VAC

MAC22 - WIREWOUND (2" dia. x 3-1/2" max)
RPMS AVAILABLE: ..... 0.5 to 15
RESISTANCE RANGE: ..... 100 to 20k Ω
POWER RATING: ..... 1.0 watt

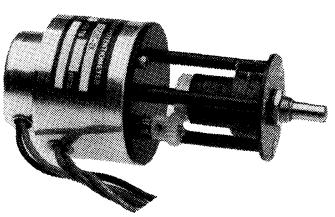


General Purpose. Wirewound element for excellent output stability.

MAC2P - CONDUCTIVE PLASTIC (2" dia. x 3-1/2" max.)
RPMS AVAILABLE: ..... 0.5 to 15
RESISTANCE RANGE: ..... 500 to 100k Ω
POWER RATING: ..... 1.0 watt

Conductive Plastic for long life and essentially infinite resolution.

MAC2E - WIREWOUND (2" dia. x4" max.)
RPMS AVAILABLE: ..... 0.5 to 15
RESISTANCE RANGE: ..... 10 to 20k Ω
POWER RATING: ..... 0.5 watt



Push on Connectors simplify harnessing.

MAC2C - CONDUCTIVE PLASTIC (2" dia. x 4" max.)
RPMS AVAILABLE: ..... 0.5 to 15
RESISTANCE RANGE: ..... 500 to 100k Ω
POWER RATING: ..... 1.0 watt

Push on Terminals simplify Harnessing. Conductive plastic allows greater life, higher wattage.

FEATURES of ETI SYSTEMS Motorized Potentiometers. Slip clutch allows manual adjustment when power is off. Operating Temperature range: -30°C to +65°C. A.C. motors are UL approved, reversible. Circuit board (optional), packages the starting capacitor, balancing resistor and braking diode. Braking diode prevents motor coasting.

FOR SERVO POSITIONING CONTROL CIRCUITRY, SEE OUR AD IN EEM (Control Systems & Components).
SEE OUR POTENTIOMETERS IN EEM (Potentiometers,Trimmers, Controls & Rheostats)

ETI SYSTEMS · 215 Via Del Norte · Oceanside, CA 92054 · TEL: (619) 757-7770 · FAX: (619) 757-2305
Division: Polaris Industrial Enterprises, Inc.

ETI SYSTEMS

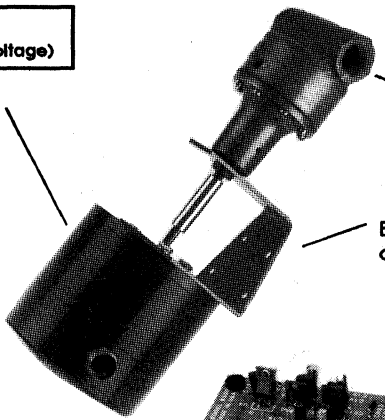
ROTARY ACTUATORS & MOTORIZED COMPONENTS

VALVE POSITIONERS

Patented design addresses safety and downtime, torque concerns, and perhaps most critical, *"styction"*. From 10-turn needle valves to regulators requiring 200 in.lbs. of torque, ETI Systems offers the precision functioning and feedback devices that fit your requirements.

WATER REGULATOR ADJUSTOR
Model VM100 (D.C. or A.C. Motor Voltage)

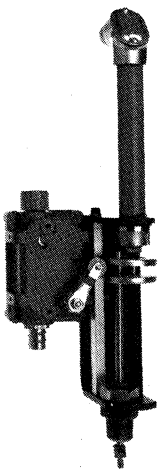
Housing is 5" in Dia. and contains:
- End travel limit switches.
- Feedback position potentiometer.
- Multiple motors (patented), provides higher torque, better load distribution and prevents catastrophic motor failure.
- Energy absorbers (patented) reduces sticking.



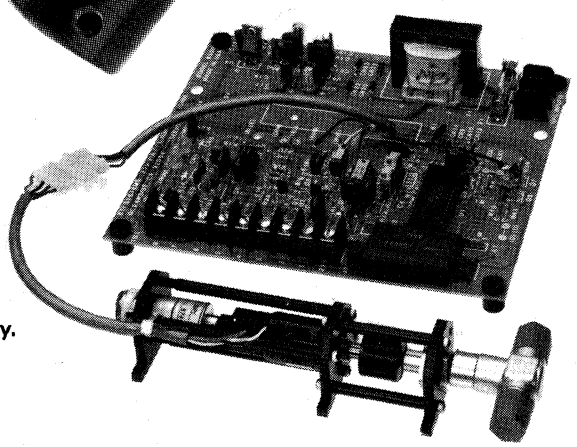
Valve or regulator (customer provided or designated).

Bracket is detachable or custom made.

WATER REGULATOR FEEDBACK
Model VL2350S



VALVE CONTROL
Model VC6500

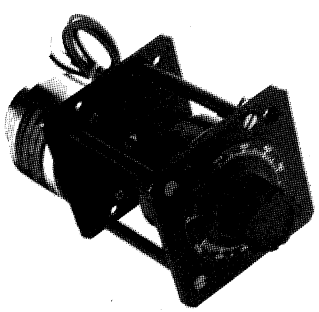


- Servo Control with feedback.
- Inputs to position valves are: 0 to 10VDC, 4 to 20 MA or binary.
- Non-Standards available.

WE WILL DESIGN FOR YOUR APPLICATION. CALL OUR ENGINEERING DEPT. FOR ASSISTANCE.

MOTORIZED RHEOSTATS & VARIABLE TRANSFORMERS

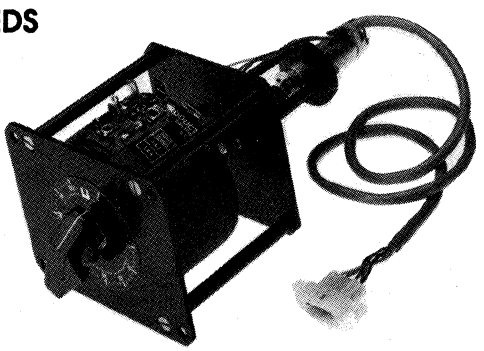
CONTROL YOUR POWER NEEDS



MOTORIZED RHEOSTAT

- Automatically or Remotely control power needs with a Motorized Rheostat or Variable Transformer from ETI Systems.
- Single or Multi gangs Available
- 6, 12 or 24 VDC
- 24 or 115 VAC
- Many RPM Selections

POSITIONING CIRCUITRY AVAILABLE



MOTORIZED VARIABLE TRANSFORMER

FOR MOTORIZED POTENTIOMETERS SEE OUR AD IN EEM (Motors, Drives & Rotating Components). FOR SERVO POSITIONING CONTROL CIRCUITRY, SEE OUR AD IN EEM (Control Systems & Components). SEE OUR POTENTIOMETERS IN EEM (Potentiometers,Trimmers, Controls & Rheostats)

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B&B PROVIDES:
- Off-The-Shelf Delivery
- Applications Engineering
- Motor & Control Modifications
- System Design & Fabrication

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AC INVERTER DRIVES
0.25 thru 10 HP
Compatible Motors and Speed Reducers

B&B LOGIC II + B&B NOVA
DC Motor Controls
Shunt Wound and PM Compatible
Motor and Control Accessories

B&B MOTORS
General Purpose Motors
Pump, Fan, Pool, Appliance
Fractional to Multi HP
Cross Ref to Major Brands

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DART MOTOR SPEED CONTROLS
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Variable Speed Controls
New American AC Inverter Series
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Controls to 1000 HP

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Speed Reducers
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HURST MOTORS
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BBSLC288

INDIANA GENERAL
90 + 180 VDC Motors
Outputs to 3HP

KB ELECTRONICS
Variable Speed DC Motor Controls
1/100 to 3HP
Options + Accessories

POWR UPS INC.
Digital DC Motor Speed Controls
Brushless DC Controls
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Motors & Gearmotors
0.13 to 750 lb-in
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Low Inertia Design
Anti-Backlash
Clamp-Type and Set Screw

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SM Cyclo Speed Reducers
¼ to 300 Horsepower
Efficiencies to 95%

ZERO-MAX DIVISION
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Crown Gear Drives

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Stepping Motor Drivers
Translators + Indexers
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B&B CONTROL SYSTEMS
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System Design & Fabrication
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Motor + Control Modifications
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B&B AUTOMATION SYSTEMS DIVISION AND APPLICATIONS ENGINEERING
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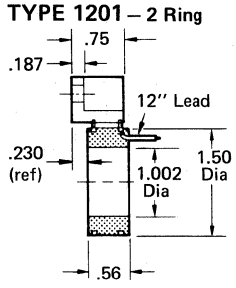
SLIP RING ASSEMBLIES

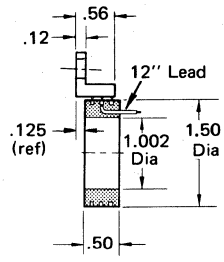
BEST DELIVERY **1**

SEPARATE ROTOR AND BRUSH BLOCK ASSEMBLY — STOCK DELIVERY

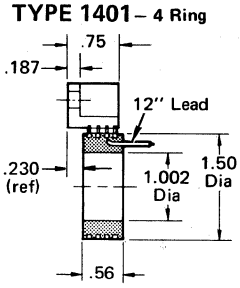
TYPE 1201 – 2 Ring



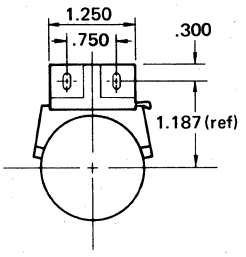
TYPE 1301 – 3 Ring



TYPE 1401 – 4 Ring

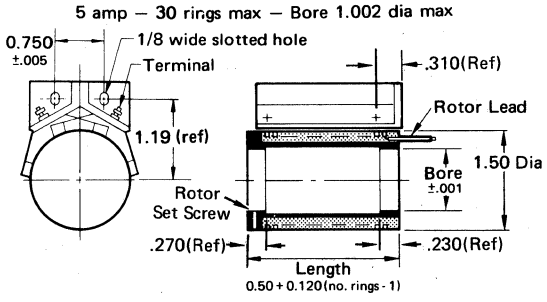


TYPICAL END VIEW



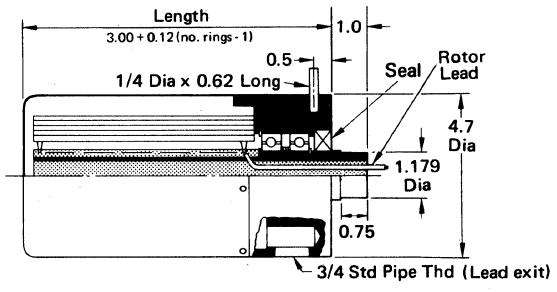
Slip Ring Assembly Type **1057**
Separate Rotor and Brush Block

5 amp — 30 rings max — Bore 1.002 dia max



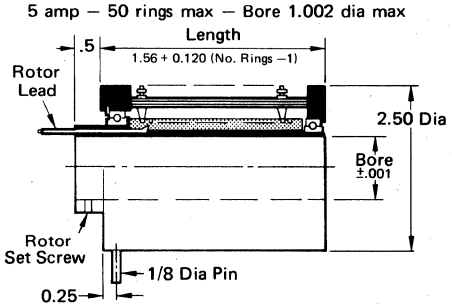
Slip Ring Assembly Type **1302**
Sealed Housing

5 amp — 50 rings max — Solid Bore



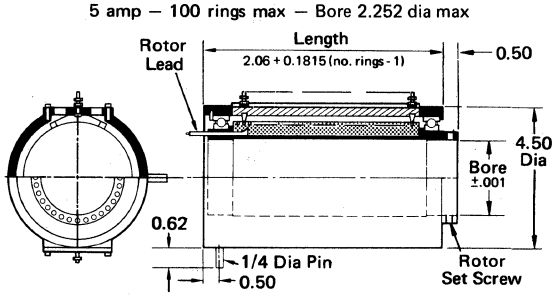
Slip Ring Assembly Type **1186**
Rigid Tube Housing — Exposed Stator Terminals

5 amp — 50 rings max — Bore 1.002 dia max



Slip Ring Assembly Type **1067**
Rigid Tube Housing — Exposed Stator Terminals

5 amp — 100 rings max — Bore 2.252 dia max



CHARACTERISTICS

RPM: Rigid one piece housing eliminates bearing alignment problems

RINGS: Coin Silver 5 AMP Rings

BRUSHES: Silver Graphite
Fabricast Grade FAG 180 (80% AG – 20% C)
Two brushes per ring
Brushes individually removable and replaceable

NOISE: 10 Milliohms dynamic resistance MAX
5 Milliohms MAX with 4 brushes per CKT

HI-POT: 1000 VAC 60 CYCLE for 15 seconds.

ROTOR: One piece steel sleeve
Ring complement vacuum cast on sleeve as unit with epoxy dielectric

COVER: Easily removable for brush and ring inspection

BEARINGS: Shielded or sealed ball bearings

PART NUMBER CODING – Specify fully when ordering

Type	Bore (Inches)	No. Rings	Lead Length (Inches)	Lead Type (Shielded - S, Unshielded - U)
X	X	X	X	X

WRITE OR PHONE FOR THE FABRICAST CATALOG

Fabricast, Inc. *CUSTOM MANUFACTURERS OF SLIP RING ASSEMBLIES*

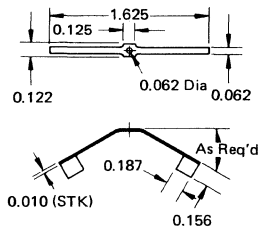
P.O. BOX 3176, 2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733 Phone (818) 443-3247 (S. El Monte/Los Angeles)

BRUSH ASSEMBLIES

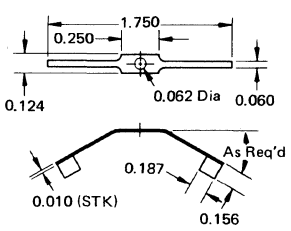
2

LEAF TYPE (BRUSH MATERIAL - FAG 180 LEAF MATERIAL - BeCu) STOCK DELIVERY

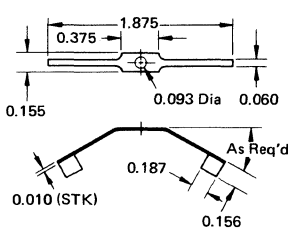
5.0 AMP DOUBLE BRUSH
P/N 1103004 BRUSH .040 WIDE



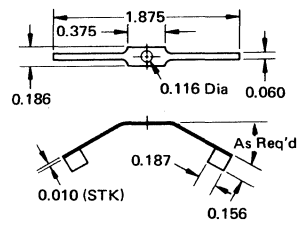
5.0 AMP DOUBLE BRUSH
P/N 1050006-13 BRUSH .040 WIDE



5.0 AMP DOUBLE BRUSH
P/N 1050006-5 BRUSH .040 WIDE

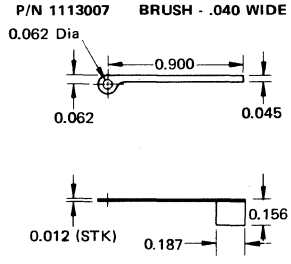


5.0 AMP DOUBLE BRUSH
P/N 1050006-2 BRUSH .040 WIDE

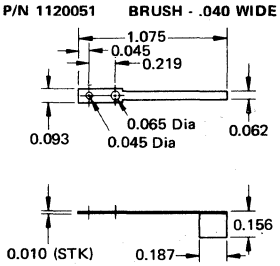


"AS REQ'D" ANGLE IN FREE STATE – LEAF WITHOUT BRUSH WOULD TOUCH RING SURFACE

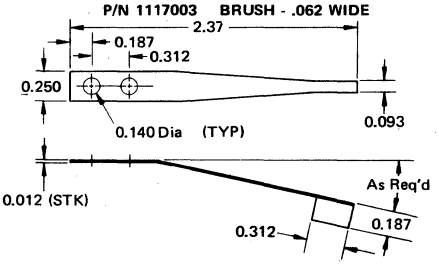
2.0 AMP SINGLE BRUSH
P/N 1113007 BRUSH - .040 WIDE



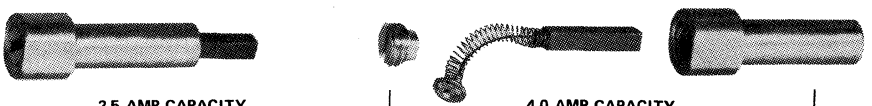
2.0 AMP SINGLE BRUSH
P/N 1120051 BRUSH - .040 WIDE



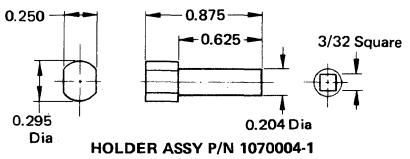
5.0 AMP SINGLE BRUSH
P/N 1117003 BRUSH - .062 WIDE



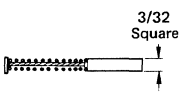
PLUNGER TYPE (BRUSH MATERIAL - FAG 180 HOLDER - BRASS) STOCK DELIVERY



2.5 AMP CAPACITY
3/32" SQUARE BRUSH

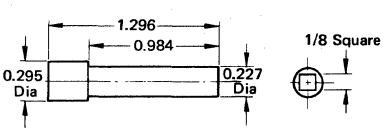


HOLDER ASSY P/N 1070004-1
CAP ASSY P/N 1070004-2



BRUSH ASSY P/N 1072-1

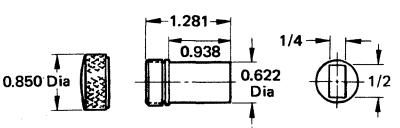
4.0 AMP CAPACITY
1/8" SQUARE BRUSH



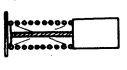
HOLDER ASSY P/N 1051032-1
CAP ASSY P/N 1051032-2

BRUSH ASSY P/N 1072-2

25 AMP CAPACITY
1/4" x 1/2" RECTANGULAR BRUSH



HOLDER ASSY P/N 1092006-1
CAP ASSY P/N 1092006-2



BRUSH ASSY P/N 1092003

BRUSH MATERIAL

- Fabricast grade Fag 180, the universal low noise level grade used for all standard brush assembles.
- Fabricast grade FAG 193, the lowest noise level grade, however, the ring surface speed is limited to 250 SFM.
- Fabricast grade FAG 150, the highest surface speed grade, however, noise levels are compromised.

Grade No.	Composition	Recommended Surface Speed	Carrying Capacity
FAG150	50% silver, 50% graphite	Over 3500 ft. per min.	100 Amps per sq. in.
FAG180	80% silver, 20% graphite	Up to 3500 ft. per min.	250 Amps per sq. in.
FAG193	93% silver, 7% graphite	Up to 250 ft. per min.	300 Amps per sq. in.

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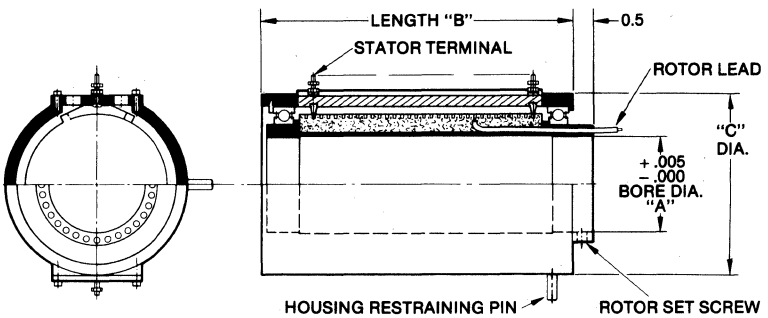
SLIP RING ASSEMBLIES

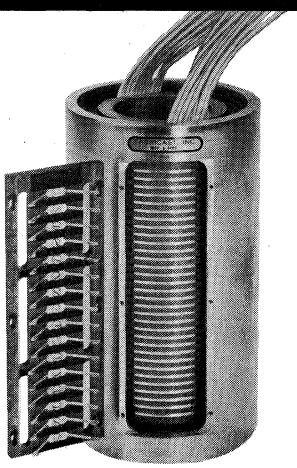
SELF—CONTAINED RIGID TUBE HOUSING

3

DISTINGUISHING CHARACTERISTICS

Rigid one piece housing eliminates bearing alignment problems. Larger section bearings are generally used in these units for a more rugged unit.





TYPE	BORE DIA "A" INCHES		NO. RINGS MAX.	CURRENT AMPS	LENGTH "B" INCHES	HOUSING DIA "C"
	NOMINAL	RANGE				
1230	Solid	—	100		3.50 + .120 (no. rings -1)	2.50
1186	1.000	0 - 1.002	100	5 amp std 2 brushes per ring	1.56 + .120 (no. rings -1)	2.50
1197	1.250	1.0 - 1.252	70		1.56 + .130 (no. rings -1)	3.50
1289	1.500	1.25 - 1.502	100		1.56 + .150 (no. rings -1)	4.00
1067	2.000	1.5 - 2.252	100	10 amp std or lo noise 4 brushes per ring	2.06 + .181 (no. rings -1)	4.50
1420	3.000	2.25 - 3.002	100		1.38 + .181 (no. rings -1)	4.75
1506	3.500	3.0 - 3.502	100		2.88 + .200 (no. rings -1)	6.50
1390	4.000	3.5 - 4.252	100		2.00 + .187 (no. rings -1)	5.75

* RING COMPLEMENT MAY BE LIMITED BY ABILITY TO PASS ROTOR LEADS UNDER BEARINGS.
* FOR 50 AMP STANDARD POWER ASSEMBLIES SEE POWER ASSEMBLY SECTION.
* INSTRUMENT AND 50 AMP POWER CIRCUITS MAY BE CAST ON COMMON SLEEVE.

CHARACTERISTICS

RPM: Rigid one piece housing eliminates bearing alignment problems

RINGS: Coin Silver 5 AMP Rings

BRUSHES: Silver Graphite
Fabricast Grade FAG 180 (80% AG — 20% C)
Two brushes per ring
Brushes individually removable and replaceable

NOISE: 10 Milliohms dynamic resistance MAX
5 Milliohms MAX with 4 brushes per CKT

CURRENT: Noted in tabulated block
Rating may be doubled with 4 brushes per CKT

HI-POT: 1000 VAC 60 CYCLE for 15 seconds

ROTOR: One piece steel sleeve
Ring complement vacuum cast on sleeve as unit with epoxy dielectric

ROTOR LEADS: 5 AMP Leads — 20 GA per MIL-W-16878 TYPE "E"
Lead exit as shown on most units. Maximum ring complement may require smaller wire or leads to exit both ends.

HOUSING: One piece tube construction

COVER: Easily removable for brush and ring inspection

BEARINGS: Shielded or sealed ball bearings

PART NUMBER CODING — Specify fully when ordering

Type	Bore (Inches)	No. Rings	Lead Length (Inches)	Lead Type (Shielded - S / Unshielded - U)
X	X	X	X	X

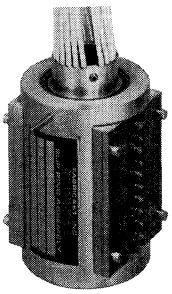
WRITE OR PHONE FOR THE FABRICAST CATALOG

Fabricast, Inc. *CUSTOM MANUFACTURERS OF SLIP RING ASSEMBLIES*

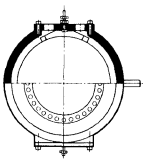
P.O. BOX 3176, 2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733 Phone (818) 443-3247 (S. El Monte/Los Angeles)

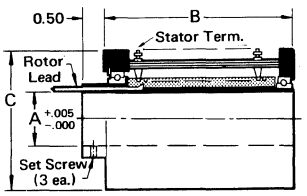
SLIP RING ASSEMBLIES — SELF-CONTAINED — 4

SELF CONTAINED RIGID HOUSING SLIP RING ASSEMBLIES



DISTINGUISHING CHARACTERISTICS
Rigid one piece housing eliminates bearing alignment problems. Bearings are thin section aircraft torque tube type or Kaydon KA series.





REPLACEABLE BRUSH ASSEMBLIES — 1000 VAC HYPOT

TYPE	BORE DIA "A", inches		NO. RINGS MAX	CURRENT	LENGTH "B", inches	Housing Dia "C"
	Nominal	Range				
4100	.500	.250 - .502	48	5 amp std 2 brushes per ring	1.19 + .125 (no. rings - 1)	2.00
4150	1.000	.000 - 1.002	64		1.19 + .120 (no. rings - 1)	2.50
4200	1.312	1.000 - 1.312	100		1.19 + .125 (no. rings - 1)	3.00
4237	1.750	1.312 - 1.752	78		1.19 + .130 (no. rings - 1)	3.37
4268	2.000	1.750 - 2.002	100		1.28 + .150 (no. rings - 1)	3.62
4350	2.750	2.250 - 2.752	100	10 amp std or lo noise 4 brushes per ring	1.75 + .150 (no. rings - 1)	4.50
4400	3.250	2.750 - 3.252	100		1.75 + .187 (no. rings - 1)	5.00
4462	3.750	3.250 - 3.752	100		1.75 + .160 (no. rings - 1)	5.50
4500	4.250	3.750 - 4.252	100		1.75 + .187 (no. rings - 1)	6.00
4600	5.250	4.250 - 5.252	79		1.75 + .186 (no. rings - 1)	7.00
4700	6.250	5.250 - 6.252	63		1.75 + .186 (no. rings - 1)	8.00
4800	7.250	6.250 - 7.252	58		1.75 + .187 (no. rings - 1)	9.00
4900	8.750	7.250 - 8.750	58		1.75 + .187 (no. rings - 1)	11.00
1271	1.000	.000 - 2.000	15	50 amp std	3.50 + 1.050 (no. rings - 1)	4.50
1291	3.000	2.000 - 3.252	9	50 amp std	4.50 + 1.120 (no. rings - 1)	6.50

NON-REPLACEABLE BRUSH ASSEMBLIES — 500 VAC HYPOT

4087	.250	.250 - .502	50	3 amp std 2 brushes per ring	.875 + .080 (no. rings - 1)	1.56
4125	.500	.250 - .752	50		.875 + .100 (no. rings - 1)	2.00
4230	2.000	1.500 - 2.002	50		.875 + .080 (no. rings - 1)	3.50

PART NUMBER CODING — Specify fully when ordering

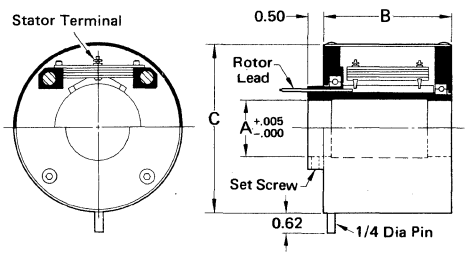
Type	Bore (inches)	No. Rings	Lead Length (inches)	Lead Type (Shielded - S, Unshielded - U)
X	X	X	X	X

CHARACTERISTICS

RPM: **Rigid one piece housing eliminates bearing alignment problems.**
RINGS: Coin Silver 5 amp rings. Copper 50 amp rings.
BRUSHES: Silver Graphite Fabricast Grade FAG 180 (80% AG — 20% C) Two brushes per ring. Brushes individually removable and replaceable.
NOISE: 10 Milliohms dynamic resistance max 5 Milliohms max with 4 brushes per ckt.
CURRENT: Noted in tabulated block. Rating may be doubled with 4 brushes per ckt.
HI-POT: See table on left.
ROTOR: One piece steel sleeve. Ring complement vacuum cast on sleeve as unit with epoxy dielectric.
ROTOR LEADS: 5 amp Leads — 20 ga per MIL-W-16878 type "E" 50 amp Leads — 8 ga — Teflon.
HOUSING: One piece tube construction.
COVER: Easily removable for brush and ring inspection.
BEARINGS: Shielded or sealed ball bearings.

SELF CONTAINED COVERED STATOR TERMINAL SLIP RING ASSEMBLIES

DISTINGUISHING CHARACTERISTICS
Bearing Bell and space bar type units best suited for larger bore assemblies.



TYPE	BORE DIA "A", inches		NO. RINGS MAX	CURRENT	LENGTH "B", inches	Housing Dia "C"
	Nominal	Range				
1296	.250	.250 - .377	48	5 amp std 2 brushes per ring	1.25 + .110 (no. rings -1)	2.25
1297	.500	.378 - .565	100		1.25 + .120 (no. rings -1)	2.75
1298	1.000	.566 - 1.002	100		1.25 + .120 (no. rings -1)	3.00
1272	1.000	1.000 - 1.750	100		2.00 + .150 (no. rings -1)	5.25
1273	2.000	1.750 - 2.625	100		2.00 + .150 (no. rings -1)	6.25
1274	3.000	2.625 - 3.750	100	10 amp or lo noise 4 brushes per ring	2.00 + .160 (no. rings -1)	7.50
1275	4.000	3.750 - 4.750	48		2.00 + .186 (no. rings -1)	9.00
1276	5.000	4.750 - 5.750	63		2.00 + .186 (no. rings -1)	10.50
1277	6.000	5.750 - 6.750	58		2.00 + .187 (no. rings -1)	12.00
1278	8.000	6.750 - 8.750	58		2.00 + .187 (no. rings -1)	15.00
1282	1.000	1.000 - 1.250	16	50 amp std 100 amp 4 brushes per ring	3.00 + 1.050 (no. rings -1)	8.00
1283	2.000	1.250 - 2.000	16		3.00 + 1.050 (no. rings -1)	9.00
1284	3.000	2.000 - 3.125	9		3.00 + 1.120 (no. rings -1)	10.00
1285	4.000	3.125 - 4.375	8		3.00 + 1.116 (no. rings -1)	11.50
1286	5.000	4.375 - 5.375	10		3.00 + 1.116 (no. rings -1)	12.50
1287	6.000	5.375 - 6.375	10		3.00 + 1.125 (no. rings -1)	13.50
1288	8.000	6.375 - 8.375	10		3.00 + 1.125 (no. rings -1)	16.00

* RING COMPLEMENT MAY BE LIMITED BY ABILITY TO PASS ROTOR LEADS UNDER BEARINGS.
* 10 AMP OR LOW NOISE CKT ON TYPES 1296, 1297, 1298, REQUIRE 2 PARALLEL RINGS PER CIRCUIT.
* INSTRUMENT AND 50 AMP POWER CIRCUITS MAY BE CAST ON COMMON SLEEVE.

PART NUMBER CODING — Specify fully when ordering

Type	Bore (inches)	No. Rings	Lead Length (inches)	Lead Type (Shielded - S, Unshielded - U)
X	X	X	X	X

CHARACTERISTICS **HOUSING:** Bell, Bell Spacer and Cover type construction. All other characteristics same as for Self Contained Rigid Housing Slip Ring Assembly.

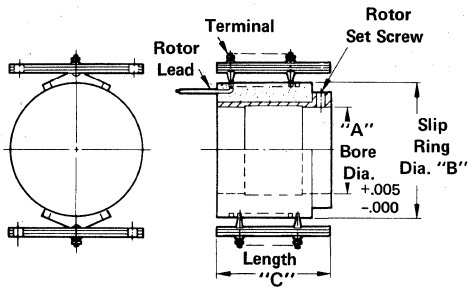
WRITE OR PHONE FOR THE FABRICAST CATALOG

Fabricast, Inc. *CUSTOM MANUFACTURERS OF SLIP RING ASSEMBLIES*

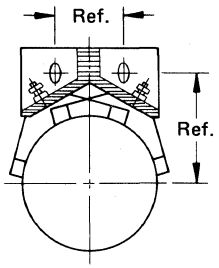
P.O. BOX 3176, 2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733 Phone (818) 443-3247 (S. El Monte/Los Angeles)

SLIP RING ASSEMBLIES — SEPARATE ROTOR & BRUSH BLOCK — 5

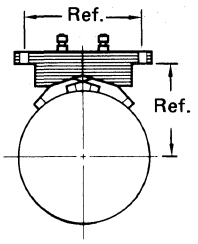
Brush Block Assy
5 AMP STD



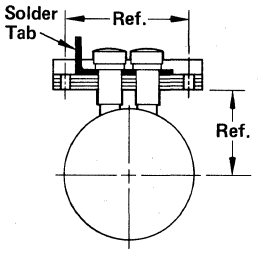
Brush Block Assy
TYPE "A"



Brush Block Assy
TYPE "E"



Brush Block Assy
50 AMP STD



TYPE	BORE DIA "A" INCHES		NO. RINGS MAX.	CURRENT AMPS	SLIP RING DIA "B"	LENGTH "C" INCHES
	NOMINAL	RANGE				
2050	SOLID	000 - .127	18	5 amp std 2 brushes per ring	.500	.625 + .125 (no. rings -1)
2087	SOLID	000 - .377	48		.875	.625 + .110 (no. rings -1)
2112	.375	000 - .627	52		1.125	.625 + .125 (no. rings -1)
2150	.750	.625 - 1.002	52		1.500	.625 + .120 (no. rings -1)
2187	1.000	.750 - 1.250	48		1.875	.625 + .125 (no. rings -1)
2200	1.125	.750 - 1.375	80		2.000	.750 + .125 (no. rings -1)
2237	1.250	1.000 - 1.502	78		2.375	.750 + .130 (no. rings -1)
2268	1.500	1.250 - 1.752	107		2.687	1.000 + .150 (no. rings -1)
2350	2.000	1.750 - 2.502	78		3.500	1.000 + .181 (no. rings -1)
2375	2.500	2.370 - 2.875	48	10 amp std or lo noise 4 brushes per ring	3.750	1.000 + .200 (no. rings -1)
2462	3.000	2.750 - 3.752	100		4.652	1.250 + .160 (no. rings -1)
2500	4.000	3.250 - 4.002	40		5.000	1.250 + .250 (no. rings -1)
2600	5.000	4.000 - 5.002	80		6.000	1.250 + .186 (no. rings -1)
2700	6.000	5.000 - 6.002	63		7.000	1.250 + .186 (no. rings -1)
2800	7.000	6.000 - 7.002	58		8.000	1.250 + .187 (no. rings -1)
2900	8.000	7.000 - 9.002	58		10.000	1.250 + .187 (no. rings -1)
3268	1.000	.750 - 1.187	16	50 amp std 2 brushes per ring	2.687	2.000 + 1.050 (no. rings -1)
3300	1.500	1.187 - 1.500	6		3.000	2.000 + 1.000 (no. rings -1)
3350	2.000	1.500 - 2.000	16		3.500	2.000 + 1.050 (no. rings -1)
3462	3.000	2.000 - 3.125	9		4.625	2.000 + 1.120 (no. rings -1)
3600	4.000	3.125 - 4.500	8		6.000	2.000 + 1.116 (no. rings -1)
3700	5.000	4.500 - 5.500	10		7.000	2.000 + 1.116 (no. rings -1)
3800	6.000	5.500 - 6.500	10		8.000	2.000 + 1.125 (no. rings -1)
3900	7.000	6.500 - 8.500	10		10.000	2.000 + 1.125 (no. rings -1)

CHARACTERISTICS

RINGS: Coin Silver AMP Rings.
Copper 50 AMP Rings.

BRUSHES: Silver Graphite.
Fabricast Grade FAG 180 (80% AG – 20% C)
Two brushes per ring
Brushes individually removable and replaceable.

NOISE: 10 Milliohms dynamic resistance MAX.
5 Milliohms max with 4 brushes per CKT.

CURRENT: Noted in tabulated block.
Rating may be doubled with 4 brushes per ckt.

HI-POT: 1000 VAC 60 cycle for 15 seconds.

ROTOR: One piece steel sleeve.
Ring complement vacuum cast on sleeve as unit with epoxy dielectric.

ROTOR LEADS: 5 AMP Leads – 20 GA per MIL-W-16878 TYPE "E"
50 AMP Leads – 8 GA – Teflon
Lead exit as shown on most units. Maximum ring complement may require smaller wire or leads to exit both ends.

BRUSH BLOCK: Glass epoxy laminate.
Optional mounting methods shown.

PART NUMBER CODING – Specify fully when ordering.

Type	Bore (inches)	No. Rings	Lead Length (inches)	Lead Type (Shielded - S / Unshielded - U)
X	X	X	X	X

WRITE OR PHONE FOR THE FABRICAST CATALOG

Fabricast, Inc. *CUSTOM MANUFACTURERS OF SLIP RING ASSEMBLIES*

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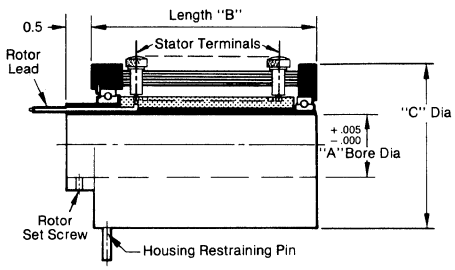
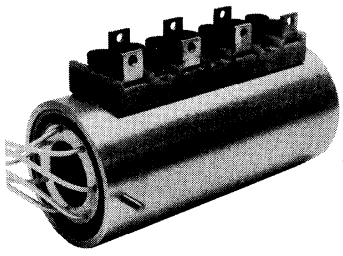
SLIP RING ASSEMBLIES 6

POWER ASSEMBLIES





CHARACTERISTICS

RPM: Rigid one piece housing eliminates bearing alignment problems

RINGS: Copper 50 AMP Rings

BRUSHES: Silver Graphite
Fabricast Grade FAG 180 (80% AG—20% C)
Two brushes per ring
Brushes individually removable and replaceable

CURRENT: Noted in tabulated block
Rating may be doubled with 4 brushes per CKT

HI-POT: 1000 VAC 60 CYCLE for 15 seconds

ROTOR: One piece steel sleeve
Ring complement vacuum cast on sleeve as unit with epoxy dielectric

ROTOR LEADS: 50 AMP Leads — 8 GA — Teflon
Lead exit as shown on most units. Maximum ring complement may require smaller wire or leads to exit both ends

BEARINGS: Shielded or sealed ball bearings

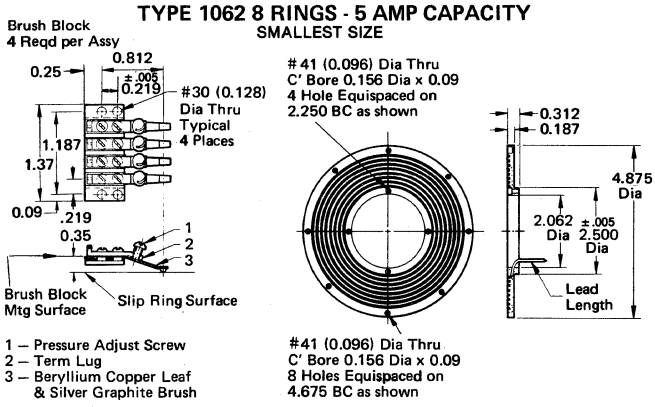
TYPE	BORE DIA "A" INCHES		NO. RINGS MAX	CURRENT	LENGTH "B" INCHES	HOUSING DIA "C"
	NOMINAL	RANGE				
5035	1.625	1.125 - 2.125	15	50 amp std	3.25 + 1.089 (no. rings-1)	4.50
5043	2.625	2.000 - 3.250	8	2 brushes	3.25 + 1.100 (no. rings-1)	5.50
5050	3.375	2.750 - 4.000	10	per	3.25 + 1.125 (no. rings-1)	6.12
5060	4.062	3.125 - 5.000	10	ring	3.25 + 1.116 (no. rings-1)	7.25
5070	5.250	4.500 - 6.000	8	100 amp	3.25 + 1.116 (no. rings-1)	8.00
5080	6.000	5.500 - 6.500	8	4 brushes	3.25 + 1.125 (no. rings-1)	9.00
5100	7.625	6.750 - 8.500	8	per	3.25 + 1.125 (no. rings-1)	11.00
5140	9.500	8.500 - 10.500	6	ring	3.75 + 1.250 (no. rings-1)	15.75

PART NUMBER CODING — Specify fully when ordering

Type	Bore (Inches)	No. Rings	Lead Length (Inches)
X	X	X	X

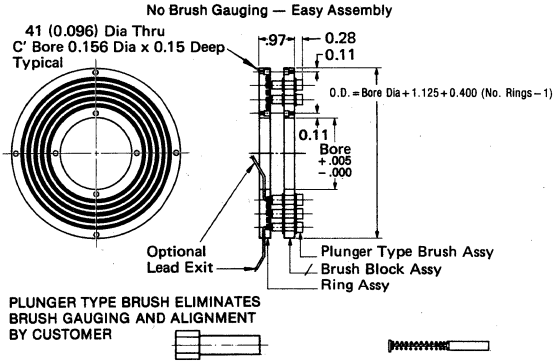
PANCAKE TYPE SLIP RING ASSEMBLIES

TYPE 1062 8 RINGS - 5 AMP CAPACITY
SMALLEST SIZE



1 — Pressure Adjust Screw
2 — Term Lug
3 — Beryllium Copper Leaf & Silver Graphite Brush

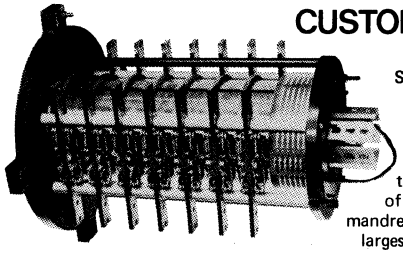
TYPE 1650 - 5 AMP CAPACITY
NO. OF RINGS PER CUSTOMER REQ'TS
No Brush Gauging — Easy Assembly



PLUNGER TYPE BRUSH ELIMINATES BRUSH GAUGING AND ALIGNMENT BY CUSTOMER

HOLDER ASSY P/N 1070004 **BRUSH ASSY P/N 1072-1**

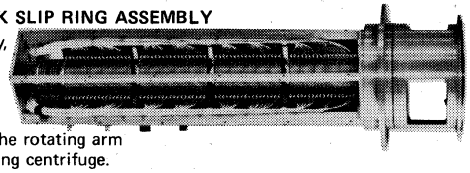
CUSTOM DESIGNED SLIP RING ASSEMBLIES



CUSTOM 7000 AMP SLIP RING ASSEMBLY

This slip ring assembly, as designed and manufactured by Fabricast, Inc., is used to supply 7000 amperes of current to the rotating mandrel of the world's second largest spin forging machine.

CUSTOM 222 TRACK SLIP RING ASSEMBLY



This slip ring assembly, as designed and manufactured by Fabricast, Inc. was used to complete the electrical circuits to the rotating arm of an astronaut carrying centrifuge.

The unit consists of 50 amp. power, 5 amp. instrumentation and 50 megacycle coaxial modules.

FABRICAST WILL ALSO CUSTOM DESIGN SPLIT RING ASSEMBLIES AND SEGMENTED SLIP RING ASSEMBLIES

WRITE OR PHONE FOR THE FABRICAST CATALOG

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GRAPHALLOY® SILVER GRAPHALLOY BRUSHES and BRUSH & SLIP-RING ASSEMBLIES...

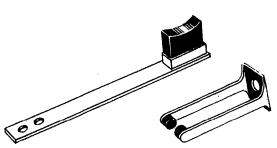
USED IN **MICROWAVE EQUIPMENT • SERVO SYSTEMS • SYNCHROS • INVERTERS • THERMOCOUPLE and STRAIN GAGE CIRCUITS • PULSE SYSTEMS • COMPUTER GROUNDING CONTACTS • TORQUE INDICATORS • MEDICAL EQUIPMENT • PACKING MACHINERY**

GRAPHALLOY® BRUSHES

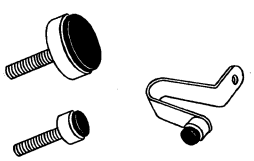
Silver-Graphalloy Brushes have been widely used because of low *and* constant contact drop, extremely low electrical noise, *and* long life. Over 100 grades are now serving in a wide variety of applications. Silver-Graphalloy Brushes on ½-inch-diameter coin silver slip rings have operated successfully in highly critical electrical circuits at speeds up to 100,000 r.p.m.

Standard sizes from ⅛"-square to ¾"-square. Many sizes in stock.

Our Engineering Department will assist you in determining the exact grade of GRAPHALLOY for your needs. *Ask for our Brush Inquiry Form 109.*

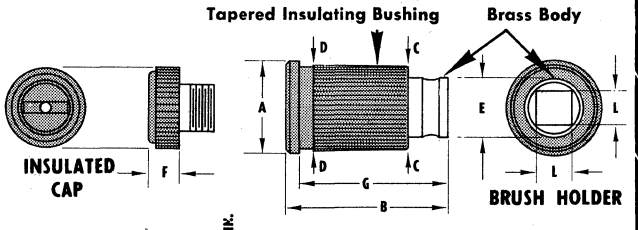


LEAF SPRINGS



CUP CONTACTS

GRAPHALLOY BRUSH HOLDERS



BRUSH HOLDER & CAP NO.	BRUSH SIZE	SUGGESTED MIN. SLIP-RING WIDTH	**MOUNTING HOLE DIAMETER	BRUSH HOLDER TO SLIP RING—MIN.	A	B	F	C	D	E	G	L
						OVERALL LENGTH		Other Sizes Available				BROACHED HOLE
14326	⅛" sq.	3/16"	13/32"	1/16"	.437"	⅞"	3/16"	.404"	.418"	.281"	25/32"	.129"
11509†	5/32" sq.	¼"	13/32"	1/16"	.437"	⅞"	3/16"	.404"	.418"	.281"	25/32"	.160"
11570†	3/16" sq.	¼"	7/16"	1/16"	.484"	⅞"	3/16"	.441"	.451"	.313"	25/32"	.193"
19011†	¼" x 3/16"	5/16"	9/16"	⅛"	.616"	1 5/16"	3/16"	.561"	.573"	.438"	1 3/16"	.256 x .193"
11527†	¼" sq.	5/16"	9/16"	⅛"	.616"	1 5/16"	3/16"	.561"	.573"	.438"	1 3/16"	.256"
14292†	3/8" x ¼"	7/16"	43/64"	⅛"	.718"	1 7/16"	¼"	.672"	.682"	.533"	1 5/16"	.382 x .256"
12166†	3/8" sq.	7/16"	13/16"	⅛"	.921"	1 13/16"	¼"	.813"	.828"	.628"	1⅝"	.382"
31392†	½" sq.	9/16"	1⅛"	⅛"	1.237"	1 13/16"	¼"	1.126"	1.141"	.878"	1 9/16"	.503"
35439†	¾" x ½"	⅞"	1 33/64"	⅛"	1.661"	2 1/32"	5/16"	1.508"	1.528"	1.253"	1 25/32"	.753"
35440†	¾" sq.	⅞"	1 33/64"	⅛"	1.661"	2 1/32"	5/16"	1.508"	1.528"	1.253"	1 25/32"	.753"

†Shunts are provided. **Mounting hole diameter for brush holder dimension D.

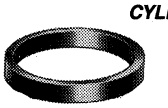
GRAPHALLOY® SLIP RINGS

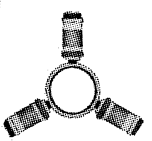
We supply Coin Silver and Bronze Slip Rings, both *cylindrical* and *flat* types ...and recommend three brushes per ring...spaced at 120°...for best contact. The cylindrical type are designed for press fitting over standard steel shafting. The flat type rings are designed for nesting either on an insulated plate or for molding into insulation. Insulated slip rings of either type, or slip-ring assemblies, can be furnished with leads attached.

No. 168 Series FLAT TYPE to 20" O.D.

Standard FLAT Rings have ¼" radial contact surface and ⅛" radial spacing between adjacent rings.

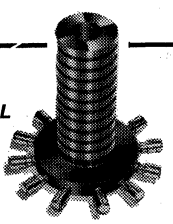
No. 116 Series CYLINDRICAL TYPE to 36" O.D.





Typical Layout

Model 319 CYLINDRICAL SLIP-RING Assembly

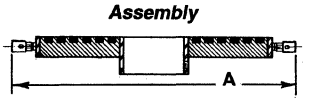


SOLID COIN SILVER RINGS

Model	Rings	Length
319-4	4	2 9/16"
319-6	6	3 5/16"
319-10	10	4 13/16"
319-14	14	6 5/16"

O.D. Slip Ring 1⅝"
Terminal 4"
Assembly I.D. .814/.813"

Model 409 FLAT SLIP-RING Assembly



SOLID COIN SILVER RINGS

Model	Rings	O.D. "A"
409-2	2	5½"
409-4	4	7"
409-6	6	8½"
409-10	10	11½"

Hub O.D. 2" I.D. 1.753/1.751"
Length 1⅛" To 5 Amps., 125 V.
More rings on application.

GRAPHALLOY BUSHINGS and PILLOW BLOCKS

Survive unlubricated! Replace oil-lubricated bushings in synchros, instruments, timers and missiles. Advantages:

(1) Lower friction at room temperatures;
(2) No oil to solidify at low temperatures;
(3) No oil to carbonize at prolonged elevated temperatures.
(4) No oil or grease drag.

Ask for Data Sheets 270 and 277 on Miniature Bronze-Graphalloy Bushings.

Ask for the following Data Sheets

GRAPHALLOY BRUSHES, SLIP RINGS & ASSEMBLIES...DS-218
GRAPHALLOY BUSHINGS, PILLOW BLOCKS...DS-117 and DS-1001

We can solve your unique electrical or mechanical problems.
Phone or write us today!

Standard and Custom-designed GRAPHALLOY® products since 1913

GRAPHITE METALLIZING Corporation
1036 Nepperhan Ave., P.O. Box 110
Yonkers, NY 10702 Tel. 914 968-8400

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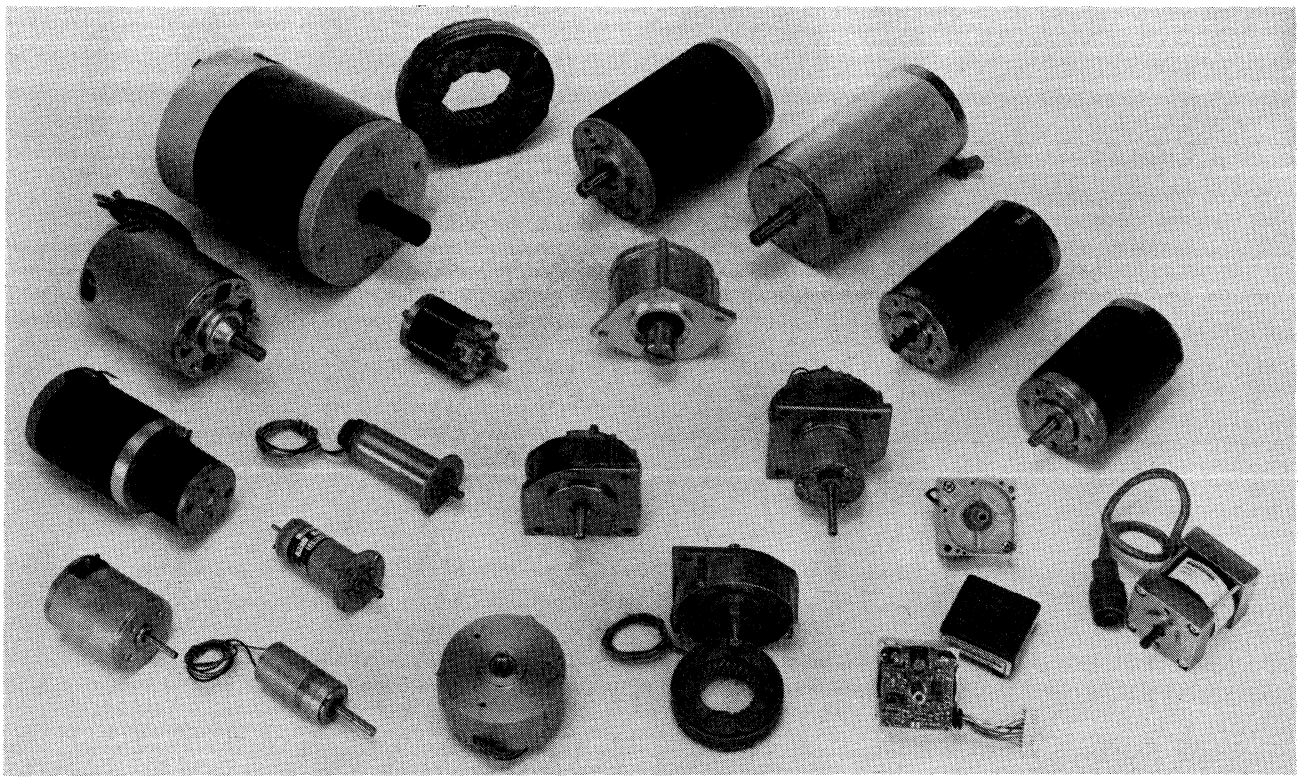
Hathaway
MOTION CONTROL DIVISION

BRUSHLESS AND BRUSH TYPE PMDC MOTORS



HATHAWAY – SPECIALTY MOTION CONTROL

BRUSHLESS DC Housed or Frameless (unhoused) Motor Designs

- 0.85 to 7.10 inches O.D.
- High Torque to Weight and Size Ratios
- Samarium Cobalt or Neodymium Magnets
- Several different lengths in each frame diameter
- Integral Hall Effect Sensors for commutation
- Standard options including brushless tachometers and optical encoders
- Limited Rotation Torque Motors
- Specially Engineered Designs
- MIL-SPEC Qualified

BRUSHLESS MOTOR DRIVES AND POSITION CONTROLS

Several classes of drive electronics are available:

- Commutation Only
- Speed Controllers
- Four Quadrant Servo Amplifiers
- Sine-wave drives
- Intelligent Position Controls: Single and Multi-axis

BRUSH COMMUTATED PMDC MOTORS

HATHAWAY offers over 35 years experience in the design and manufacture of specialized PMDC motors.

- 0.8 to 4.25 inches OD
- MIL-SPEC Motors
- Low Cost Commercial Grade
- Tachometer and Brake Options
- Custom Engineered Designs

TRANSDUCERS

- Rotary Encoders
- Linear Encoders
- Fiber-optic Encoders
- Precision Analog Optical Tachometers (TACHODER)
- Optical Brushless Commutation

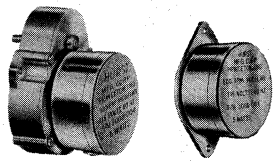
APPLICATIONS

- Specialized Industrial Automation Systems
- Military and Aerospace
- Instrumentation
- Medical and Life Support Systems
- Precision Servo Systems

Hathaway
MOTION CONTROL DIVISION
10837 E. Marshall • Tulsa, OK 74116 • (918) 438-7800 • FAX (918) 438-7629 • TLX 796-355

HURST HURST MANUFACTURING DIVISION,
EMERSON ELECTRIC COMPANY, BOX 326, PRINCETON, IN 47670. TELEPHONE (812) 385-2564. FAX (812) 386-7504

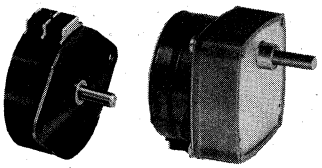
STEPPING AND SYNCHRONOUS MOTORS



A SERIES

Designed for long life at rated loads. Geared models have hardened steel gears and pinions running on steel studs. Hi-Torque rotors available; also voltages other than those shown may be specified. Widely used in applications requiring high quality components.

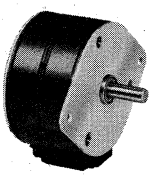
Dim. Geared: 2.81″ H x 1.63″ D
Direct Drive: 1.94″ H x 1.02″ D



S SERIES

Compact direct drive or geared motors for applications where space is limited and precise performance is required. Geared motors have typical torque ratings to 200 oz-in @ 200 p/s (max. gear train loading). Dual-stack motors featuring greater torque are now available. Call or write for complete specifications.

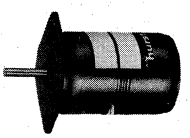
Dim. Geared: 2.45″ H x 1.78″ D
Direct Drive: 2.28″ H x .97″ D



SC SERIES

SC Series stepping motors have approximately 66% greater torque yet are only ⅔″ longer than the popular SAS Series motors. Dual sleeve bearings are standard but ball bearings as well as double ended shafts may be specified.

Dim. Direct Drive: 3.13″ H x 1.41″ D



BA SERIES

This exceptionally small stepping motor — a mere 0.895″ x 1.438″ — has a relatively high torque to inertia ratio. Its design recognizes the demand for small components to fit where space is severely limited. Applications are found in a wide range of medical and scientific instruments and robotics. These stepping motors are also recommended for low duty-cycle, battery operated equipment.

Dim. Direct Drive: .895″ H x 1.438″ D

DIRECT DRIVE STEPPING MOTORS

	AS and ABS	SAS and SBS	SCS	BAS
STEP ANGLE (degrees)	7.5 and 15	7.5 and 15	7.5	18
STEPS PER REVOLUTION	48 and 24	24 and 48	48	20
2-PHASE HOLDING TORQUE (oz-in)	3.8 and 4.3	8.0 and 11.9	18.5 and 20.5	1.10
RATED TORQUE @ 4-5 p/s (oz-in)	2.3 and 2.75	7.5 and 9.0	12.5 and 16.5	0.625
INPUT POWER (Watts)	3.5 and 4.5	8	8	2.5
NOMINAL VOLTAGE (Volts)	12	6, 12, 24	5, 6, 12, 24	5, 6, 12, 24
WINDING RESISTANCE (Ohms)	100 and 53	9, 36 and 144	6.1, 8.8, 35, 140	20, 29, 115, 461
ROTOR INERTIA (oz-in)	0.07	0.17	.29	1.19
TEMPERATURE RISE (°C)	30 and 48	65	58	46
WEIGHT (oz)	6.8	8	11.5	2.1

GEARED STEPPING MOTORS

	AS and ABS	SAS and SBS
REDUCTION	300 to 4⅛	600 to 2
STEP ANGLE (degrees)	0.025 to 3.6	0.025 to 7.50
NOMINAL VOLTAGE (Volts)	12	12
OUTPUT SPEED @ 200 p/s (rpm)	0.83 to 120	0.42 to 125.0
TYPICAL TORQUE @ 200 p/s (oz-in)	150* to 5.3	200* to 3
INPUT POWER (Watts)	3.5 and 4.5	8
WINDING RESISTANCE (Ohms)	100 and 53	9, 36, 144
WEIGHT (oz)	11	16

*Maximum gear train loading

NOTES
1. Standard lead wire configuration is 6 leads.
2. All stepping motors shown here can be driven with Hurst Stepping Motor Controls.

DIRECT DRIVE SYNCHRONOUS MOTORS

	A and AB	SA and SB	SC	BA
SPEED @ OUTPUT SHAFT (rpm)	300 or 600	300 or 600	300	720
RATED TORQUE (oz-in)	2.0 to 3.75	6.0 to 9.0	8.75 to 11.5	0.625
INPUT POWER (Watts)	3 to 6.5	5 to 7	7 to 9	1.5
CAPACITOR VALUE (mfd)	.25 to .62	.50 to .62	.68 to .85 ± 10%	0.15 ± 10% 400 VDC
FULL LOAD TEMPERATURE RISE (°C)	21 to 43	28 to 37	35 to 40	30
WEIGHT (oz)	6.8	8	10	2.1

GEARED SYNCHRONOUS MOTORS

	A and AB	SA and SB	SC
SPEED @ OUTPUT SHAFT (rpm)	1 to 120	1 to 360	15 to 150
RATED TORQUE (oz-in)	150 to 4.0	200* to 7	116* to 13
INPUT POWER (Watts)	3 to 6.5	5 to 7	7 to 9
CAPACITOR VALUE (mfd)	.25 to .62	.50 to .62	.68 to .85
WEIGHT (oz)	11	16	18

*Maximum gear train loading

NOTES
1. Capacitors furnished with most standard synchronous motors.
2. All synchronous motors shown on this page operate on 115 VAC, 60 Hz.

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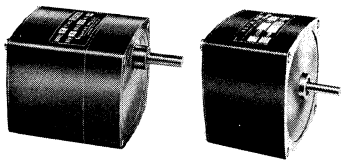
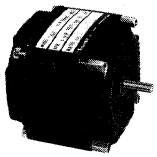
STEPPING AND SYNCHRONOUS MOTORS



T SERIES

Compact, rugged and efficient, TS Series motors are designed for heavy-duty applications. Geared models offer hardened steel gears and pinions with dynamic torque ratings up to 250 ounce-inches. Both geared and direct drive motors have machined die cast housings. Sleeve bearings are standard but ball bearings may be specified on the output shaft.

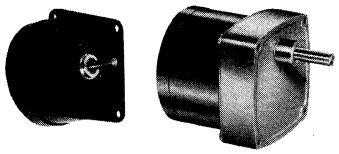
Dim. Geared: 2.38″ H x 2.53″D
Direct Drive: 2.38″ H x 1.75″ D



KVS SERIES

KVS Series motors are hybrid permanent magnet types. The motors are constructed with multitoothed rotors and stators of unequal tooth number so that a vernier effect provides the equivalent of a large number of poles and small step angles without the necessity for gearing. Standard KVS motors are furnished with 6-lead bifilar windings for 12 VDC operation. Other voltages and 2-phase, bipolar windings may be specified.

Dim. Direct Drive: 2.38″ H x 2.44″ D

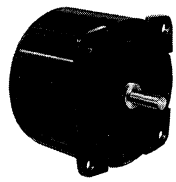


P SERIES

PAS and PBS Series motors provide users with a choice of direct drive or geared models, standard or Hi-Torque rotors and, for direct drive models, a choice of mounting plates. Voltages other than those shown may be specified.

Gearing is scaled to provide a maximum dynamic gear train loading of 200 ounce-inches.

Dim. PAS Geared: 2.38″ H x 2.25″ D
PAS Direct Drive: 2.28″ H x 1.56″ D
PBS Geared: 2.38″ H x 2.13″ D
PBS Direct Drive: 2.28″ H x 1.41″ D



R SERIES

Designed specifically to combine greater torque and small size, RAS and RBS stepping motors meet many industrial and instrument requirements. Standard 7.5° step angle motors have a torque rating at 4-5 p/s of 23 ounce-inches. The Hi-Torque model is rated at 29 ounce-inches. Models with 15° step angles are rated, respectively, 13 and 17 ounce-inches.

Dim. Direct Drive: 2.88″ H x 1.84″ D

DIRECT DRIVE STEPPING MOTORS

	TS	KVS	PAS and PBS	RAS and RBS
STEP ANGLE (degrees)	7.5	1.8 and 3.75	7.5 and 15	7.5 and 15
STEPS PER REVOLUTION	48	200 and 96	48 and 24	48 and 24
2-PHASE HOLDING TORQUE (oz-in)	14 and 15.5*	25 and 21	11, 12.3, 14, 16.5	24, 27, 33, 37
RATED TORQUE @ 4-5 p/s (oz-in)	8.5 and 10.4*	18.5 and 14	5.8, 7.3, 8.5, 11.5	13, 17, 23, 29
INPUT POWER (Watts)	8.5	12	8 and 8.5	12
NOMINAL VOLTAGE (Volts)	6, 12, 24	12	12	6, 12, 24
WINDING RESISTANCE (Ohms)	9.5, 31, 135	18	32 and 35	6, 24, 96
ROTOR INERTIA (oz-in)	0.34	0.82	0.19 and 0.34	0.92
TEMPERATURE RISE (°C)	40, 45, 52	56 and 50	50, 52	55 and 60
WEIGHT (oz)	20	30	13	26

*Hi-Torque rotor

GEARED STEPPING MOTORS

	TS	PAS and PBS
REDUCTION	300 to 2	300 to 2
STEP ANGLE (degrees)	0.025 to 0.375	0.025 to 3.75
STEP PER REVOLUTION	14,400 to 96	14,400 to 96
OUTPUT SPEEDS @ 200 p/s (rpm)	.83 to 125	.83 to 125
TYPICAL TORQUE @ 200 p/s (oz-in)	250* to 7.5	200* to 7.5
INPUT POWER (Watts)	8.5	8, 8.5
WINDING RESISTANCE (Ohms)	31	32 and 35
WEIGHT (oz)	27	18

NOTES
1. (PAS and PBS). Square mounting plate is standard for direct drive motors.
2. (TS, RAS and RBS). Standard motors have 4-phase bifilar windings (6 leads) for 6, 12, or 24 VDC operation.
3. All stepping motors shown here can be driven with Hurst Stepping Motor Controls.

DIRECT DRIVE SYNCHRONOUS MOTORS

	T and TA	PA and PB	RA
SPEED @ OUTPUT SHAFT (rpm)	300 or 360	300 or 600	300
RATED TORQUE (oz-in)	6.6 to 10.25	5.5 to 11	15 or 20
INPUT POWER (Watts)	6 to 9.5	7.5 to 11	11 or 14.5
CAPACITOR VALUE (mfd)	.68 to .85	.68 to 1	1.0 or 1.3
FULL LOAD TEMPERATURE RISE (°C)	27 to 38	31 to 45	37 or 46
WEIGHT (oz)	20	13	26

GEARED SYNCHRONOUS MOTORS

	T and TA	PA and PB
SPEED @ OUTPUT SHAFT (rpm)	1 to 150	1 to 360
RATED TORQUE (oz-in)	13-250*	6 to 200
INPUT POWER (Watts)	7 or 9.5	7.5 to 11
CAPACITOR VALUE (mfd)	.68 or .85	.68 to 1
WEIGHT (oz)	27	18

*Maximum gear train loading

NOTES
1. Capacitors furnished with most standard synchronous motors. (No capacitor furnished with TA or BA Series motors).
2. (PA and PB). Square mounting plate is standard for direct drive models.
3. All motors except some TA Series motors operate on 115 VAC, 60 Hz. Some TA models operate on 115 VAC, 50 Hz.

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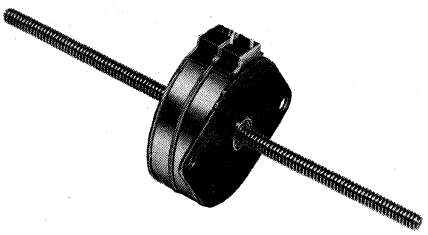
LINEAR ACTUATORS, Stepping or Synchronous



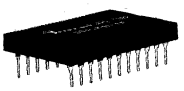
Stepping (SLS Series) or synchronous (SL Series) linear actuators are reversible, permanent magnet rotor types. An integral part of the rotor assembly is a sintered bronze nut for extended life. The nut accepts a ¼" diameter, .048 pitch Acme screw that provides linear motion for pushing, pulling, lifting and positioning applications. Standard 8" lead screws have a maximum travel of 6.75" and a maximum thrust of 25 pounds. Screws of other lengths may be specified. Ball bearings are standard. SL (synchronous) Series motors provide travel of .24 inch per second. SLS (stepping) Series motors have a resolution of .001" per step or 1000 steps per inch.

New 600 rpm versions of these motors are now available. They have all the quality features of the SL and SLS Series. The direct drive model has a linear travel rate of .48"/sec. The stepping version has 500 steps/in. Consult the factory for complete specifications.

CONTROLS FOR STEPPING MOTORS

MODEL 220001

The 220001 is a DIP package containing all the basic circuitry required for operation of a 4-phase, unipolar stepping motor: a pulse generator, bidirectional logic sequencer, and phase drivers. It is fabricated as a thick film hybrid circuit using CMOS and bipolar components for small size and low power consumption.

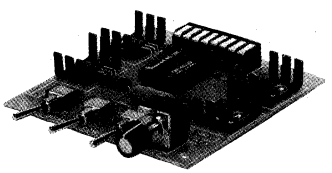


FEATURES:

- 5V logic level control of
  - — rotational direction
  - — run/hold
  - — single step (jog)
  - — phase driver disable
- 2-on, 2-off phase sequencing
- drivers rated at 500 ma per phase
- operation from single 6 to 24 VDC supply

MODEL EPC-016

The EPC-016 is a PC board assembly containing the 220001 hybrid, power drive transistors, and all external components needed for manual control of a stepping motor. A motor, DC power supply, and this board form a complete system.



FEATURES:

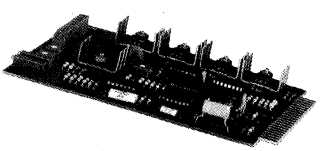
- 3 position switch for operation of motor in continuous step, jog, or hold mode
- CW/CCW rotation selection switch
- phase disable switch
- step frequency adjust potentiometer
- 2 amp per phase drive capability
- operation from single 6 to 24 VDC supply
- Dimensions: 4" x 4"

MODEL EPC-013

The EPC-013 is a PC board assembly with additional stepping motor control capabilities.

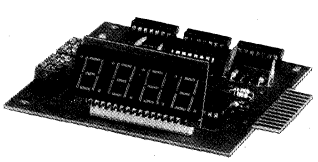
FEATURES:

- sequencing and drivers for 3 or 4 phase unipolar motors
- 3 modes of excitation
  - — full step, 2 phases on
  - — full step, 1 phase on
  - — half step, alternating 1-2 phases
- ramping oscillator for step rate control
- adjustable ramp rates
- linear or exponential ramp profile
- single step (jog) input
- gating for external control of input pulses
- manual or digital interface to control functions
- 2 amps per phase drive capability
- operation from single 6 to 30 volt supply
- 5V regulator output available for external use
- Dimensions: 6.5" x 4.5"



MODEL EPC-014

The EPC-014 is a general purpose presettable counter/display PC board assembly suitable for use with most stepping motor drive systems. In a typical application, it is preset with a number of motor steps, counts and displays the steps as executed, and provides a control signal when the preset count is reached. It is also suitable for count and control applications using input pulses derived from sources other than step commands, e.g., from an external encoder or other sensor.

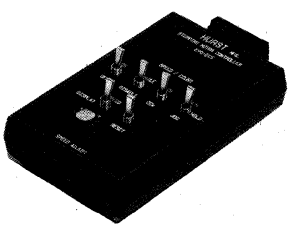


FEATURES:

- 4 decade counter/display
- manual count preset via BCD switches
- optional remote location of count preset switches and display
- manual or digital control of enable input
- 5V logic level output latch
- operation from 5VDC supply
- Dimensions: 4.0" x 4.5"

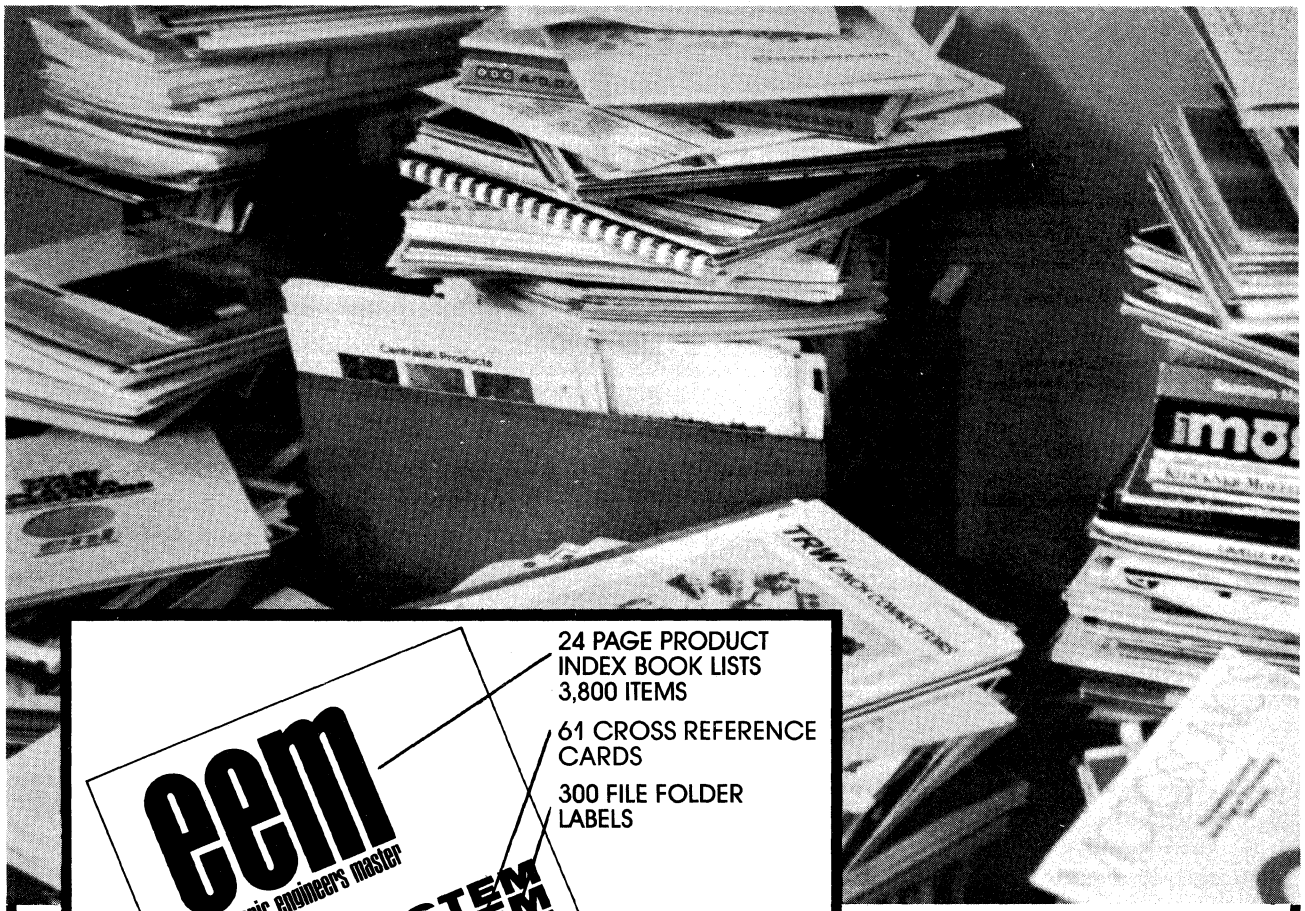
MODEL EPC-015

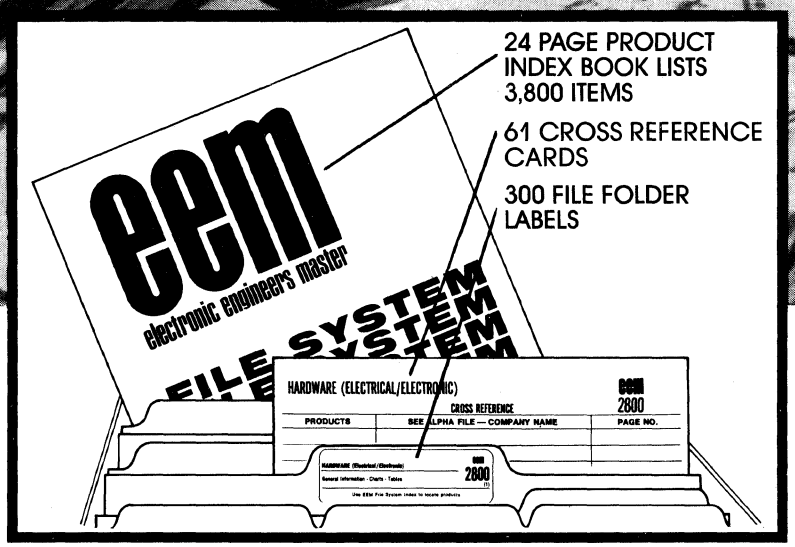
The EPC-015 is a totally encased, hand-held driver containing all the control features of the EPC-016 plus selectable display of step frequency or step count. A motor, DC powder supply, and this controller form a complete control system.



FEATURES:

- 4 decade frequency/count display
- all control features of EPC-016
- 1 amp per phase motor drive capability
- operation from a single 6 to 24 VDC supply
- compact size: 1" x 3.5" x 6"





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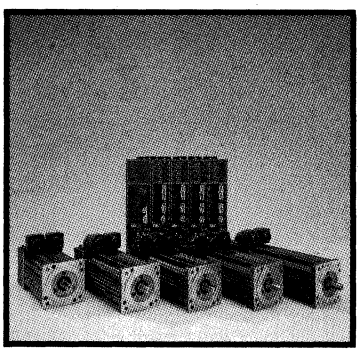
INDUSTRIAL DRIVES

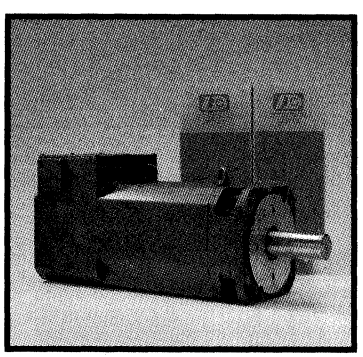
INNOVATIVE PRODUCTS FOR MOTION CONTROL

NEW GOLDLINE SERIES
Unsurpassed Brushless Servo Technology



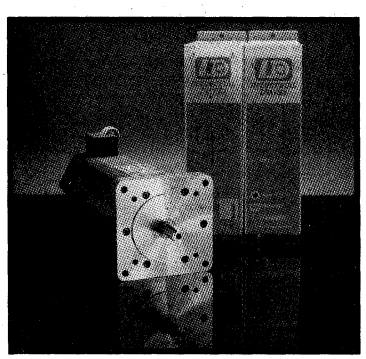
- 1.8 to 84.5 lb.ft of continuous torque—speeds in excess of 5,000 RPM
- Rugged TENV IP65 sealed construction for use in harsh environments
- Highest acceleration and deceleration capabilities
- Class H insulation provides in excess of 9 years of winding life under rated conditions
- Compact single board design minimizing interconnections and vastly increasing reliability and life
- Precise torque and velocity control
- Continuous power ratings to 4 KVA—peak power ratings 8 KVA
- Personality card in the amplifier matches the motor and drive to your application.

NEW GOLDLINE SPINDLE SYSTEMS



- Power ratings from 10 to 35 HP—standard speeds to 6,000 RPM, options to 10,000 RPM and higher
- Permanently lubricated bearings and Class H insulation ensure reliable operation and longest motor life
- Rugged die-cast aluminum rotors with no moving parts, completely brushless design, and integral frameless resolver provide superior operation in harsh environments
- 4-quadrant motor operation with regeneration capabilities for rapid deceleration
- Overcurrent trip protects electronics saving downtime and maintenance expense—no isolation transformer required
- Spindle orient option available

NEW EXPLOSION-PROOF BRUSHLESS SERVOMOTORS



- 5.0 to 11.2 lb.ft of continuous torque—speeds to 5,000 RPM
- Designed to operate in hazardous locations
- Same superior motor design as other brushless motors—utilizes high energy neodymium-iron-boron magnets
- Integral frameless resolver with amplifier options which allow closing a position loop
- Applications including chemical plants; munitions production; paint spraying; gasoline pumping equipment; and process control, and air and hydraulic pumps in hazardous environments
- UL approved

For product information please call 1-800-77-SERVO!

INDUSTRIAL DRIVES A KOLLMORGEN DIVISION

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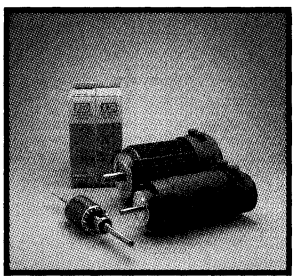
INDUSTRIAL DRIVES

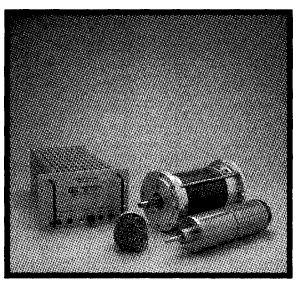
INNOVATIVE PRODUCTS FOR MOTION CONTROL

AC INDUCTION SERVO SYSTEMS



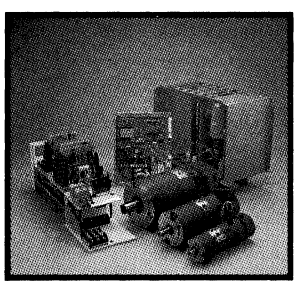
- 1.5 to over 31 lb.ft of continuous torque—speeds to 4,000 RPM
- Microprocessor-based three-phase sine-wave modular drive utilizes proprietary slip control technique optimizing motor performance
- Precise control maintained down-to-zero speed
- Permanently lubricated ABEC3 bearings and Class H insulation provide longest motor life

SUBMERSIBLE MOTORS AND DRIVES



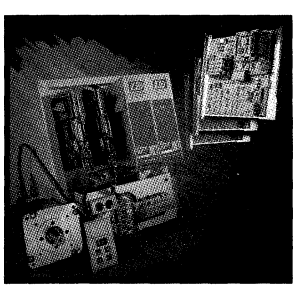
- Power ratings from 0.3 to 20 HP
- Pressure compensated—reliable operation of motors and drives to depths of 20,000 feet (10,000 PSI)
- Integral motor/controller packages
- Special control drives minimize audible noise, EMI, RFI, and structure-bourn vibrations—designed to military specifications

BRUSH-TYPE SERVOMOTORS AND DRIVES



- Permanent magnet DC servomotors—advanced designs
- Wide motor selection 35 oz.in to over 100 lb.ft of continuous torque—speeds to 6,000 RPM
- Patented technology PWM and SCR amplifiers complement motors with features including high bandwidth, commutation current limits, and overspeed shutdown
- Amplifiers 6 to 200 amps continuous

DIGITAL POSITIONING SYSTEMS



- Complete systems—all components premounted on back panel and thoroughly tested
- Menu-driven software tailored to your specific machine's operation sequence
- Built-in diagnostics for simplified troubleshooting
- Standard and custom systems available

For product information please call 1-800-77-SERVO!

INDUSTRIAL DRIVES A KOLLMORGEN DIVISION

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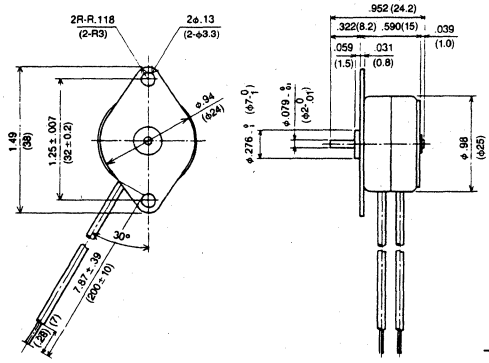
INLAND MOTOR
KOLLMORGEN CORPORATION

PM TYPE STEPPER MOTORS

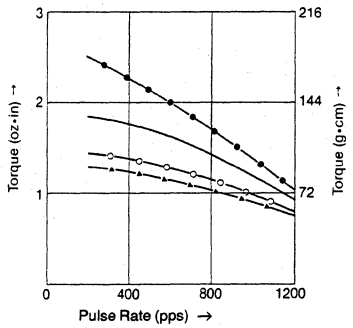
PF25 SERIES

Unit: in. (mm)



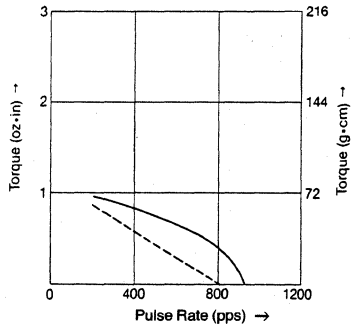
Typical Torque vs. Pulse Rate Characteristics

Pullout Torque vs. Pulse Rate by Magnet Material (PF25-48 with Double Voltage)



—●— : Neodymium —— : Anisotropic Ferrite
—○— : Plastic Magnet –▲– : Isotropic Ferrite

Torque vs. Pulse Rate (PF25-48 At Rated Voltage)



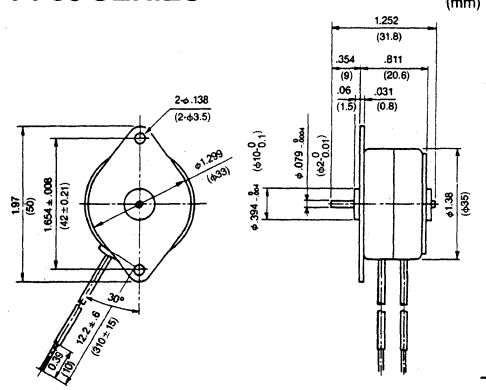
– – – – : Pull-in torque, ——: Pull-out torque

Specifications

Items \ Models		PF25-48				PF25-24		
Excitation Mode		2-2						
Step Angle	(°)	7.5				15		
Step Angle Tolerance	(%)	±5						
Steps per Revolution		48				24		
Rating		Continuous			Intermittent	Continuous		
DC Operating Voltage	(V)	24	12	5	24	24	12	5
Operating Current	(mA/ϕ)	48	100	313	200	48	100	313
Winding Resistance	(Ω/ϕ)	480	120	16	120	480	120	16
Winding Inductance	(mH/ϕ)	137	39	5.5	39	119	34	4.5
Holding Torque	(oz·in/g·cm)	1.39/100			2.0/142	1.11/80		
Rotor Inertia	(oz·in²/g·cm·s²)	$5.36\times10^{-3}/1.0\times10^{-3}$						
Starting Pulse Rate, Max.	(pps)	790			1100	490		
Slewing Pulse Rate, Max.	(pps)	900			1300	900		
Ambient Temp Range, Operating	(°C)	−10~+50						
Temperature Rise	(°C)	70			–	70		
Weight	(oz/g)	1.23/35						

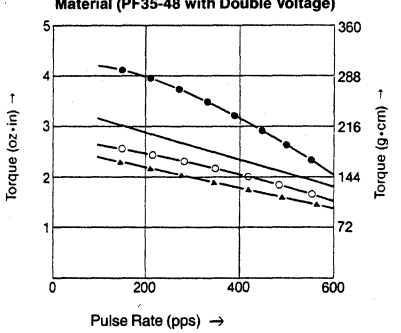
PF35 SERIES

Unit: in. (mm)



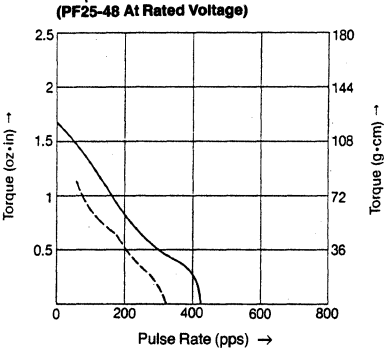
Typical Torque vs. Pulse Rate Characteristics

Pullout Torque vs. Pulse Rate by Magnet Material (PF35-48 with Double Voltage)



—●— : Neodymium —— : Anisotropic Ferrite
—○— : Plastic Magnet –▲– : Isotropic Ferrite

Torque vs. Pulse Rate (PF25-48 At Rated Voltage)



– – – – : Pull-in torque, ——: Pull-out torque

Specifications

Items \ Models		PF35-48				PF35-24		
Excitation Mode		2-2						
Step Angle	(°)	7.5				15		
Step Angle Tolerance	(%)	±5						
Steps per Revolution		48				24		
Rating		Continuous			Intermittent	Continuous		
DC Operating Voltage	(V)	24	12	5	24	24	12	5
Operating Current	(mA/ϕ)	67	133	313	266	67	133	313
Winding Resistance	(Ω/ϕ)	360	90	16	90	360	90	16
Winding Inductance	(mH/ϕ)	202	48	8.9	48	202	48	8.9
Holding Torque	(oz·in/g·cm)	2.78/200			3.88/280	2.00/150		
Rotor Inertia	(oz·in²/g·cm·s²)	$0.024/4.5\times10^{-3}$						
Starting Pulse Rate, Max.	(pps)	500			680	310		
Slewing Pulse Rate, Max.	(pps)	530			770	410		
Ambient Temp Range, Operating	(°C)	−10~+50						
Temperature Rise	(°C)	55			–	55		
Weight	(oz/g)	2.8/80						

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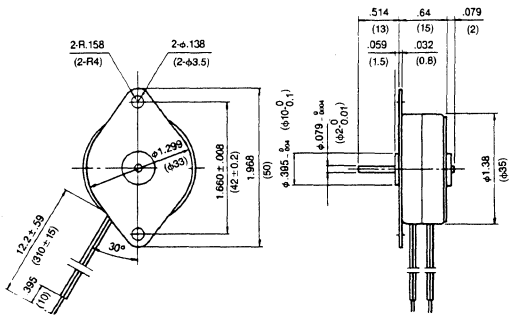
INLAND MOTOR
KOLLMORGEN CORPORATION

PM TYPE STEPPER MOTORS

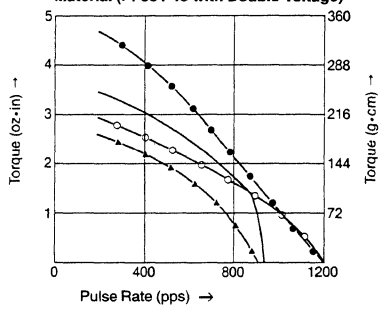
PF35T SERIES
THIN PROFILE

Unit: in. (mm)



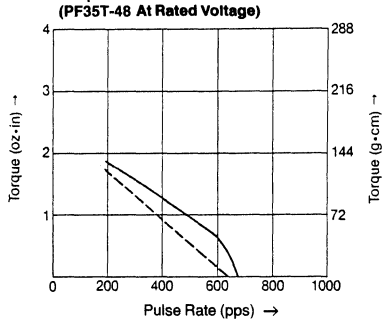
Typical Torque vs. Pulse Rate Characteristics

Pullout Torque vs. Pulse Rate by Magnet Material (PF35T-48 with Double Voltage)



—●— : Neodymium —— : Anisotropic Ferrite
—○— : Plastic Magnet —▲— : Isotropic Ferrite

Torque vs. Pulse Rate (PF35T-48 At Rated Voltage)



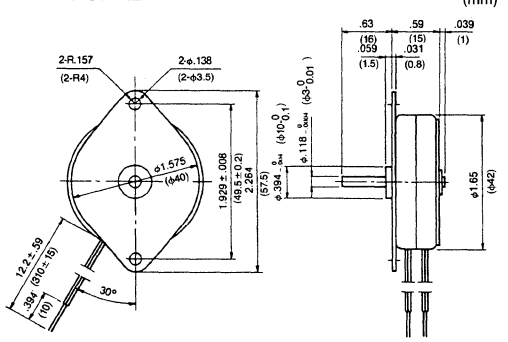
- - - - : Pull-in torque, —— : Pull-out torque

Specifications

Items \ Models		PF35T-48			
Excitation Mode		2-2			
Step Angle	(°)	7.5			
Step Angle Tolerance	(%)	±5			
Steps per Revolution		48			
Rating		Continuous			Intermittent
DC Operating Voltage	(V)	24	12	5	24
Operating Current	(mA/ϕ)	72	170	416	343
Winding Resistance	(Ω/ϕ)	333	70	12	70
Winding Inductance	(mH/ϕ)	180	36	6.5	36
Holding Torque	(oz·in/g·cm)	2.78/200			4.31/310
Rotor Inertia	($oz·in^2/g·cm·s^2$)	$14.4\times10^{-3}/2.7\times10^{-3}$			
Starting Pulse Rate, Max.	(pps)	600			850
Slewing Pulse Rate, Max.	(pps)	610			900
Ambient Temp Range, Operating	(°C)	−10~+50			
Temperature Rise	(°C)	70			–
Weight	(oz/g)	2183/77			

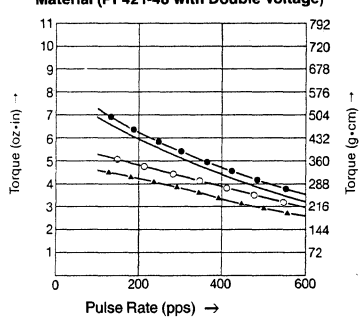
PF42T SERIES
THIN PROFILE

Unit: in (mm)



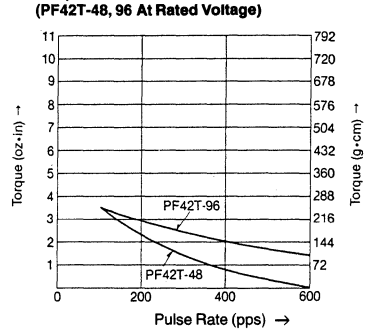
Typical Torque vs. Pulse Rate Characteristics

Pullout Torque vs. Pulse Rate by Magnet Material (PF42T-48 with Double Voltage)



—●— : Neodymium —— : Anisotropic Ferrite
—○— : Plastic Magnet —▲— : Isotropic Ferrite

Torque vs. Pulse Rate (PF42T-48, 96 At Rated Voltage)



—— : Pull-out torque

Specifications

Items \ Models		PF42T-48				PF42T-96		
Excitation Mode		2-2						
Step Angle	(°)	7.5				3.75		
Step Angle Tolerance	(%)	±5						
Steps per Revolution		48				96		
Rating		Continuous			Intermittent	Continuous		
DC Operating Voltage	(V)	24	12	5	24	24	12	5
Operating Current	(mA/ϕ)	96	200	526	400	96	200	526
Winding Resistance	(Ω/ϕ)	250	60	9.5	60	250	60	95
Winding Inductance	(mH/ϕ)	152	35	5.6	35	110	25	4
Holding Torque	(oz·in/g·cm)	4.72/340			6.8/490	5/360		
Rotor Inertia	($oz·in^2/g·cm·s^2$)	$76.6\times10^{-3}/14.3\times10^{-3}$						
Starting Pulse Rate, Max.	(pps)	380			470	540		
Slewing Pulse Rate, Max.	(pps)	520			830	590		
Ambient Temp Range, Operating	(°C)	−10~+50						
Temperature Rise	(°C)	70			–	70		
Weight	(oz/g)	3118/110						

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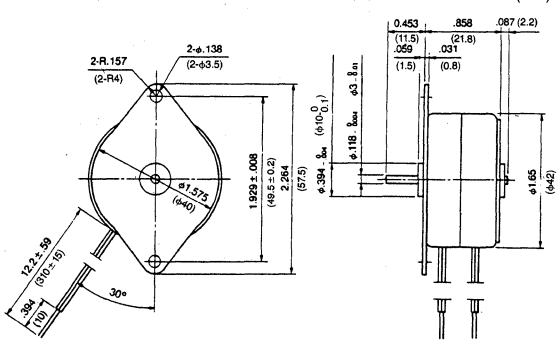
INLAND MOTOR
KOLLMORGEN CORPORATION

PM TYPE STEPPER MOTORS

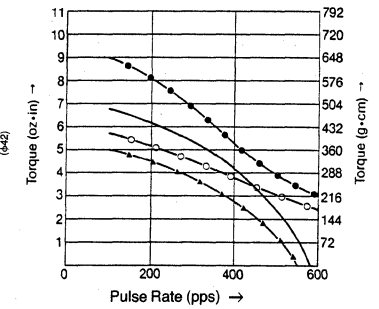
PF42 SERIES

Unit: in (mm)



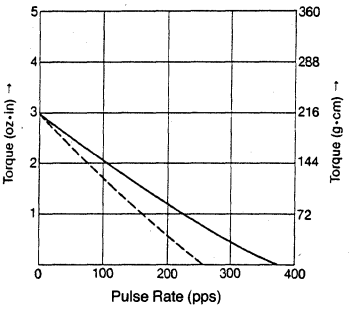
Typical Torque vs. Pulse Rate Characteristics

Pullout Torque vs. Pulse Rate by Magnet Material (PF42-48 with Double Voltage)



—●— : Neodymium —— : Anisotropic Ferrite
—○— : Plastic Magnet —▲— : Isotropic Ferrite

Torque vs. Pulse Rate (PF42-24 At Rated Voltage)



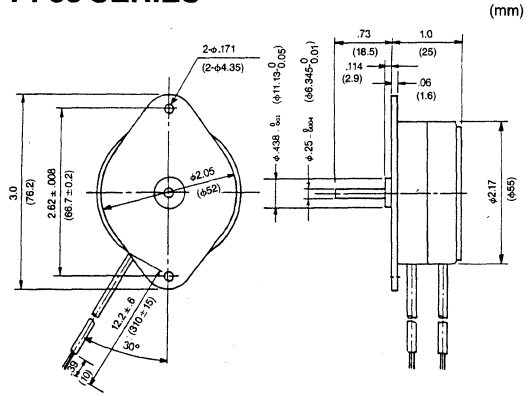
– – – – : Pull-in torque, —— : Pull-out torque

Specifications

Items \ Models		PF42-48				PF42-24		
Excitation Mode		2-2						
Step Angle	(°)	7.5				15		
Step Angle Tolerance	(%)	±5						
Steps per Revolution		48				24		
Rating		Continuous			Intermittent	Continuous		
DC Operating Voltage	(V)	24	12	5	24	24	12	5
Operating Current	(mA/ϕ)	86	170	416	343	86	170	416
Winding Resistance	(Ω/ϕ)	280	70	12	70	280	70	12
Winding Inductance	(mH/ϕ)	200	54	9.1	54	160	43	7.2
Holding Torque	(oz·in/g·cm)	6.25/450			8.33/600	4.17/300		
Rotor Inertia	(oz·in²/g·cm·s²)	6.86×10^{-2}				$9\times10^{-2}/16.8$		
Starting Pulse Rate, Max.	(pps)	310				240		
Slewing Pulse Rate, Max.	(pps)	320				350		
Ambient Temp Range, Operating	(°C)	−10~+50						
Temperature Rise	(°C)	55			–	55		
Weight	(oz/g)	5.6/160						

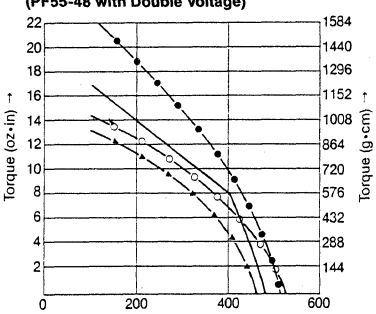
PF55 SERIES

Unit: in (mm)



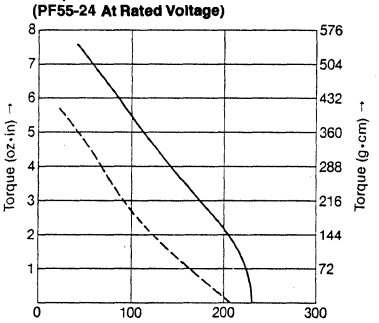
Typical Torque vs. Pulse Rate Characteristics

Pullout Torque vs. Pulse Rate by Magnet Material (PF55-48 with Double Voltage)



—●— : Neodymium —— : Anisotropic Ferrite
—○— : Plastic Magnet —▲— : Isotropic Ferrite

Torque vs. Pulse Rate (PF55-24 At Rated Voltage)



– – – – : Pull-in torque, —— : Pull-out torque

Specifications

Items \ Models		PF55-48				PF55-24		
Excitation Mode		2-2						
Step Angle	(°)	7.5				15		
Step Angle Tolerance	(%)	±5						
Steps per Revolution		48				24		
Rating		Continuous			Intermittent	Continuous		
DC Operating Voltage	(V)	24	12	5	24	24	12	5
Operating Current	(mA/ϕ)	166	333	1000	666	166	333	1000
Winding Resistance	(Ω/ϕ)	145	36	5	36	145	36	5
Winding Inductance	(mH/ϕ)	166	43	5.9	43	143	37	5.1
Holding Torque	(oz·in/g·cm)	16.7/1200			22.2/1600	12.5/900		
Rotor Inertia	(oz·in²/g·cm·s²)	$0.214/40\times10^{-3}$						
Starting Pulse Rate, Max.	(pps)	300			400	205		
Slewing Pulse Rate, Max.	(pps)	310			410	230		
Ambient Temp Range, Operating	(°C)	−10~+50						
Temperature Rise	(°C)	55			–	55		
Weight	(oz/g)	10.6/300						

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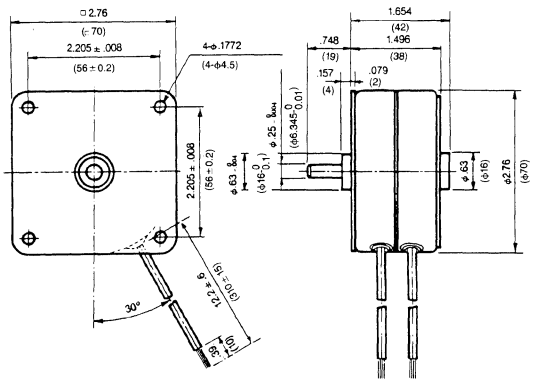
INLAND MOTOR

KOLLMORGEN CORPORATION

PM TYPE STEPPER MOTORS

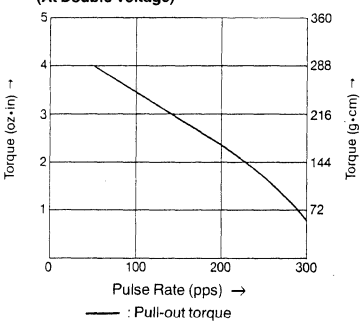
PF70 SERIES

Unit: in (mm)

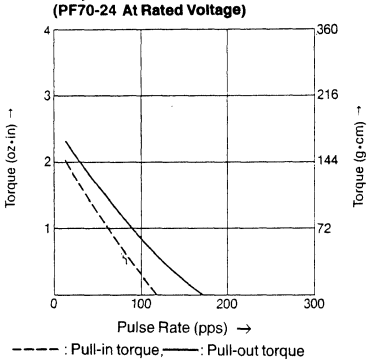


Typical Torque vs. Pulse Rate Characteristics

Pullout Torque (At Double Voltage)



Torque vs. Pulse Rate (PF70-24 At Rated Voltage)

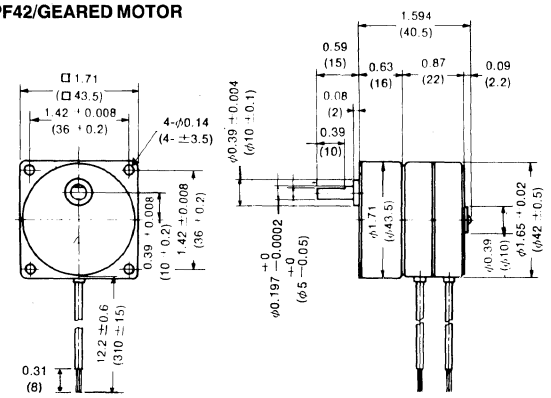


Specifications

Items \ Models		PF70-48				PF70-24		
Excitation Mode		2-2						
Step Angle	(°)	7.5				15		
Step Angle Tolerance	(%)	±5						
Steps per Revolution		48				24		
Rating		Continuous			Intermittent	Continuous		
DC Operating Voltage	(V)	24	12	5	24	24	12	5
Operating Current	(mA/φ)	300	600	1400	1200	300	600	1400
Winding Resistance	(Ω/φ)	80	20	3.6	20	80	20	3.6
Winding Inductance	(mH/φ)	120	27	5.4	27	120	27	5.4
Holding Torque	(oz-in/g•cm)	41.7/3000			52.8/3800	34.7/2500		
Rotor Inertia	($oz\text{-}in^2/g\text{•}cm\text{•}s^2$)	$80.4 \times 10^{-2}/15 \times 10^{-2}$						
Starting Pulse Rate, Max.	(pps)	180			250	135		
Slewing Pulse Rate, Max.	(pps)	200			310	155		
Ambient Temp Range, Operating	(°C)	−10~+50						
Temperature Rise	(°C)	80			–	80		
Weight	(oz/g)	24.7/700						

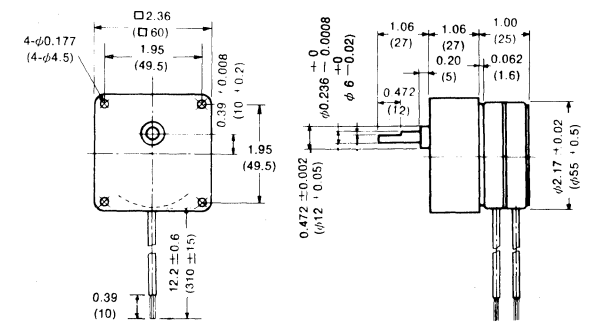
PF42G/PF55 GEARED SERIES

PF42/GEARED MOTOR



PF55/GEARED MOTOR

UNIT: in. (mm)



Specifications PF42G

Speed Reduction Ratio	Maximum Allowable Torque	Speed Reduction Ratio	Maximum Allowable Torque
6/25	13.8 oz-in 1 kg•cm	1/50	41.7 oz-in 3 kg•cm
1/5		1/60	
3/25	27.8 oz-in 2 kg•cm	1/62.5	
1/10		1/75	
1/12.5		1/100	
1/15		1/120	
3/50	34.7 oz-in 2.5 kg•cm	1/125	55.6 oz-in 4 kg•cm
1/20		1/150	
1/25		1/200	
1/30		1/250	
		1/300	

Specifications PF55G

Speed Reduction Ratio	Maximum Allowable Torque	Speed Reduction Ratio	Maximum Allowable Torque
6/25	55.6 oz-in 4 kg•cm	1/25	97 oz-in 7 kg•cm
1/5		1/30	
3/25		1/50	
1/10		1/60	
1/12.5		3/250	138 oz-in 10 kg•cm
1/15		1/100	
3/50		1/125	
		1/150	
		1/250	
		1/300	

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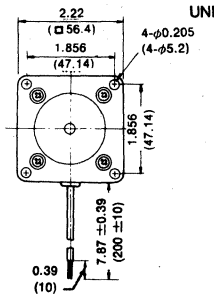
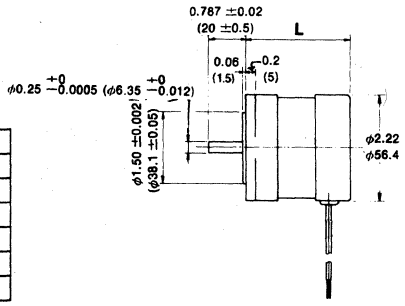
INLAND MOTOR
KOLLMORGEN CORPORATION

HB TYPE STEPPER MOTORS

PJ SERIES

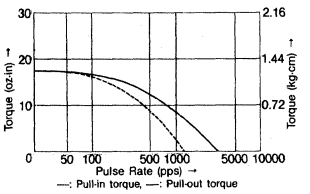


	L	
	in	mm
PJ39	1.54	39
PJ42	1.65	42
PJ50	1.97	50
PJ55	2.17	55
PJ80	3.15	80

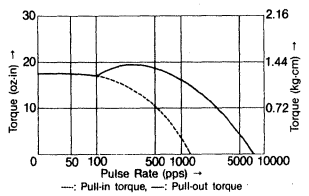


Typical Performance Curves

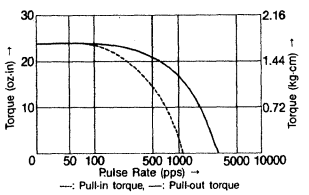
PJ39B1 Torque Characteristics (L/6.0R)



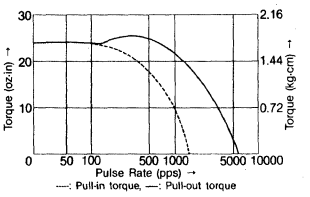
PJ39B1 Torque Characteristics (Chopper Drive)



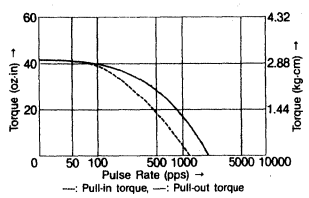
PJ42B1 Torque Characteristics (L/5.2R)



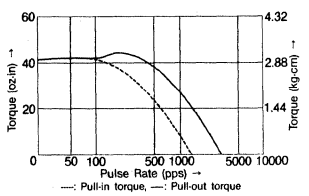
PJ42B1 Torque Characteristics (Chopper Drive)



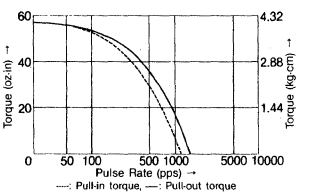
PJ50B1 Torque Characteristics (L/5.0R)



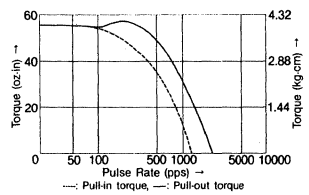
PJ50B1 Torque Characteristics (Chopper Drive)



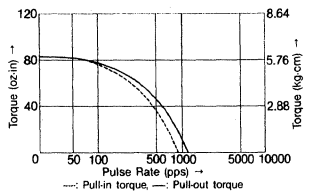
PJ55B1 Torque Characteristics (L/5.3R)



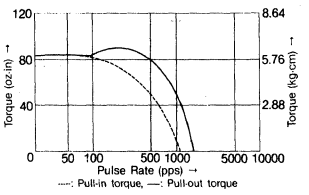
PJ55B1 Torque Characteristics (Chopper Drive)



PJ80B1 Torque Characteristics (L/5.2R)



PJ80B1 Torque Characteristics (Chopper Drive)



Specifications

Items \ Models	PJ39			PJ42			PJ50			PJ55			PJ80		
	A1	B1	C1	A1	B1	C1	A1	B1	C1	A1	B1	C1	A1	B1	C1
Excitation Mode	2-2														
Step Angle (°)	1.8														
Step Angle Tolerance (%)	±5														
Steps per Revolution	200														
DC Operating Voltage (V)	2	4	8	2.3	4.6	9.2	3	6	12	3.4	6.8	13.6	3.36	6.7	13.4
Operating Current (mA/φ)	2	1	0.5	2	1	0.5	2	1	0.5	2	1	0.5	2	1	0.5
Winding Resistance (Ω/φ)	1	4	16	1.15	4.6	18.4	1.5	6	24	1.7	6.8	27.2	1.68	6.7	26.8
Winding Inductance (mH/φ)	0.6	2.0	8.9	0.6	2.8	12.4	1.3	5.6	19.5	1.7	7.6	27.6	2.2	9.4	36.0
Holding Torque (oz-in/kg•cm)	22.8/2			34.7/2.5			69.4/5			83.3/6			111.1/8		
Rotor Inertia (oz-in²/g•cm•s²)	$29x10^{-2}$/$5.4x10^{-2}$			$33.3x10^{-2}$/$6.2x10^{-2}$			$56.4x10^{-2}$/$10.5x10^{-2}$			$70.3x10^{-2}$/$13.1x10^{-2}$			$132.6x10^{-2}$/$24.7x10^{-2}$		
Ambient Temp. Range, Operating (°C)	−10 ~ +60														
Temperature Rise (°C)	70														
Weight (oz/g)	11.3/320			12/340			15.9/450			18.3/520			29.3/830		

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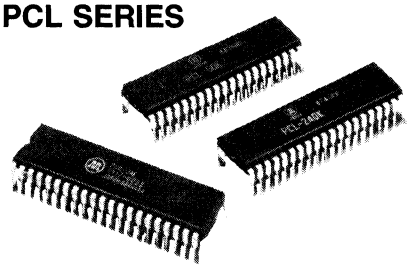
INLAND MOTOR

KOLLMORGEN CORPORATION

PROGRAMMABLE SINGLE CHIP HIGH-SPEED PULSE GENERATORS

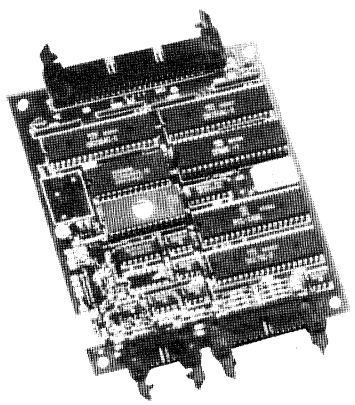
PCL SERIES



The PCL series pulse generators are the motion control ICs, the output frequency of which can be programmed through an external CPU.
This series includes three models: PCL-80K, PCL-240K and PCL-3M. The PCL-80K is designed for general stepper motor control. The PCL-240K is for high-speed stepper motor control and servomotor control. The PCL-3M is a high performance chip which features high speed and high accuracy for controlling servomotors.
The major applications include robots, X-Y-Z-θ tables, automatic assembling machines, winding machines and X-Y plotters.

PCL-EQUIPPED CONTROL BOARDS

ED-9236/AE-0101



The ED-9236 and AE-0101 are the control boards which integrate a CPU, memories, I/O ports, a clock and other functions in one compact package. They provide a pulse output of the desired frequency with good accuracy. IC sockets are used to mount the CPU and ROM, thereby allowing easy program emulation.

ED-9236 for single-shaft control
The ED-9236 has the PCL-240K, 8255's (PIO) and 8279 (KEY, DISP) efficiently arranged on the Z-80's memory map, thereby allowing program execution at an increased speed. The 8279 also allows desired setting of key input (64 points) and display output (16 digits) through software.

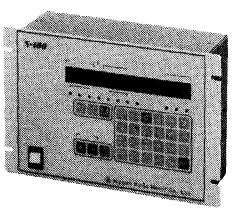
AE-0101 for multi-shaft control
The AE-0101 has PCL-240K's and 8255's (PIO) efficiently arranged on the Z-80 memory map, thereby allowing program execution in an increased speed.
Since the AE-0101 can integrate up to 3 PCL-240K, you can select a desired package to control up to 3 shafts.

Specifications

Items / Models	ED-9236	AE-0101
Input Power	Single +5V	
CPU	Z-80A or the equivalent (4MHz)	
ROM	i2764, i27128 or the equivalent	
RAM	TC5564PL-15 (battery backup optionally available)	
I/O Ports	Two 8255's (PIO) and one 8279 (KEY, DISP)	Two 8255's (PIO)
Clock	4MHz	
Digital Pulse Generator	One PCL-240K	Up to three PCL-240K as required
Board Size (Parts Mounting Area)	4.72 x 5.51 inches (4.25 x 5.43 inches)	4.65 x 6.02 inches (4.25 x 5.04 inches)
Max. Height with Parts Mounted	.59 inches standard (.79 inches with optional device/s)	

PCL-EQUIPPED CONTROLLER

N-100



The N-100 is the microprocessor-based single-shaft controller which incorporates a PCL-equipped pulse generator board and a keyboard in a compact package.
For control of two or more shafts, a corresponding number of the controllers are required.
The N-100 can be conveniently used for X-Y tables, machine tools and industrial machinery.

APPLICATION ENGINEERING; PROTOTYPE SHOP

A fully equipped step motor laboratory and model shop supervised by experienced application engineers is located in Sierra Vista, Arizona. This capability makes Inland/Nippon Pulse stand apart as a knowledgeable supplier of step motors. Prototypes to meet the customer's exact requirements can be made locally and quickly. Responsiveness on prototypes is followed up with dependable high volume manufacturing.

"For additional information on modifications available or a complete catalog of all stepper motor and drive electronic products manufactured by Nippon Pulse Motor Company, contact Inland Motor Sierra Vista, Arizona."

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MINIGLOSSARY SERVO COMPONENTS

SPECIFICATIONS

Excitation: The input voltage and frequency.

Transformation Ratio: The ratio of the output voltage, at maximum coupling, to the input voltage.

Phase Shift: The lead or lag of the output voltage with respect to the input voltage. For most synchros and resolvers, the phase shift can be approximated by the angle whose tangent is the ratio of the primary winding's DC resistance to its reactive component.

Impedance: Specified as R + jX, where R is the AC resistive component and X is the reactive component. Important impedances are: (a) Z_{po} (or Z_{ro} for rotor primary units), which is the impedance of the primary winding with the secondary open; (b) Z_{so}, which is the impedance of the secondary winding with the primary open; and (c) Z_{ss}, which is the impedance of the secondary with the primry shorted (essentially when driven by a low impedance).

Null Voltage: The voltage remaining when the unit is at electrical zero or in the minimum coupling position.

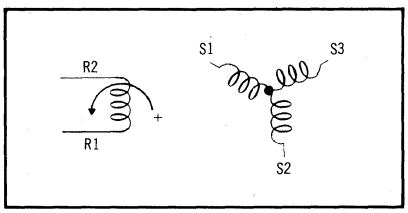
Accuracy: The error of the position of the rotor with respect to the electrical angle. It is defined as the output voltage driven by the "speed" (pole pairs) of the unit, referenced to the starting point of the calibration (usually the electrical zero position). Error is commonly expressed in minutes of arc (1/60 of a degree) or in seconds of arc.

Loads: For a transmitting unit, the impedance that the output voltage signal faces. This can be a receiver, a differential with its load, a control transformer, an A/D converter, etc.

Operation Temperature: The ambient temperature range over which the unit performs its primary function.

FUNCTIONS

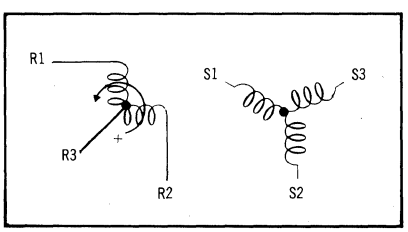
Transmitter: A unit with a Y-connected stator that outputs a signal proportional to the position of its single-phase excited rotor. High power units, called "torque transmitters," are used to drive one or more receivers. Low power transmitters are used to drive control transformers.



Receiver: A unit with a three-phase stator excited by the input, usually from a torque transmitter, and a single-phase rotor that follows the resulting stator field. Usually used to drive a position pointer.

Control Transformer: A unit with a three-phase stator excited by the input from a transmitter and a single-phase rotor mechanically driven to the null position by an external motor or other device.

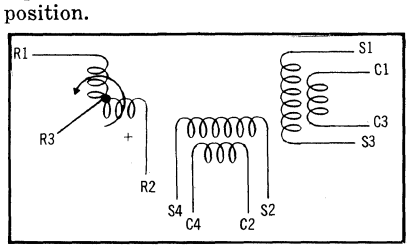
Differential: A unit with a three-phase stator and a three-phase rotor. It is usually connected between a transmitter, which excites its stator, and a receiver or control transformer. It can be used to "dial in" correction factors for the synchro chain.



Transolver: A unit with a three-phase stator and a two-phase rotor that can be used either as a control transmitter (with one rotor phase excited and the other shorted), or as a control transformer with the signal obtained from one phase of the rotor—making sure the other phase is equally loaded to prevent unbalances.

Differential Resolver: A unit with a two-phase stator and a three-phase rotor that is used as a transolver with the advantage that when connected as a control transformer, the signal does not travel through slip rings.

Resolver: A unit with a two-phase rotor and a two-phase stator that is used to create or receive SIN-COS signals such as vector resolutions for solving inertial platform coordinate transformations, unknowns of right triangles, etc. Resolvers can also be used as transmitting, differential, or receiving elements by proper choice of impedances. It is also possible to use resolvers as phase shifters where, in one mode, one rotor phase is excited and the two stator windings are feeding an appropriate RC network and indicating a phase shift, referred to the input, that corresponds to the rotor position.



Compensated Resolver: A unit with a "2×2" phase stator and a two-phase rotor used as a resolver with the added benefit of feedback windings in parallel with the stator windings that increase the useful accuracy over a wide range of environmental operating conditions.

Linear Transformer: A unit with a single-phase stator and single-phase rotor designed to provide a linear output voltage that is directly proportional to the rotor input angle. It operates over a range of less than ±90°, and is analogous to a potentiometer providing infinite resolution, but without contact between the elements. It can be used only with AC voltages.

Brushless Synchro: Available in two types—hairspring and bobbin. Hairspring synchros use spiral wound conductor springs to pick off the rotor signal, and are generally limited to a ±165° rotation. Most have mechanical stops to prevent damage due to overrotation. Bobbin synchros pick off the rotor signal with rotary transformers inside the unit, allowing the rotor unlimited motion.

Pancake Unit: A name derived from the physical dimensions of the unit, which has a diameter that exceeds axial length. Sizes range from under 1" to 20" or more. The unit is frequently used as a gimbal pickoff element and is designed to fit a particular application envelope. It can be supplied as a rotor and stator only.

Litton

Poly-Scientific

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Blacksburg, Virginia
24060-3100
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TWX 710-875-3694

HOW TO SPECIFY A SLIP RING

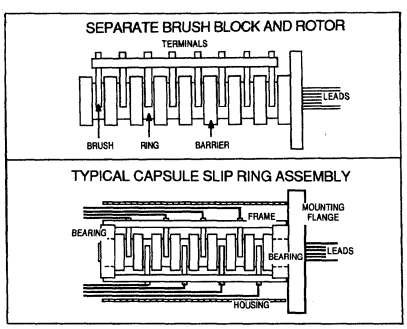
Many of the more than 4,000 Poly-Scientific slip ring designs are available for use in their existing configuration, or they may be modified to meet your specific requirements. New designs can also be created to meet the most demanding specifications.

Our engineers are experienced in a wide range of slip ring applications. We utilize resources such as the Anvil computer-aided design (CAD) system. And, a very active in-house quality circle program solicits the best inputs from all of our many skilled craftspeople, from start to finish.

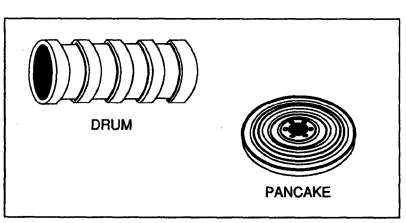
This section is designed to guide you through the process of specifying a slip ring. We've outlined below the major considerations that a slip ring engineer will need to know about your application.

A. Basic Slip Ring Design

Throughout these pages, you will see the terms "slip ring capsule" and "slip ring separates". The term "separate" indicates an individual rotor/brush block combination. The term "capsule" is used to denote a self-contained unit consisting of a rotor, stator and its own integral ball bearings.



There are two basic slip ring configurations to consider based on space allocation in your system: the more common drum approach where each ring is adjacent to the next along the centerline, somewhat like the threads on a bolt, and the pancake approach where the rings are concentric with one another like the grooves on a phonograph record. The pancake approach is used when length is at a premium but diameter is less restrictive.



B. Defining the Mechanical Envelope

The envelope is, of course, largely dictated by the space available in the system. The slip ring engineer should be given the maximum space available in the system so all existing candidate designs can be considered. It is imperative that the space required for the slip ring be specified in the early stages of the system design and that it be consistent with the structural and electrical demands.

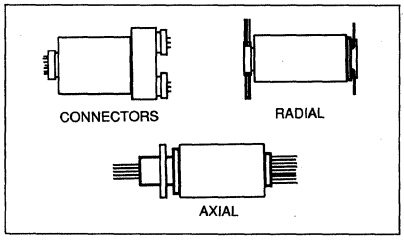
C. Defining System Interface Requirements

The slip ring engineer will need to know these system interface considerations:

1. Is a bore required through the slip ring for routing coolant plumbing, hydraulic lines, pneumatic lines, waveguides, etc? In such applications, the slip ring actually mounts concentric with these lines in the system.

2. How will the slip ring attach to the system? It is never advisable to hard mount both the rotor and the stator to the system since the slip ring bearings may overload if there is any misalignment between them and the system bearings.

3. How should the electrical connections to the slip ring be made? Is it desirable to have connectors integral with the slip ring on both the rotor and stator, or would flying leads on one or the other ends be desireable? And if flying leads are preferred, should they exit the rotor in a radial or axial direction, and what length should the leads be?



D. Defining Electrical Requirements

The current specified enables the slip ring engineer to propose a unit with the appropriate cross-sectional area of the rings, brushes and lead wires. The specified voltage dictates the spacing between adjacent rings and brushes. It is helpful in achieving the most cost effective and smallest practical envelope not to rate all circuits at the maximum level. For example, if you need 20 circuits total, three of which must carry ten amps, designate three for high current. Don't go for 100% functional interchangeability by specifying that all 20 be able to carry ten amps. And, if the ten amps is a surge current with a continuous current of only two amps, tell us that, too. There is no reason for you to pay for ten amps continuous capacity when you only need two.

Be aware that voltage surges and spikes are the major cause of system slip ring failures. Poly-Scientific uses a very conservative approach to circuit design, however, it is not uncommon in some power supply systems to see voltage spikes ten or more times the normal operating voltage. We strongly recommend surge protection on all power supplies.

Most smaller slip rings will satisfactorily conduct signals to 1 MHz or 500 Kilobits. Special slip rings can be used to pass broadband signals from dc to 1 gigahertz and data rates of 500 megabits or even higher. Crosstalk, insertion loss and bit error rate information can be provided if data rates, formats and impedances are defined.

E. Defining Mechanical Requirements

1. Operating speed (rpm's). Almost any slip ring can operate successfully at speeds to 100 RPM although many applications only require operation at a few rpm. But slip rings are also routinely used to instrument jet turbine engines operating at speeds in excess of 20,000 RPM. The operating speed in conjunction with the diameter dictates the surface speed of the brush relative to the ring and hence the internal design approach and material selection.

2. What rotational life is necessary for your application? Will the unit oscillate or rotate at a continuous speed?

F. Defining the Environment

The environment in which the slip ring must survive is a key factor. Operating temperature is important in specifying the proper lubricant. And if the slip ring will operate exposed to the elements or to a hostile environment, integral seals must be included in the design. Any unusual shock or vibration should also be specified.

The next eight pages of the catalog give a brief overview of our slip ring design and production expertise. The last page of our section allows you to list your specific application needs. For specific product information, please contact our sales department at 1-800-336-5917 (in Virginia, call 703-953-4751).

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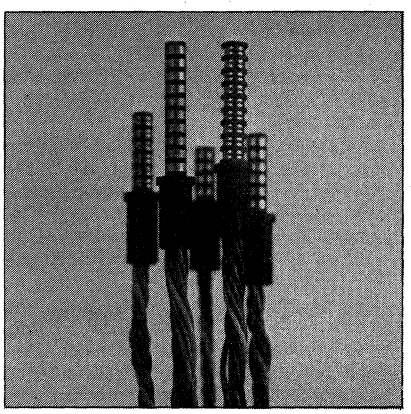
SLIP RING SEPARATES

Sometimes a self contained "capsule" slip ring is not practical due to size constraints or cost limitations. (Don't however, fail to include in this comparison your costs for mating the slip ring and brush block or to consider the risk of damage to the fragile unprotected brushes). If a separate rotor/stator approach is dictated for your application please review the following tabulation of an assortment of candidate designs—or contact us for a custom design.



Rotor Specifications

NUMBER OF CIRCUITS	PART NUMBER	MATING BRUSH BLOCK	RING O.D.	RING PITCH	SHAFT DIAMETER	SHAFT LENGTH	FLANGE DIAMETER	SPECIAL FEATURES
1-10	258	259	.081	.050	.125	.250	.150	P, RB, UG, VG, S, FB
1-37	263	262	.220	.050	.250	.375	.312	FB, RB
1-10	865	259	.080	.050	.109	.187	.170	S, FB
1-20	1202	262	.125	.050	.250	.375	.312	FB
8	1454	1455	.550	.060	.584	.640	.580	.376 Bore, RB, VG
10	1546	1547	2-.331 8-.151	.060	.187	.250	.345	VG #2 Ring Segment, #1 Shorted to #2
5	1555	259	.081	.050	.141	.300	.180	FB
19	2037	2038	1.860	.030	1.880	.685	1.880	1.500 Bore. .685 VG
3	2384	2981 2385	.067	.025	.071	.070	.115	Double V-Groove
1-10	2690	259	.081	.050	.125	.250	.150	FB, Same as 258
1-37	2731	262	.220	.050	.250	.375	.312	RB, Same as 263
1-10	2914	259	.081	.050	.125	.250	.150	FB
5	3046-1	3046-2	.550	.060	.580	.640	.580	.376 Bore, RB, VG
6	3975	3416	.067	.025	.061	.125	.109	Double V-Grooves

Abbreviations used:

FB - Flat Barrier
RB - Raised Barrier
P - Plastic Backshaft
VG - V-Groove
UG - U-Groove
S - Stainless Steel Backshaft

Circuits 1-10—Option of having 1 through 10 circuits. Shaft lengths shown are for maximum number of rings (circuits).

Brush Block Specifications

NUMBER OF CIRCUITS	PART NUMBER	RING DIAMETER	PITCH	MOUNTING HOLE DIAMETER	HOLE SPACING	SETTING LENGTH	THICKNESS	SPECIAL FEATURES
1-10	259	.081	.050	.090	.437	.250	.188	-Silver Terminal -Tin Terminals -Gold Terminals -Leads
1-37	262	.220	.050	.090	.600	.250	.250	-Terminals
10	1547	.331 .151	.060	.116	.656	.312	.312	-Leads, -Terminals
8	1455	.550	.060	.096	.812	.290	.125	-Terminals (MD4036-2)
19	2038	1.864	.030	.090	.600	1.035	.250	-Terminals
6	3416	.067	.025	—	—	.200	.100	-Terminals -Double Brushes
3	2981	.067	.025	.053	.140	.180	.150	-Double Brushes -PCB Terminals
3	2385	.068	.025	—	—	.200	.100	-Terminals

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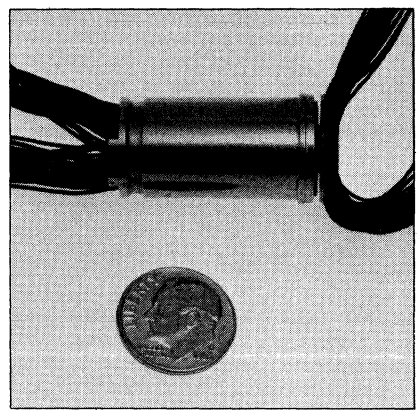
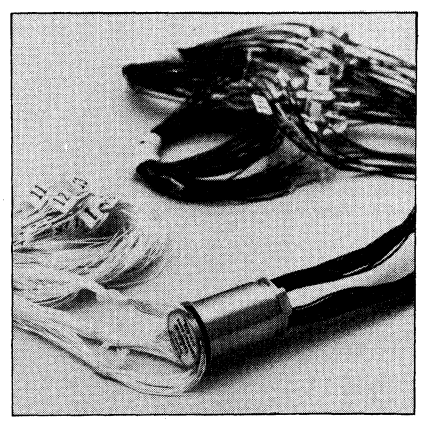
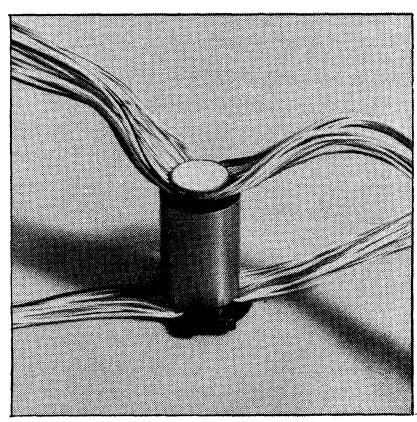
MINIATURE SLIP RING CAPSULES

These smallest of all slip ring assemblies are widely used in the pitch, roll and yaw axes of inertial navigation systems where there can be no sacrifice in reliability to achieve packaging density.

Very tight pitch controls are maintained on individual ring locations with center-to-center spacings as small as 0.015 inch between adjacent rings.







NUMBER OF CIRCUITS	PART NUMBER	CURRENT RATING PER CKT	CURRENT RATING TOTAL	LENGTH	DIAMETER
16	267	1.2A	10A	.912	.375
20		1.2A	14A	1.932	.375
24		1.2A	17A	1.152	.375
28		1.2A	20A	1.272	.375
32		1.2A	23A	1.392	.375
36		1.2A	25A	1.512	.375
20	264	1.4A	17A	1.035	.500
40		1.4A	33A	1.635	.500
60		1.4A	49A	2.235	.500
7	2492	.4A	2A	.61	.375
12	2274	1.2A	12A	.728	.373
15	2493	.36A	4A	.660	.375
16	2075	1.3A	13A	.882	.372
17	1804	1.2A	16A	1.375	.350
30	2245	.7A	20A	.979	.380
32	1444	1.2A	29A	1.468	.375
36	2754	1.2A	31A	1.173	.498
40	3069	1.4A	37A	1.30	.682
45	2759	1.1A	36A	1.05	.593
50	2044	.95A	36A	1.025	.593
50	1937	1.4A	45A	1.470	.683
54	1956	1.2A	38A	1.403	.560
80	2210	1.4A	69A	2.00	.658
95	4175	1.6A	77A	3.09	.880

THE FOLLOWING MINIATURE SLIP RINGS HAVE A BORE:

NUMBER OF CIRCUITS	PART NUMBER	CURRENT RATING PER CKT	CURRENT RATING TOTAL	LENGTH	DIAMETER	BORE
8	2395	1.6	7A	.70	1.75	0.75
30	4198	2.6A	36A	2.785	3.081	1.50
32	2335	4A	57A	3.39	4.10	2.30
12	2472	4A	22A	3.440	4.10	2.30
51	2837	4A	90A	4.50	4.10	2.30

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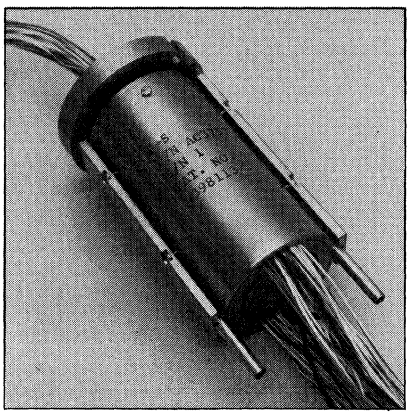
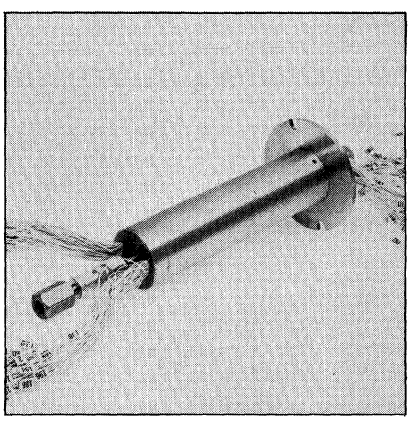
HIGH SPEED SLIP RINGS

For successful slip ring operations above several thousand RPM, increased structural demands and frictional heating at the sliding contact surface are two concerns that must be addressed. Applications for high speed slip rings include aircraft turbine testing, stressometer feedback in rolling mills, and gasoline or diesel engine testing.

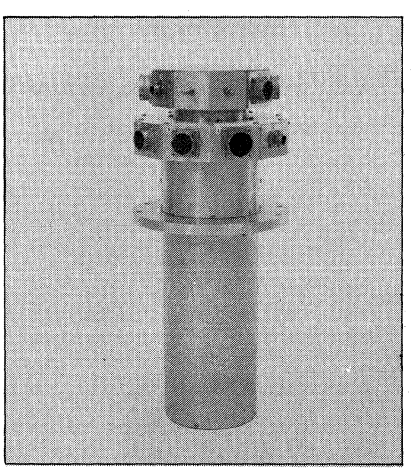




NUMBER OF CIRCUITS	PART NUMBER	LENGTH	DIAMETER	BORE	BRUSH	NOTES
15	2645	3.75	14.01	12.593	Composite	Separate
19	2275	9.84	9.05	7.48	Composite	Separate Ring & Brush Block
28	3042	1.635	.685	N/A	Gold	Liquid Cooled
28	3762	1.67	1.0	N/A	Gold Multifilament	Gas Cooled
35	3757	2.53	1.60	N/A	Gold Multifilament	Gas Cooled
40	1823	4.08	1.75	N/A	Composite	
64	4160	5.0	3.5	1.5	Gold Multifilament	
100	3057	6.40	1.5	N/A	Gold	Liquid Cooled
200	4064	10.0	2.25	N/A	Gold	Liquid Cooled
300	4075	11.75	2.28	N/A	Gold	Liquid Cooled

VACUUM AND SPACE CAPSULES

The use of slip rings in a hard vacuum environment focuses special attention on the area of outgassing organics that could interfere with other components in the system and in the area of lubrication for long term operation. Our contact material recommendations are based on a two year continuous life test program that we conducted in a 10^{-7} torr environment and have been proven in numerous space flights.



NUMBER OF CIRCUITS	PART NUMBER	LENGTH	DIAMETER	BORE	BRUSH	NOTES
24-84	2832	7.167-11.650	2.44	N/A	Composite 4 per ring	Cylindrical Separate
25	3881	1.376	5.832	1.24	Composite	2 sided pancake
31	3304	6.663	2.125	N/A	Gold Monofilament	Cylindrical Separate
34	2857	1.94	6.95	2.68	Gold 4 per ring	2 Sided Pancake Separate
70	3192	4.61	1.46	N/A	Gold Multifilament	Concentric Capsule
170	4238	18.00	6.00	N/A	Gold	Capsule, Lubrication Reservoir

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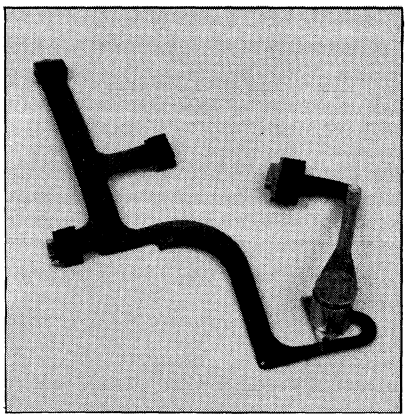
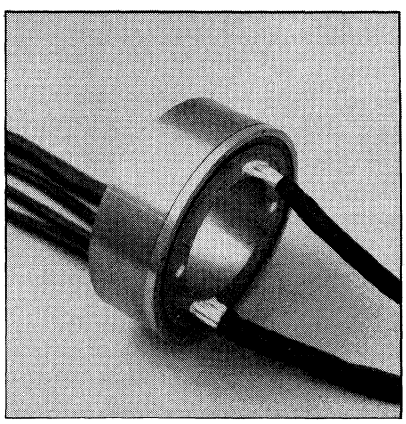
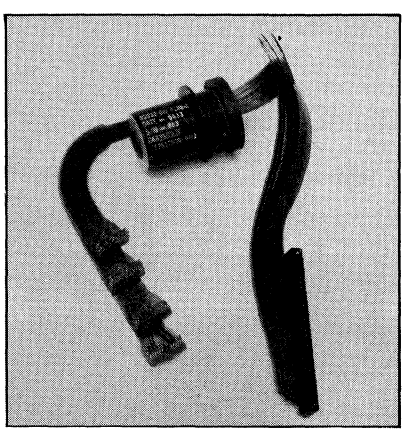
POLY-TWIST CAPSULES

The Poly-Twist is a reliable slip ring substitute for limited rotation applications. Sometimes called a twist-cap, this device provides a self-contained, no-sliding contact rotary interface using flexible circuit tapes. Typical dimensions and data are tabulated below for a few of our many twist-cap designs. Although the majority of applications for the thousands of units supplied to date have required miniature twist-cap assemblies, some very large designs have also been provided.

NUMBER OF CIRCUITS	PART NUMBER	ROTATION	CURRENT CAPACITY	LENGTH	DIAMETER
14	2728	+/-55	14 @ 12A	2.90	1.75
24	2938	+/-100	1 @ .2A 4 @ 1.2A 19 @ .8A	2.50	.75
24	3182	+/-45	4 @ 1.4A 20 @ .5A	1.10	.31
24	3197	+/-45	24 @ 1A	1.07	.75
38	2937	+/-90	4 @ 3.0A 34 @ 1.0A	2.00	5.75
45	2911	+/-45	2 @ 1.0A 4 @ 3.0A 4 @ 2.2A 35 @ .6A	1.75	1.20
46	2729	+/-55	4 @ 2.0A 42 @ 1.0A	2.90	1.75
50	2904	+/-90	2 @ 2.3A 2 @ 2.5A 4 @ 4.5A 6 @ 1.0A 36 @ 7.0A	1.63	1.00
51	3196	+/-45	51 @ 1.0A	1.12	.87
60	2613	+/-75	12 @ 3.8A 48 @ 1.2A	1.69	1.00
60	2644	+/-300	12 @ 0.9A 48 @ 0.2A	1.56	0.68
63	3004	+/-100	3 @ 3.5A 6 @ 4.5A 12 @ 1.7A 42 @ 1.2A	2.77	1.50
68	2783	+/-30	68 @ 1.7A	2.00	.69
80	2661	+/-210	24 @ 3.0A 56 @ 1.0A	2.25	2.50
80	3195	+/-70	80 @ .6A	.635	2.40
84	3003	+/-100	1 @ 3.4A 14 @ 1.5A 69 @ .8A	2.27	1.50
88	3719	+/-145	3 @ 5A 7 @ 2A 78 @ 1A	3.50	1.37
98	2805	+/-30	12 @ 4.0A 86 @ 1.0A	2.50	.99
110	3165	+/-200	22 @ 2.7A 88 @ 1.73A	1.90	2.50
110	2804	+/-60	20 @ 4.0A 90 @ 1.0 A	1.35	1.80
111	3053	+/-110	4 @ 5.8A 4 @ 4.1A 4 @ 2.1A 28 @ 1.4A 71 @ .8A	3.00	1.40
172	4134	+/-90	16 @ 5A 156 @ 2A	5.58	2.25
176	3002	+/-35	12 @ 3.2A 27 @ 2.6A	3.10	2.38
192	3428	+/-210	12 @ 3.0A 17 @ 2.5A 163 @ 1.0A	3.37	3.69
220	3842	+/-75	170 @ 1.5A 50 @ 5A	4.30	1.80
1920	4148	+/-90	1920 @ 3A	5.00	31.80







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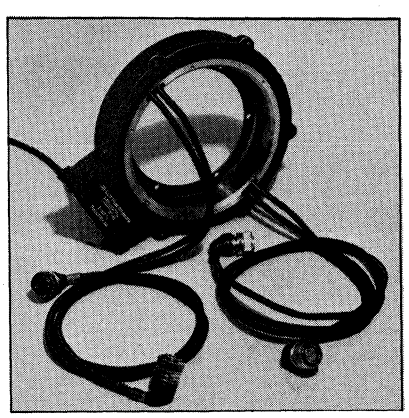
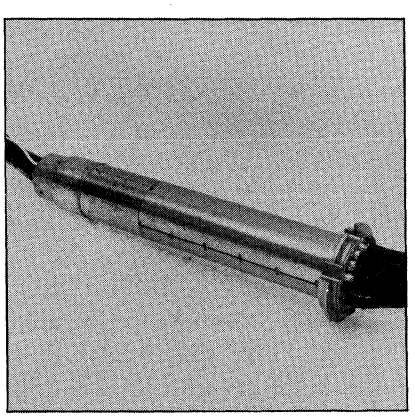
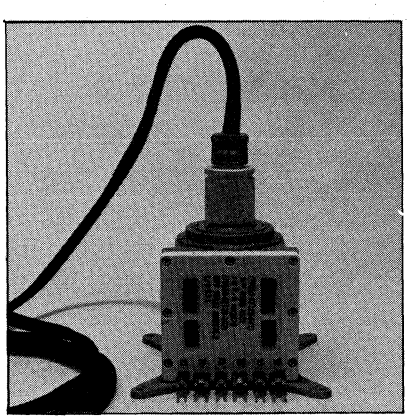
HELICOPTER SLIP RINGS

Slip rings that power de-icing and blade folding systems must transfer high current levels to blade systems rotating at high speeds. They must also withstand vibration levels and environmental hazards typical of helicopter operation. The latest de-icing applications include both main and tail rotor slip rings, with main rotor current levels to 60 amperes and tail rotor speeds to 1,500 RPMs.

		POWER				SIGNAL				
PART NUMBER	ROTATIONAL SPEED	DIMENSIONS	NUMBER OF CKTS	CURRENT RATING	VOLTAGE RATING	NUMBER OF CKTS	GAUGE OR TYPE	INTENDED SIGNAL	APPLICATION	MAX WEIGHT (LB)
1209	264 RPM	O.D. 3.999 Bore 3.000 Length 12.190	8	50A	200V 500V (Peak)	N/A	N/A	N/A	Sea Knight	
2876	258 RPM	O.D. 3.200 Length 6.500	3	60A	200VAC 400Hz	3	28VDC 5A		Main Rotor De-Ice SRA for U.S. Army Blackhawk	
3018	1500 RPM	O.D. 10.190 Bore 6.130 Length 4.462	3	20A	1800V (Peak)	N/A	N/A	N/A	Tail Rotor De-Ice for Seahawk/ Blackhawk	
3091	1500 RPM	O.D. 9.250 Bore 7.000 Length 1.650	2	16AWG	1500V	N/A	N/A	N/A	Tail Rotor De-Ice AH 64 Apache	2.40
3741	432 RPM	O.D. 3.150 Length 21.000	N/A	N/A	N/A	150	50VDC, 1A 24AWG		Main Rotor A129 Helicopter	
3742	1657 RPM	O.D. 5.000 Bore 2.20 Length 5.182	N/A	N/A	N/A	50	24 AWG		Tail Rotor	
4101	258 RPM	O.D. 4.190 Length 11.800	3 3	60A 25A	200V 400Hz	12	3A 28V	Pulses to control/ monitor rotor head loads	Main Rotor De-Ice and Blade Fold for Seahawk	10.5
4103	397 RPM	O.D. 3.250 Length 20.500	4	60A	220V	8 58	2 or 6A 1A	Resolver	V-22 Osprey	23
4106	210 RPM	O.D. 5.510 Length 22.676	14 22 1	130A 10A Bonding Ring	270VDC 200V 400Hz	32	24AWG	Signal & health monitoring Resolver	EH-101; De-Ice & Blade Folding ckts	39.5
4239	210 RPM	O.D. 5.510 Length 16.410	22 1	10A Bonding Ring	200V 400Hz	32	24AWG	Resolver	Same as 4106 w/o De-Ice ckts	19.0







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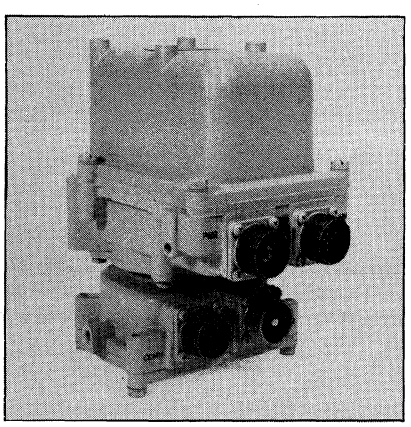
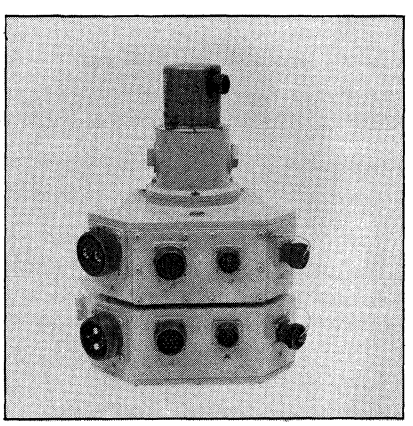
VEHICULAR SLIP RINGS

Electrical and hydraulic slip rings are used in vehicles such as tanks, retrievers, mobile missile launchers, and armored personnel carriers. A typical armored vehicle might contain slip rings in the turrett, the commander station, and the periscope.

	POWER			SIGNAL			
PART NUMBER	NUMBER OF CIRCUITS	CONT. CURRENT RATING	VOLTAGE RATING	NUMBER OF CIRCUITS	GAUGE OR TYPE	INTENDED SIGNAL	SPECIAL FEATURES
2985	1 1	150A 150A	150V Peak Ground	12	Control	5A, 150V	
2993	1 1	150A 150A	150V Ground	24	Control	5A, 150V	
2869				160	20 AWG	28 VDC 7.5A	4 hydraulic at 200 PSI, 2 GPM; 1 pneumatic at 6 PSI
2772	2 1 1	300A 600A 75A	28VDC	40	Signal/ low power	28VDC 7.5A	1 pneumatic at 1200 PSI, 600 CFM
2676	1 1	150A 150A	Ground	14	3A		1 hydraulic at 200 PSI, 1 hydraulic at 50 PSI, 1 pneumatic at 2 PSI
2918	4	200A	28VDC	2 55	Twin AX 22 AWG	6MHz 4A, 28VDC	1 hydraulic at 2000 PSI, 34 GPM; 1 hydraulic at 100 PSI, 34 GPM; 1 pneumatic at 6 PSI, 15 CFM
3489	1 1	150A 150A	Ground	80		5A	
3733	2	200A	24VDC	42	20 AWG	3A, 28VDC	CBR Air Channel
4231	13	2 @ 15A 2 @ 10A 2 @ 5A 6 @ 3A 1 @ 10A	150V Peak Ground	34 1	Control RG 179	2A, 150V 10MHz	6.5 Inch Bore





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Slip Ring Products
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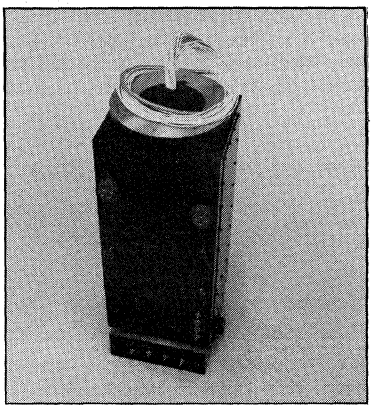
Blacksburg, Virginia
24060-3100

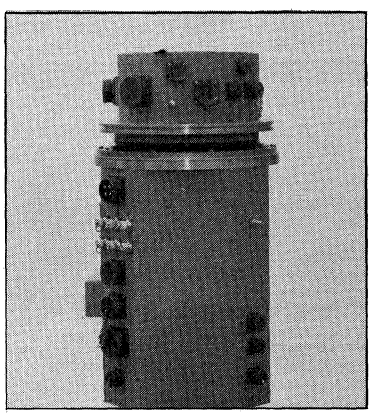
703-953-4751, FAX 703-953-1841
TWX 710-875-3694

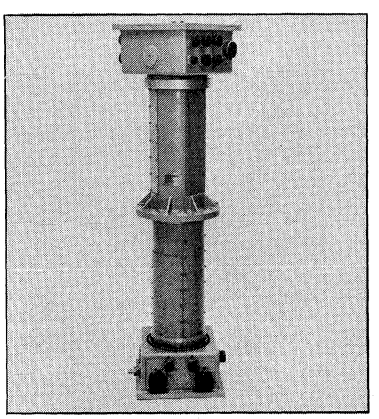
PEDESTAL SLIP RINGS

Typically found in radar, missile and gun fire control systems, Pedestal Slip Rings contain varying combinations of logic, control, and high frequency analog signal and power circuits.

NUMBER OF CIRCUITS	PART NUMBER	NUMBER OF POWER CIRCUITS/ CURRENTS	LENGTH	DIAMETER	BORE	SPECIAL FEATURES
65	2912	12 @ 10A	21.0	7.3	None	3-35 MHz channels
72	2672	6 @ 150A	33.3	12.0	None	Rugged & Sealed 4 10MHz channels
218	2686	16 @ 10A	17.8	3.6	None	Very high circuit density
259	2258	9 @ 160A 5 @ 10–30A	60.0	12.0	None	12-60 MHz Channels
18	4062	0	3.9	5.5	3.2	Integral Resolver
19	2608	3 @ 550A 2 @ 110A	8.3	20.8	1.0	
37	2945	0	5.9	7.1	2.7	
57	4120	13 @ 22A	17.2	11.4	4.5	
78	4189	6 @ 10A	11.0	7.9	3.0	Unlubricated contact technology
103	3474	18 @ 3A	14.6	7.4	3.5	4-1 GHz ckts.
127	2480	17 @ 60A	25.5	15.3	9.7	Lightweight (88 lbs)
150	2446	3 @ 50A 6 @ 20A	29.0	16.0	8.0	Sealed for shipboard use
153	2607	1 @ 50A 4 @ 20A	50.0	8.0	1.3	Meets MIL-STD-901 Hammer Drop
176	2284	10 @ 100A 95 @ 10-20A	33.0	12.8	6.0	12-6 MHz Channels
252	2125	4 @ 100A 3 @ 60A	37.5	21.5	10.0	3-30 MHz Channels







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24060-3100
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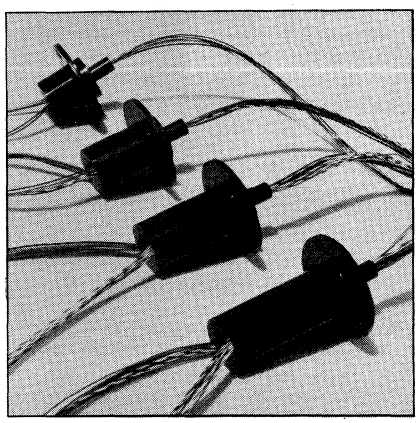
TWX 710-875-3694

INDUSTRIAL SLIP RINGS

NUMBER OF CIRCUITS	PART NUMBER	CONTINUOUS CURRENT	LENGTH	DIAMETER	NOTES
6 12 18 24	4023	2A	.76 1.24 1.72 2.20	.870	Suitable for CCTV; Units can be shipped from stock
1-12	4183	2A	1.58	1.36	0.985 inch through bore
2	3773	5A	1.50	1.00	Water tight
10	4221	.5A	.78	.37	#10 circuit is a switch circuit
12	4102	.5A	BB 1.05 SR 1.67	.982 .46	Slip ring and brush block set Slip ring bore .196 inch
14	3141	1 ground-150A 1-150A 12-7.5	9.28	11.25	Sealed, rugged construction
16	4019	1A	2.35	1.00	Fiber brush capsule. 3000 RPM

No more than 20% of all rings should be loaded with rated current simultaneously.

Many industrial applications such as continuous-panning CCTV cameras, automated machinery and robotic end-effectors can benefit from the continuous, unrestrained, rotational freedom of a slip ring. Our 4023 Industrial Slip Rings offer the reliability of precious metal contacts at an affordable price. This is made possible by standardizing on four basic models (6, 12, 18, and 24 rings), which are mass produced for volume pricing.



SPECIAL SLIP RINGS

Cable Reel Slip Rings

Cable reel slip rings can be found in a wide range of military and industrial applications including marine/seismic exploration, underwater towed vehicles, remote tele-operated vehicles, construction cranes, and buoyant submarine antennas. These slip rings are designed for a particularly rugged environment while also providing field accessability of the brush block assemblies if repairs are necessary. With access plates in place, sealed bearings, and integral gasketed connectors, the internal portion of the unit is well protected from environmental conditions.

Mooring Slip Rings

Deep water drilling requires a slip ring to allow complete freedom to weathervane for floating power generation stations (SALM type installations). Experience to date in mooring applications include currents to 600 amps, voltages to 35,000 volts (transmission of 36 megawatts of power) in sizes to 8 feet in diameter by 10 feet in length.

Medical Electronics Slip Rings

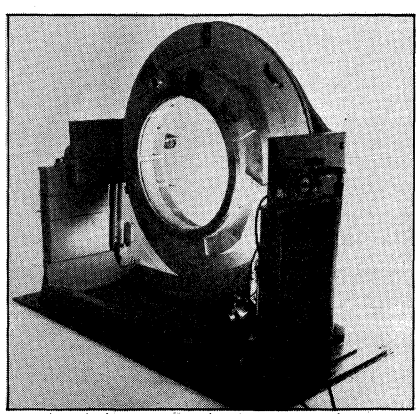
Slip rings are used in various scanner applications, particularly for computed axial tomography (CAT Scanners) which require the need to scan at faster speeds, unencumbered by mechanical stops. These units provide a large through bore for mounting as an integral part of the gantry.

Voltages to 200,000 volts are handled safely with careful attention to gradients, internal surface contours, material selection and debris management.

Our slip rings require minimum inertia for spin-up and braking consistent with structural and electrical safety.

Slip rings for medical scanners are built on a history of reliable low maintenance applications, with reliability levels exceeding a million circuit hours being demonstrated.

Our CT slip ring capsules are typically sealed with static seals and redundant dynamic lip seals at all rotary interfaces. A slip ring with separate mating brush blocks is available in a low cost design for low voltage CT scanners where the X-ray voltage is stepped up on the rotating gantry.



Slip Ring Applications Are Only Limited by Your Imagination

These are just a few of the unique applications of slip ring technology. When you need to pass power and/or data through a rotating interface—turn to Litton.

Many of the designs and manufacturing processes are proprietary and are covered under one or more U.S. or European patents.

Call us toll-free at **800-336-5917** (In Virginia, call 703-953-4751) for more information.

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24060-3100
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TWX 710-875-3694

CUSTOMER SPECIFICATION FORM

Date _____ Engineer _____ Customer Part No _____

Customer Name _____ Phone Number _____

Address _____

CAPSULE ☐ SEPARATE SLIP RING ☐ SEPARATE BRUSH BLOCK ☐ POLY-TWIST ☐ (for +/- _____ Degrees)

Application _____

Number of Rings _____ (Detail circuit functions below)

Size: Available length _____ Diameter _____ Bore _____

Wear (life): Hours (or yrs) _____ @ Duty Cycle _____

Environment: Temperature: Operating Range _____°C, Pressure: Normal _____ Minimum _____

Vibration: _____ g's @ _____ Hz Shock _____ g's

Sealing: None _____ Dust _____ Water Spray _____ Submersion _____

Rotational Speed: Normal _____ Maximum _____

CIRCUIT DATA

Circuit Function	No. Rings	Current (amps)		Working Volts	Digital Risetime or Freq. (Hz)	Crosstalk Isolation (dB)
		Normal	Max			

Torque, max starting _____ gm-cm Weight-max _____

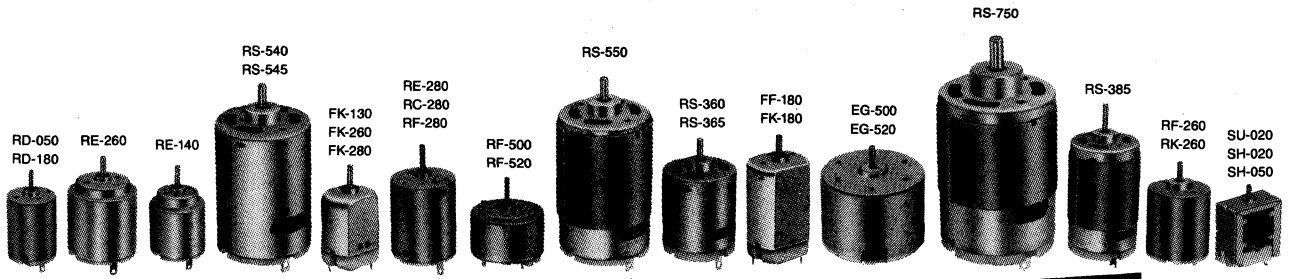
Lead Length: Rotor end _____ Stator _____

Connectors: Rotor end _____ Stator _____

Additional Requirements: (Integral Potentiometer, Resolver, Switch, Hydraulics, Pneumatics, Optical Channel, etc.)

Please provide sketch of available mounting space if possible.

Call us toll-free at **800-336-5917** (In Virginia, call 703-953-4751) for more information.



Cost effective.

Mabuchi Subfractional-HP motors. Small. Light. Reliable. Efficient. Better than ever.

We're the world's largest manufacturer of subfractional-HP motors — producing over 3 million per day! Shown here is merely a small sampling of the extensive spectrum of our standard motors with average performance characteristics at indicated voltage. So comprehensive is our range of standard models, it's a virtual certainty there's one or more to fit your needs perfectly — that's cost-effectiveness!

Please request or fill out a questionnaire and/or indicate your desired performance: we'll suggest the motors most suited to your needs.

Power curves and 3-view drawings with production tolerances available upon request. Mabuchi Subfractional-HP motors are used for such machine worlds as audio/video equipment, home appliances, personal care, cameras, peripherals, office/medical equipment, automotives, garden tools, hand tools, etc.

MOTOR				SIZE			Operating Voltage Range	TYPICAL CHARACTERISTICS									Stall Torque
								Winding Code		NO LOAD		AT MAXIMUM EFFICIENCY					
Series	Group	Type	Model	Outside Diameter (inch)	Housing Length (inch)	Typical Power Source	V	Number	V	Speed RPM	Current AMP	Speed RPM	Current AMP	Torque OZ-IN	Output W	Eff. %	OZ-IN
ECONOMY	STANDARD	RE	RE-140	.827	.984	DRY CELL	1.5-3.0	2270	1.5	8,200	0.190	6,250	0.62	0.089	0.40	44.2	0.375
			RE-260	.937	1.059		1.5-4.5	2670	3.0	12,500	0.230	10,250	1.03	0.222	1.68	54.1	1.222
			RE-280	.953	1.201		1.5-6.0	2865	3.0	9,200	0.155	7,800	0.85	0.278	1.60	62.3	1.81
		SU	SU-020	.709×.374	.744		1.0-3.0	09170	3.0	11,800	0.080	8,150	0.18	0.022	0.132	24.6	0.071
	CARBON	RC	RC-280S	.953	1.201		4.5-12.0	20120	6.0	7,800	0.125	6,450	0.60	0.417	2.00	56.0	2.430
		FK	FK-130S	.791×.594	.988		4.5-20.0	07500	12.0	7,200	0.030	5,350	0.09	0.108	0.43	40.8	0.424
			FK-260S	.953×.720	1.059		4.5-15.0	10350	12.0	7,300	0.036	5,950	0.16	0.244	1.07	56.3	1.32
			FK-280S	.953×.720	1.201		4.5-20.0	10350	12.0	5,700	0.028	4,650	0.13	0.253	0.87	57.5	1.39
		SH	SH-020S	.709×.374	.744		4.5-12.0	09170	6.0	19,000	0.110	13,600	0.28	0.061	0.608	36.8	0.213
			SH-050S	.709×.374	.866		4.5-12.0	09170	9.0	23,400	0.105	17,350	0.30	0.090	1.151	42.6	0.347
LOW NOISE	STANDARD	RF	RF-260T	.953	1.059	DRY CELL BATTERY RECTIFIED A.C.	1.0-9.0	3255	1.2	5,700	0.160	4,750	0.800	0.164	0.575	59.9	0.986
			RF-280	.953	1.201		1.5-12.0	2485	3.0	7,300	0.115	6,130	0.602	0.236	1.069	59.2	1.472
			RF-500T	1.260	.768		1.5-9.0	14430	6.0	3,650	0.024	3,050	0.122	0.196	0.441	60.0	1.194
			RF-520T	1.260	.846		1.5-12.0	12580	12.0	4,550	0.018	3,890	0.106	0.278	0.799	62.8	1.917
		RD	RD-050T	.673	9.13		1.5-6.0	09220	4.5	7,600	0.039	5,710	0.118	0.054	0.23	43.5	0.222
			RD-180S	.839	1.142		1.2-12.0	2085	2.4	5,310	0.052	4,530	0.304	0.142	0.476	65.2	0.972
		FF	FF-180S	.803×.606	1.264		1.0-6.0	3534	1.2	7,550	0.220	6,250	1.08	0.179	0.83	63.7	1.06
	CARBON	RK	RK-260S	.953	1.059		5.0-15.0	12250	12.0	10,900	0.056	9,030	0.27	0.289	1.925	59.5	1.681
		FK	FK-180S	.803×.606	1.264		4.5-15.0	14150	6.0	7,050	0.060	5,700	0.26	0.197	0.83	53.6	1.04
HEAVY DUTY	CARBON	RS	RS-360S	1.091	1.283	BATTERY RECTIFIED A.C.	4.5-26.0	14250	12.0	7,300	0.090	5,850	0.36	0.556	2.40	55.6	2.81
			RS-365S	1.091	1.283		6.0-26.0	1385	18.0	20,800	0.220	17,000	0.99	0.897	11.3	63.3	4.93
			RS-375S	1.091	1.488		12.0-26.0	2073	24.0	25,800	0.230	21,700	1.21	1.19	19.1	65.8	7.50
			RS-385S	1.091	1.488		12.0-26.0	2073	24.0	22,000	0.180	18,800	1.05	1.27	17.6	69.7	8.68
			RS-395S	1.091	1.831		6.0-26.0	2455	12.0	10,000	0.190	8,400	1.00	1.36	8.4	69.6	8.61
			RS-540	1.406	1.969		3.0-12.0	7516	3.6	19,100	2.85	15,700	13.1	2.19	25.4	53.8	12.3
			RS-545S	1.406	1.969		6.0-26.0	5016	6.0	15,000	1.20	12,600	6.35	2.87	26.8	70.3	18.1
			RS-550S	1.406	2.244		3.6-15.0	7522	6.0	12,400	0.70	11,300	7.34	3.87	32.3	73.3	44.4
			RS-750S	1.661	2.362		4.5-18.0	8027	9.6	18,400	1.8	15,800	11.10	6.76	79.1	73.9	48.6
ELECTRONIC GOVERNOR		EG	EG-500AD-6F	1.429	.984	DRY CELL RECTIFIED A.C.	4.2-7.5	18290	6.0	2,400 RPM at 8 G-CM load							
			EG-500AD-9F	1.429	.984		6.0-11.0	14430	9.0								
			EG-500AD-2F	1.429	.984		8.4-15.0	12580	12.0								
			EG-520AD-6F	1.429	1.063		4.2-7.5	16340	6.0								
			EG-520AD-9F	1.429	1.063		6.0-11.0	14470	9.0								
			EG-520AD-2F	1.429	1.063		8.4-15.0	12580	12.0								

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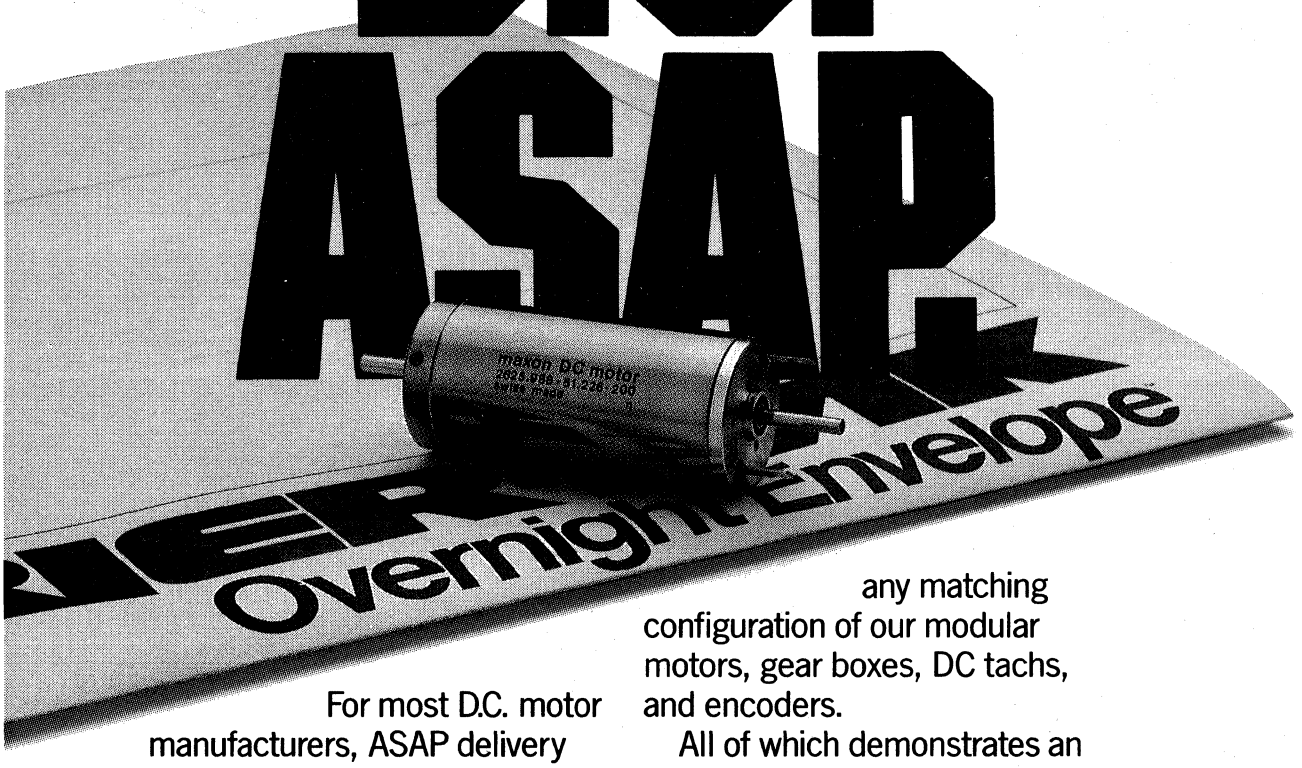
D.C. ASAP.



For most D.C. motor manufacturers, ASAP delivery actually means several weeks.

But when maxon DC motors says ASAP, we truly mean it.

Because we maintain an extensive stock program. So if you choose any motor from our Stock Program Catalog, you'll get a prototype in just days.

Besides a broad selection of ferrite, AlNiCo, and rare earth D.C. motors, our ASAP delivery applies to virtually any matching configuration of our modular motors, gear boxes, DC tachs, and encoders.

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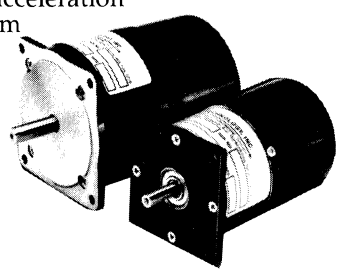
New!...and only from MFM Technology. Brushless NEMA 23 and 34 frame size servo motors replace stepper and DC brush motors. Advantages of these MFM brushless servo motors:

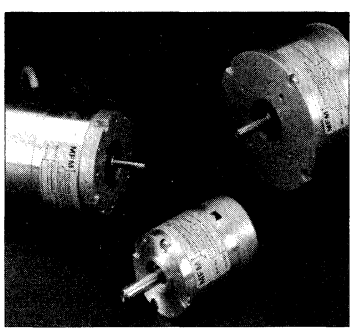
* smooth at all speeds - no cogging!
* instantaneous linear acceleration
* full torque to 6,000 rpm
* no resonance effects
* cool operation



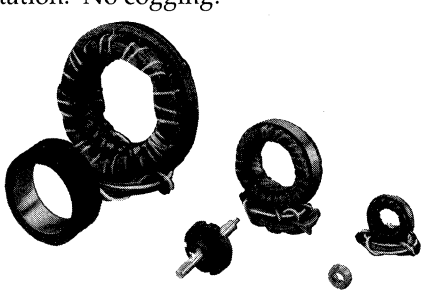
Using samarium-cobalt magnets, MFM brushless DC motors are available in 10 frame sizes from 1.25 inch through 10.0 inch diameter with peak torque ratings from 13.5 oz-in. to 4500 lb-in.

Modular motor components are matched to provide optimum performance using many standard rotor configurations.

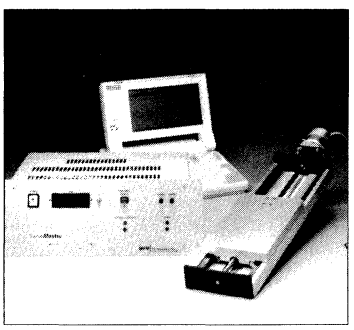
No cogging!



Unhoused motors are supplied as kits for better performance and cost savings for direct mounting onto the driven shaft. Eliminate performance-reducing effects of conventional couplings, belts, or pulleys. Choice of Hall sensor, optical encoder, or resolver commutation. No cogging!

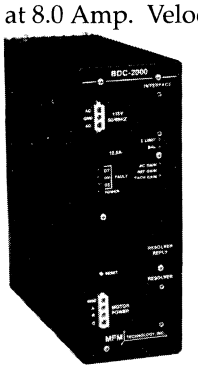


Servo *Master* is a complete brushless servo system consisting of a programmable motion controller, power supply, brushless servo amplifiers, and brushless DC motors with shaft encoder feedback.



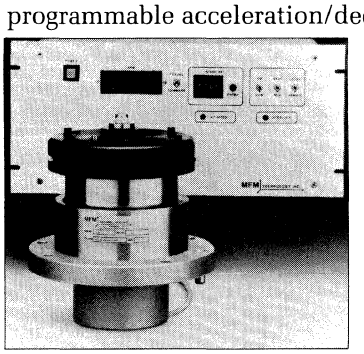
This system provides closed loop control of up to three axes, and makes possible micropositioning of mechanical stages, combined with high speeds.

Model BDC 2000 is a four quadrant sine-wave PWM brushless motor drive. Output bus rating is 160 Volt at 8.0 Amp. Velocity or current loop control accepts a ±10 volt analog command signal. Resolver-to-digital conversion provides electronic commutation, absolute shaft position, and velocity control.



Emulated channel A, B and index encoder output is provided for use with a motion controller. Other models offer power ratings to match a broad range of motor speed and torque requirements.

Precision air or ball-bearing spindles with embedded brushless DC motors are available with micro-inch shaft run-out tolerances. Model BDC 0550 linear sine-wave drive offers programmable acceleration/deceleration, virtually no EMI/RFI, closed loop servo control and IEEE-488 or RS-232C digital interface. Speed accuracy > .001% with smooth speed from less than 1 rpm to more than 15,000 rpm.



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- Originators of Skew-Wound Coreless Micromotors.
- Patented and Licensed the World Over.

MOTOR STYLE SELECTOR

STYLE	SERIES	CASE DIAMETER (mm)	CASE DIAMETER (in)	OVERALL LENGTH (mm)	OVERALL LENGTH (in)	CONT. MECH. POWER OUTPUT (W)	MAX. CONT. TORQUE (oz-in)	RECOMMENDED MAX SPEED (RPM)
MOTORS								
	1016	10	(.39)	16	(.63)	0.45	.07	13,000
		FITS GEARHEAD SERIES 10/1, & 12/3						
	1212	12	(.47)	12.2	(.48)	0.1	.01	15,000
		FITS GEARHEAD SERIES 12/3, & 10/1						
	1219	12	(.47)	18.7	(.74)	0.45	.11	12,000
		FITS GEARHEAD SERIES 12/3, & 10/1						
	1319	13	(.51)	19	(.75)	0.9	.17	12,000
		FITS GEARHEAD SERIES 15/1, 15/2, 15/3, 15/5, & 16A						
	1331	13	(.51)	31.2	(1.23)	2.0	.36	12,000
		FITS GEARHEAD SERIES 15/5						
	1516	15	(.59)	15.8	(.62)	0.3	.07	12,000
		FITS GEARHEAD SERIES 15/1, 15/2, 15/3, 15/5, & 16A						
	1524	15	(.59)	23.8	(.94)	0.6	.14	12,000
		FITS GEARHEAD SERIES 15/1, 15/2, 15/3, 15/5, & 16A						
	1616	16	(.63)	15.8	(.62)	0.45	.11	12,000
		FITS GEARHEAD SERIES 16/1, 16/2, 16/3, 16/5, 16A						
	1624	16	(.63)	23.8	(.94)	0.9	.21	12,000
		FITS GEARHEAD SERIES 16/1, 16/2, 16/3, 16/5, & 16A						
	2017	20	(.79)	17.2	(.68)	0.45	.11	12,000
	2025	20	(.79)	24.8	(.98)	0.9	.21	8,000
	2225	22	(.87)	24.8	(.98)	1.0	.28	8,000
		FITS GEARHEAD SERIES 22/2, 22B, 23/1, & 34PG						
	2230	22	(.87)	30.0	(1.18)	2.0	.36	8,000
		FITS GEARHEAD SERIES 22/2, 22B, 23/1, & 34PG						
	2233	22	(.87)	32.8	(1.29)	2.0	.43	8,000
		FITS GEARHEAD SERIES 22/2, 22B, 23/1, & 34PG						
	2338	23	(.91)	37.6	(1.48)	3.5	.85	8,000
		FITS GEARHEAD SERIES 34PG, & 23/1						
	2842	28	(1.10)	42.0	(1.65)	6.0	2.80	5,000
		FITS GEARHEAD SERIES 23/1, 34PG, 38/1, & 38/2						
	3540	35	(1.38)	40.0	(1.57)	10.0	3.55	5,000
		FITS GEARHEAD SERIES 34PG, 38/1, & 38/2						
	3557	35	(1.38)	57.0	(2.24)	15.0	6.38	5,000
		FITS GEARHEAD SERIES 34PG, 38/1, & 38/2						
	3557...CS	35	(1.38)	57.0	(2.24)	20.0	7.09	5,000
		FITS GEARHEAD SERIES 34PG, 38/1, & 38/2						
	3557...CR	35	(1.38)	57.0	(2.24)	25.0	8.50	5,000
		FITS GEARHEAD SERIES 34PG, 38/1, & 38/2						
GEARMOTORS								
	2020	20	(.79)	20.0	(.79)	0.4	.21 to 1.42	200 to 3,000
	2034	20	(.79)	33.3	(1.31)	0.8	.43 to 1.42	500 to 2,000

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ALSO AVAILABLE:

- Tacho-Generators
- Optical Encoders
- Control Systems
- Shaft Couplings
- Precision Gearheads
- Motor-Tachometers

MOTOR STYLE SELECTOR

STYLE	SERIES	CASE DIAMETER (mm)	CASE DIAMETER (in)	OVERALL LENGTH (mm)	OVERALL LENGTH (in)	CONT. MAX. POWER OUTPUT (W)	MAX. CONT. TORQUE (oz-in)	RECOMMENDED MAX SPEED (RPM)
	GNM 2130	34	(1.34)	94	(3.70)	8.0	1.81	6,000
	FITS GEARHEAD SERIES G4, G4A, & G5							
	GNM 2145	34	(1.34)	110	(4.33)	12.0	2.70	6,000
	FITS GEARHEAD SERIES G1.1, G4, G4A, & G5							
	GNM 2636	45	(1.77)	98	(3.86)	22.0	13.14	4,000
	FITS GEARHEAD SERIES G1.2 & G12.1							
	GNM 2670	45	(1.77)	142	(5.59)	40.0	21.72	4,000
	FITS GEARHEAD SERIES G13.1							
	GNM 3125	55	(2.17)	126.5	(4.98)	30.0	15.07	4,000
	FITS GEARHEAD SERIES G24							
	GNM 3150	55	(2.17)	126.5	(4.98)	55.0	27.65	4,000
	FITS GEARHEAD SERIES G2.6							
	GNM 3175	55	(2.17)	126.5	(4.98)	75.0	37.74	4,000
	FITS GEARHEAD SERIES G11.1							
	GNM 4125	70	(2.76)	118	(4.65)	45.0	32.71	3,000
	FITS GEARHEAD SERIES G8N							
	GNM 4150	70	(2.76)	143	(5.63)	75.0	52.67	3,000
	FITS GEARHEAD SERIES G11.2							
	GNM 4175	70	(2.76)	168	(6.61)	100	79.01	3,000
	GNM 5440	83	(3.27)	166.5	(6.56)	125	79.37	3,000
	FITS GEARHEAD SERIES G3.1 & G6.1							
	GNM 5480	83	(3.27)	206.5	(8.13)	210	149.53	3,000
	FITS GEARHEAD SERIES G6.1, G40.1, GC10, & GC20							
	GNM 6250	100	(3.94)	193	(7.60)	250	133.00	3,000
	GNM 62100	100	(3.94)	243	(9.57)	450	225.00	3,000
	FITS GEARHEAD SERIES G40.1, GC10, GC20, & GC30							
	GNM 7045	120	(4.72)	202	(7.95)	175	177.87	3,000
	GNM 7085	120	(4.72)	256	(10.08)	300	295.16	3,000
	GNM 70130	120	(4.72)	313	(12.32)	430	414.88	3,000
	FITS GEARHEAD SERIES G50.1, GC10, GC20, & GC30							

- **Available with Integral Brakes, AC/DC Tachs, and Optical & Magnetic Encoders.**
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- Diameters from 10 mm - 120 mm (0.39 - 4.72 in.)
- Continuous Output Torque to 97 ft-lb.

GEARHEAD STYLE SELECTOR

STYLE	SERIES	OUTSIDE DIAMETER (mm)	OUTSIDE DIAMETER (in)	SHAFT DIAMETER (mm)	SHAFT DIAMETER (in)	RATIOS FROM TO	MAX. CONT. TORQUE (oz-in)	INTER-MITTENT TORQUE (oz-in)
GEARHEADS								
	10/1	10	(.394)	2	(.079)	4:1 - 1024:1	≤ 14.00	≤ 28.3
		FITS MOTOR SERIES 1016, 1212, & 1219						
	12/3	12	(.472)	2	(.079)	9.17:1 - 154.368:1	≤ 5.6	≤ 14.1
		FITS MOTOR SERIES 1212, 1219, & 1016						
	15/1 & 16/1	17	(.669)	2	(.079)	11.8:1 - 5752:1	≤ 2.8	≤ 7.1
		FITS MOTOR SERIES 1516, 1616, 1524, & 1624						
	15/2	16	(.630)	2	(.079)	3.45:1 - 235,067:1	≤ 4.3	≤ 14.2
		FITS MOTOR SERIES 1516, & 1524						
	15/3	16	(.630)	2	(.079)	6.3:1 - 235,067:1	≤ 4.3	≤ 14.2
		FITS MOTOR SERIES 1516, & 1524						
	15/5	16	(.630)	3	(.118)	6.3:1 - 235,067:1	≤ 14.2	≤ 42.6
		FITS MOTOR SERIES 1516, 1524, & 1331						
	16A	16	(.630)	2	(.079)	11.8:1 - 5752:1	≤ 7.1	≤ 14.2
		FITS MOTOR SERIES 1319, 1516, 1524, 1616, & 1624						
	16/2	17	(.669)	2	(.079)	3.45:1 - 235,067:1	≤ 4.3	≤ 14.2
		FITS MOTOR SERIES 1616, & 1624						
	16/3	17	(.669)	2	(.079)	6.3:1 - 235,067:1	≤ 4.3	≤ 14.2
		FITS MOTOR SERIES 1616, 1624						
	16/5	17	(.669)	3	(.118)	6.3:1 - 235,067:1	≤ 14.2	≤ 42.6
		FITS MOTOR SERIES 1616, 1624						
	22B	24	(.945)	4	(.157)	9:1 - 2187:1	≤ 14.2	≤ 56.6
		FITS MOTOR SERIES 2225, 2230, & 2233						
	22/2	23.8	(.937)	4	(.157)	3.1:1 - 983,447:1	≤ 14.2	≤ 56.7
		FITS MOTOR SERIES 2225, 2230, & 2233						
	23/1	23	(.906)	6	(.236)	14:1 - 1526:1	≤ 100	≤ 141.6
		FITS MOTOR SERIES 2233,2338, & 2842						
	34PG	34	(1.339)	8	(.315)	12:1 - 54880:1	≤ 710	≤ 710
		FITS MOTOR SERIES 2233, 2338, 3540, & 3557						
	38/1 & 38/2	38	(1.60)	8	(.315)	14:1 - 1526:1	≤ 1.418	≤ 2.127
		FITS MOTOR SERIES 3540, 3557, & 2842						
	G1.1	—		6	(.236)	7.3:1 - 38:1	≤ 92	≤ 283.2
		FITS MOTOR SERIES GNM 2145						
	G1.2	—		8	(.315)	7.3:1 - 38:1	≤ 155.7	≤ 283.2
		FITS MOTOR SERIES GNM 2636						
	G2.6	—		10	(.394)	4.8;1 - 36:1	≤ 424.8	≤ 1132.8
		FITS MOTOR SERIES GNM 3150						

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- Full-Line Stocking Distributors Worldwide
- Zero Back-Lash Gearing on Selected Models.

GEARHEAD STYLE SELECTOR

STYLE	SERIES	OUTSIDE DIAMETER (mm)	OUTSIDE DIAMETER (in)	SHAFT DIAMETER (mm)	SHAFT DIAMETER (in)	RATIOS FROM TO	MAX. CONT. TORQUE (oz-in)	INTER-MITTENT TORQUE (oz-in)
	G3.1	—		12	(.472)	5.6:1 - 35:1	≤ 877.9	≤ 1,840.8
		FITS MOTOR SERIES GNM 5440						
	G4	—		8	(.315)	15:1 - 43740:1	≤ 339.8	≤ 424.8
		FITS MOTOR SERIES GNM 2145, & 2130						
	G4A	—		8	(.315)	60:1 - 9720:1	≤ 453.1	≤ 566.4
		FITS MOTOR SERIES GNM 2130, & 2145						
	G5	34	(1.34)	8	(.315)	30:1 - 54880:1	≤ 710	≤ 710
		FITS MOTOR SERIES GNM 2130, & 2145						
	G6.1	83	(3.27)	20	(.787)	8:1 - 185.7:1	≤ 7,080	≤ 18,408
		FITS MOTOR SERIES GNM 5440, & 5480						
	G8N	—		12	(.472)	15:1 - 405:1	≤ 2,832	≤ 2,832
		FITS MOTOR SERIES GNM 4125						
	G11.1	56	(2.21)	14	(.551)	8.3:1 - 242.9:1	≤ 3,115	≤ 4,248
		FITS MOTOR SERIES GNM 3175						
	G11.2	56	(2.21)	14	(.551)	8.3:1 - 242.9:1	≤ 3,115	≤ 4,248
		FITS MOTOR SERIES GNM 4150						
	G12.1	—		10	(.394)	10:1 - 810:1	≤ 708	≤ 1,133
		FITS MOTOR SERIES GNM 2636						
	G13.1	45	(1.77)	12	(.472)	5.5:1 - 220:1	≤ 2,195	≤ 2,832
		FITS MOTOR SERIES GNM 2670						
	G24	—		10	(.394)	15:1 - 540:1	≤ 1,416	≤ 1,699
		FITS MOTOR SERIES GNM 3125						
	G40.1	—		15	(.591)	10:1 - 56:1	≤ 3,540	≤ 9,912
		FITS MOTOR SERIES GNM 5480						
	G50.1	—		20	(.787)	10:1 - 40:1	≤ 5,310	≤ 14,160
		FITS MOTOR SERIES GNM 70130						
	GC10	—		19	(.748)	3.38:1 - 15.17:1	≤ 8,780	≤ 17,700
		FITS MOTOR SERIES GNM 5480 & 70130						
	GC20	—		24	(.940)	19.85:1 - 44.42:1	≤ 16,992	≤ 42,480
		FITS MOTOR SERIES GNM 5480, & 70130						
	GC30	—		28	(1.102)	60.19:1 - 129.50:1	≤ 45,314	≤ 94,876
		FITS MOTOR SERIES GNM 70130						

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PLANETARY GEARMOTORS

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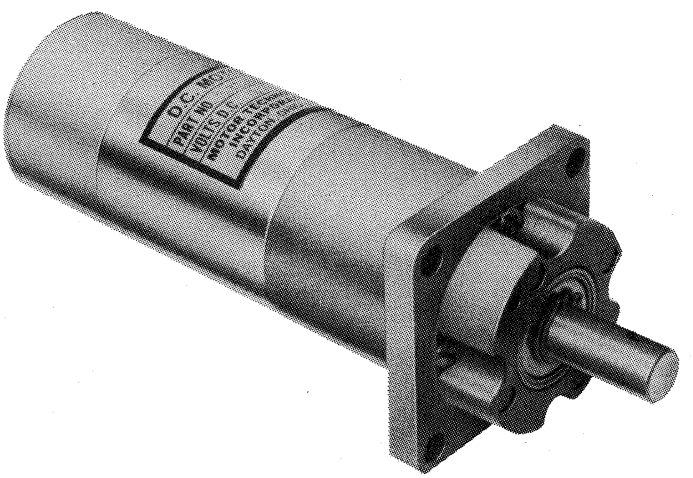

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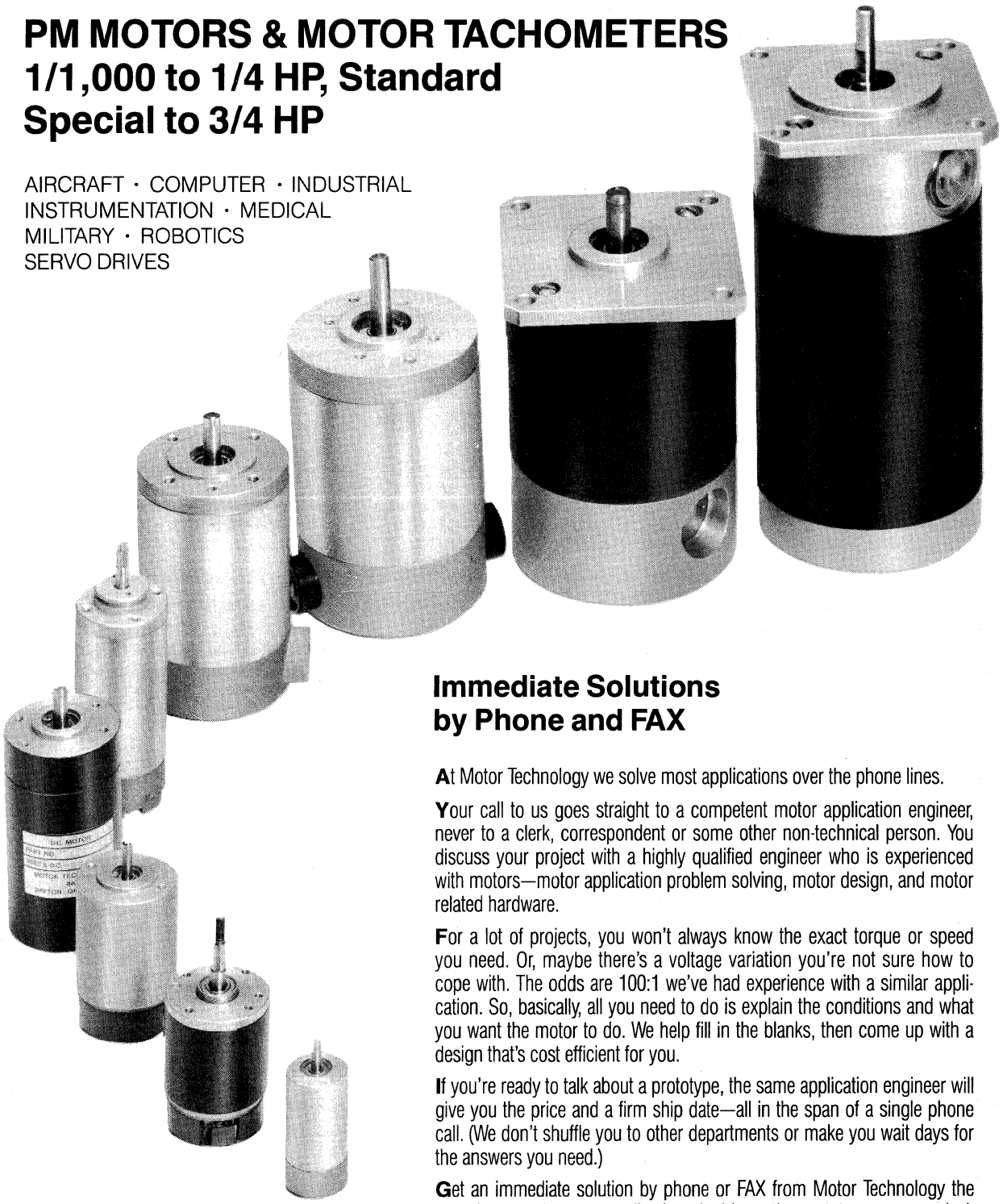

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At Motor Technology we solve most applications over the phone lines.

Your call to us goes straight to a competent motor application engineer, never to a clerk, correspondent or some other non-technical person. You discuss your project with a highly qualified engineer who is experienced with motors—motor application problem solving, motor design, and motor related hardware.

For a lot of projects, you won't always know the exact torque or speed you need. Or, maybe there's a voltage variation you're not sure how to cope with. The odds are 100:1 we've had experience with a similar application. So, basically, all you need to do is explain the conditions and what you want the motor to do. We help fill in the blanks, then come up with a design that's cost efficient for you.

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Output shaft concentric and in line.

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Custom Prototypes in Three to Four Days

Motor Technology is a quick response company.

We custom engineer while you're on the phone, then follow-up with your prototype 3-4 days later. A distributor might be able to deliver as fast, but he couldn't match Motor Technology's factory engineering assistance. And our solution comes to you with two important guarantees:

1 We guarantee performance—the torque you need, over the speed range required, at the voltage selected. The motor, motor tachometer or gearmotor will do exactly what we say, or you don't pay for it.

2 We guarantee the prototype to be production feasible. That's assurance you aren't likely to get with a "kludge" assembled by a distributor technician.

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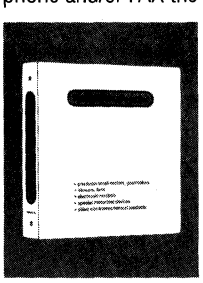
To find out more about us, write or call for our extensive catalog. Or, just phone and/or FAX the problem to us.



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Wide range of standards, with complete performance and specification data. Includes short course on how to predict performance when torque, speed or voltage conditions vary. Shipped UPS, same day.

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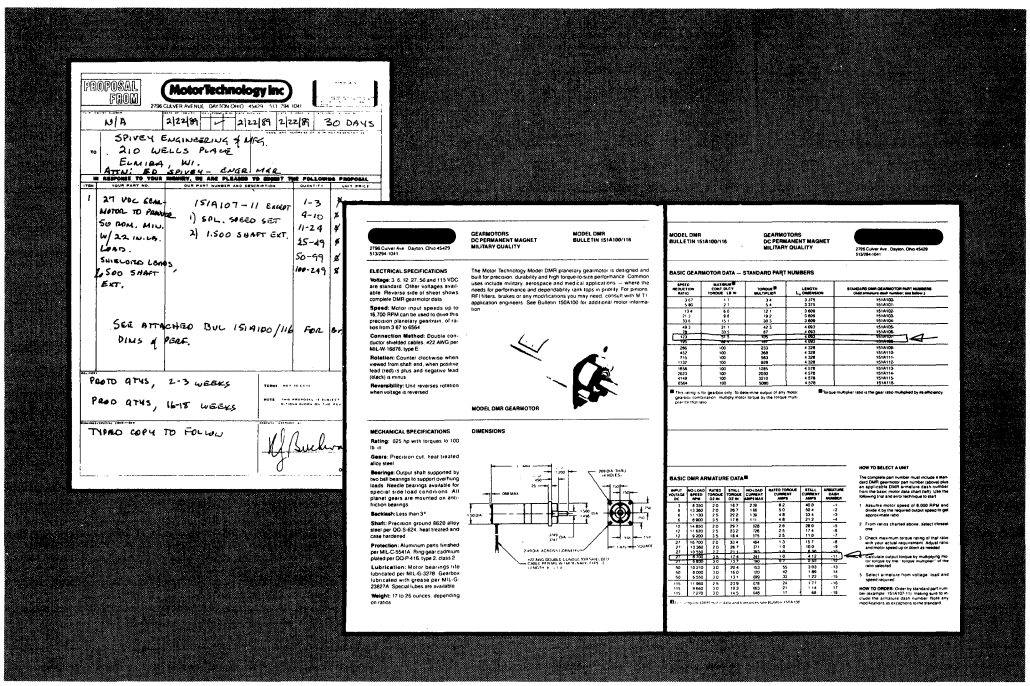

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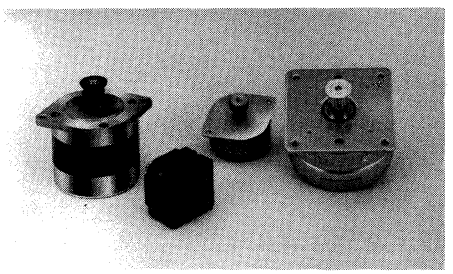
PRECISION STEPPING/ SPINDLE MOTORS

Whether design requirements require an existing motor or a custom design, NMB Technologies will fit your exact specifications. Vertically integrated processes assure quality and dependability. Parts and subassemblies are manufactured in-house on automated production lines. Motors from NMB Technologies offer higher torque, lower inertia, greater accuracy and cooler operation at very competitive prices.

ASTROSYN HYBRID TYPE (Laminated Construction) Typical Motor and Performance Specs

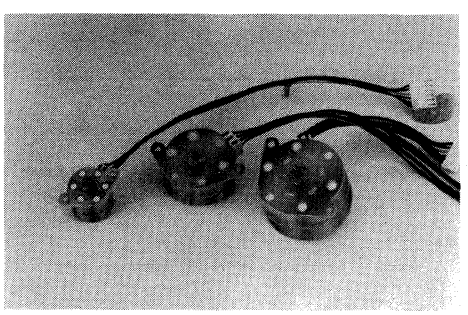


Model No.	∅	Per Winding			Hold. Torque
		VDC	Amps	Ohms	g-cm
0.9° Step Angle					
16PY-Q001	4	9.2	0.24	38.0	900
16PY-Q202	4	4.3	0.35	12.4	400
17PY-Q001	4	9.2	0.24	38.0	900
17PY-Q201	4	9.2	0.24	38.0	400
23LY-C001	4	8.5	0.85	10.0	5000
23LY-C201	4	5.5	0.78	7.1	2500
23LY-C301	4	3.0	1.70	1.8	4000
1.8° Step Angle					
14PM-K001	4	12.0	0.24	48.0	650
15PM-K004	4	8.6	0.36	24.0	700

ASTROSYN PM TYPE (Press Construction) Typical Motor and Performance Specs

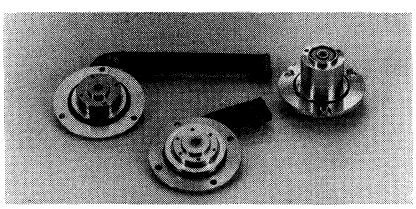
Model No.	∅	Per Winding			Hold. Torque
		VDC	Amps	Ohms	g-cm
1.8° Step Angle					
27BM-H101	4	12	0.36	33	450
7.5° Step Angle					
17BB-H051	4	16	0.13	120	300
20BB-H051	4	12	120.00	100	400

ACCUSTEP PM SERIES STEPPING MOTORS



Type	Length (S.L.)	Steps Per Rotation	Hold Torque (g-cm)	Max. Pull-In Freq. (P.P.S.)
PL15	L	20	45.3	860
PM20	S	20	55	740
	L	20	85	670
PM25	S	24	74	660
	L	24	90	690
PM25	S	48	80	680
PM35	S	24	260	480
	L	24	350	430
PM35	S	48	420	710
	L	48	580	650
PM42	S	48	680	640
	S	96	450	730
	S	100	440	750
	L	48	1100	550
PM55	L	48	1800	370
PM58	S	96	1600	430
	S	100	1500	440

BRUSHLESS DC SPINDLE MOTORS



Model Number	Supply Voltage	Rated Speed	Rated Current
LM-3H-01*	12V ± 10%	2700 RPM ±0.2%	<180mA
LM-30-S1-YM††	12V ± 10%	2400 RPM ±0.2%	<180mA
LM-3H-04**	12V ± 10%	3600 RPM ±0.2%	<250mA
LM-5H-04†	12V ± 10%	3600 RPM ±0.2%	<400mA

*Loaded with 1 disk **Loaded with 3 disks
†Loaded with 4 disks ††Loaded with optical disk

FEATURES AND BENEFITS

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ASTROSYN STEPPING MOTORS HYBRID AND PERMANENT MAGNETIC MODELS

- Quiet, reliable performance, long life
- Wide range of laminated and press construction models — standard or custom designs

ACCUSTEP PM SERIES MOTORS

- Up to 15% more torque than comparably sized units
- As much as 20% lower operating temperature

BRUSHLESS DC SPINDLE MOTORS

- Smaller and have lower profile than competitive products
- Coreless design with stator sheet coil achieves lower radial run outs
- High precision ball bearings

COMPETITIVE PRICING

- Vertically integrated processing for total quality control
- Precision automated production
- In-line quality control and testing

Model No.	∅	Per Winding			Hold. Torque
		VDC	Amps	Ohms	g-cm
1.8° Step Angle (Cont'd)					
17PM-M002	4	12.0	0.15	38.00	500
17PM-M012	4	6.0	0.67	9.00	900
23LM-C004	4	6.0	1.2	5.00	5000
23LM-C108	4	5.4	1.5	3.60	6000
23LM-C202	4	4.0	1.1	3.50	2500
23LM-C302	4	1.3	3.9	0.33	4000
23LM-C401	4	1.7	4.7	0.37	8000
23LM-C501	4	2.2	4.6	0.48	10,800
23LM-C602	4	12.0	0.16	75.00	980
34PM-C006	4	2.0	3.6	0.55	10,000

Model No.	∅	Per Winding			Hold. Torque
		VDC	Amps	Ohms	g-cm
1.8° Step Angle (Cont'd)					
34PM-C108	4	12.0	1.00	12.00	20,000
34PM-C201	4	5.0	4.40	1.13	30,000
42PM-C015	4	4.0	3.10	1.20	45,000
42PM-C109	4	12.0	1.50	7.70	81,000
42PM-C201	4	4.3	6.10	0.70	150,000
3.6° Step Angle					
17PS-C026	4	12.0	0.24	50.00	900
17PS-C035	4	9.0	0.50	18.00	760
5° Step Angle					
23PQ-C001	4	6.0	1.20	5.00	1700

Model No.	∅	Per Winding			Hold. Torque
		VDC	Amps	Ohms	g-cm
7.5° Step Angle (Cont'd)					
23BB-H001	4	5	750.00	6.6	900
28BB-H101	4	5	1.40	3.6	2600
15° Step Angle					
15BA-H052	4	12	170.00	70.0	150
17BA-H052	4	12	0.24	50.0	230

ASTROSYN MODELS

Notes:

1) First two digits of P/N denote frame diameter size in inches x 10. Example: 23 LM C006 has a frame size of 2.3 inches.
2) Most motors listed are available with single or double-ended shafts.
3) Options available include lead screws, gears and pulleys.
4) Standard drivers are available for all standard motors. For special designs contact NMBT applications engineers.

Typical Torque Characteristics				Driving Conditions	
Drive Freq. (P.P.S.)	Pull-Out Torque (g-cm)	Drive Freq. (P.P.S.)	Pull-Out Torque (g-cm)	Winding Ohms	Drive Volts (V)
100	41.4	500	20	10	5
100	34	500	22	100	12
100	59	500	28	80	12
100	44	500	30	80	12
100	75	500	45	50	12
100	55	500	42	65	12
100	190	400	105	30	12
100	270	300	160	120	24
100	290	400	175	30	12
100	470	300	320	20	12
100	485	300	355	15	12
100	410	600	210	15	12
100	400	600	210	15	12
100	820	300	530	10	12
100	1100	200	850	10	12
100	1000	300	570	10	12
100	980	300	570	10	12

ACCUSTEP PM/SERIES MODELS

Notes:

1) First two numerical digits indicate frame diameter size in mm. Example: PM35L-024 has a frame size of 35 mm (1.58").
2) A range of shaft lengths, front plate styles and wiring harnesses are available.
3) Pinion gear option is available.

*Denotes (S) Short or (L) Long

Starting Torque	Starting Current	Starting Time	Non-Repeat. Runout	Acoustic Noise	Torque Constant
>55 gf-cm (at 0.6A)	<0.6A	<8 Sec	<0.6um	<40dBA (at 30cm)	145gh-cm/A ±10%
>55gf-cm (at 0.7A)	<0.7A	<4 Sec.	<0.5um	<40dBA (at 30cm)	140gf-cm/A ±10%
>187gf-cm	1.6A ± 10%	<10 Sec	<0.6um	<42dBA (at 30cm)	180gf-cm/A ±10%
230gf-cm ± 10% (at 1.1A)	1.6A ± 10%	<15 Sec	<0.6um	<45dBA (at 30cm)	160gf-cm/A ±10%

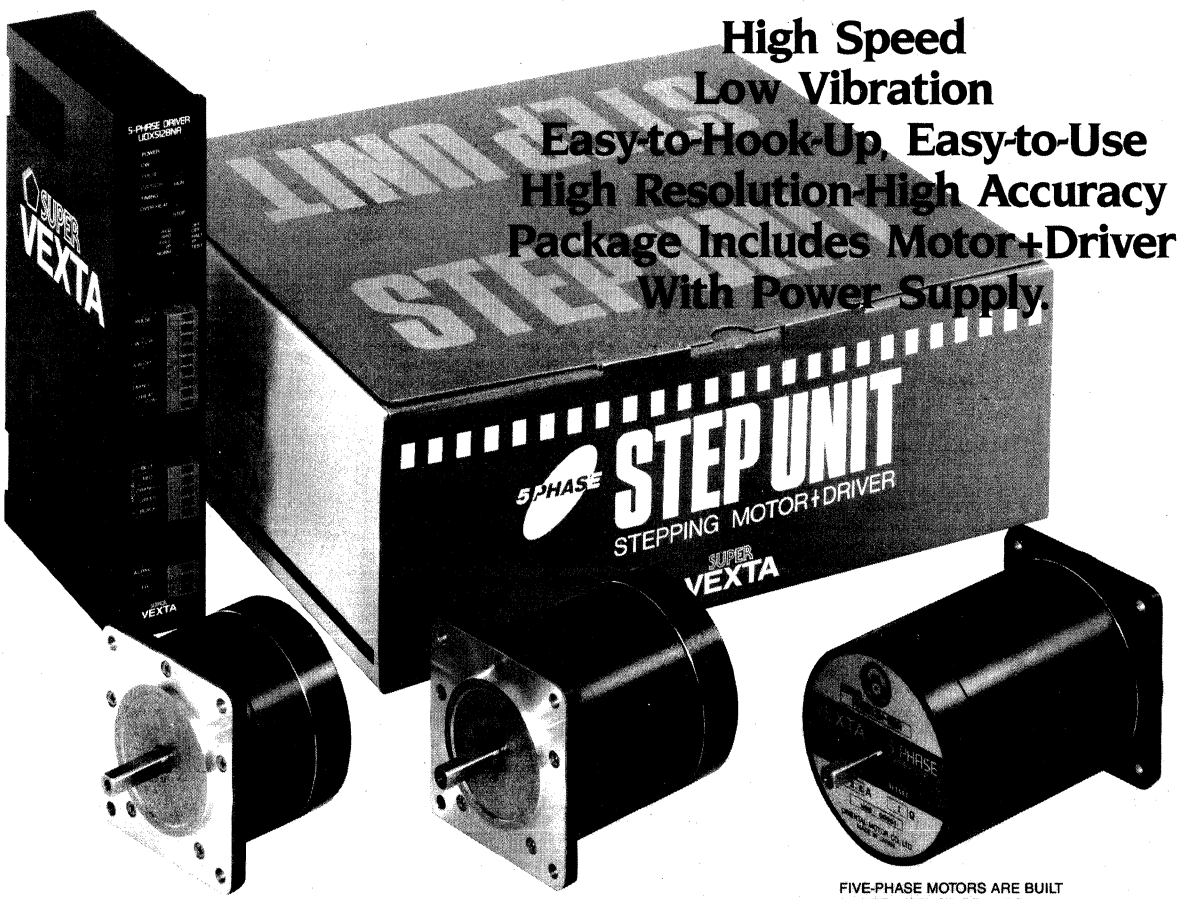
NMB TECHNOLOGIES INCORPORATED
MOTOR DIVISION

For complete specifications and pricing, contact

NMB TECHNOLOGIES INCORPORATED
9730 Independence Ave., Chatsworth, CA 91311 • Telephone (818) 341-3355
FAX: (818) 341-8207 • TWX: (910) 494-1232 • Telex Number: 651340

SUPER
VEXTA® BY ORIENTAL MOTOR

The New-Pentagon UPD Five-Phase Step Motor/Driver is a *Mover* not a Shaker.



High Speed
Low Vibration
Easy-to-Hook-Up, Easy-to-Use
High Resolution-High Accuracy
Package Includes Motor+Driver With Power Supply.

FIVE-PHASE MOTORS ARE BUILT UNDER LICENSE OF BERGER-LAHR

Innovative new-pentagon five-phase UPD step motor/driver packages.

A new generation of high performance easy-to-use motion control products.

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San Jose Office: 1600 Wyatt Drive, Suite 2 Santa Clara, California 95054 Phone: (408)988-2655
Chicago Office: 5420 Newport Drive, Suite 51 Rolling Meadows, Illinois 60008 Phone: (312)577-0310
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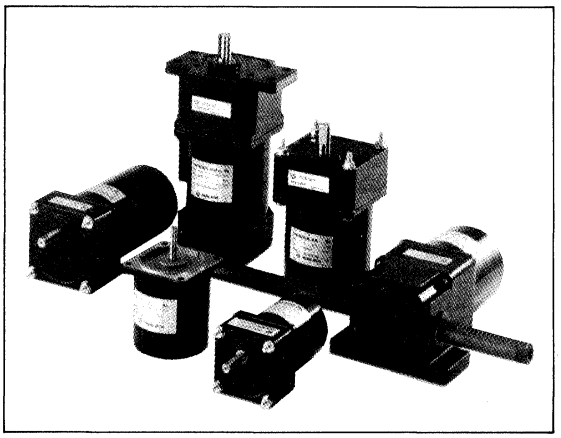
ORIENTAL MOTOR®

HIGH QUALITY FHP ELECTRIC MOTORS



Oriental Motor's reputation for high quality, cost-effective products is well known among automation equipment manufacturers. These motors are used in a variety of products that touch and improve the lives of millions of people. From automating the office in printers, to automating medical and factory automation equipment, **Oriental Motor** is there.

Oriental Motor has over 2000 different standard products that are available in quantities from one, to huge OEM volumes. All **Oriental Motor** products are built with the pride and craftsmanship of a century of manufacturing experience. The engineers at **Oriental Motor** have strived to designed each product to give years of trouble-free service.

Our Product line has 4 different parts: **Oriental Motor** brand AC motors, gearmotors, and speed control motors. **Vexta** Control motors including Step motors and DC brushless motors. **Orix** long life fans, and **SUPER VEXTA** motion control systems.

Features:

Over 2000 standard products available, request our general catalog.
Instrument quality motors at reasonable prices.
Designed with ball bearings for long-life and maintenance-free service.
Available in quantities from one piece to the largest OEM volumes.
Backed by Oriental Motor reputation for award-winning quality.
Standard versions available from stock or with short 3 to 6 week lead times.
Available from our nation-wide stocking distributor network.

Induction Motors

Specifications — **115V. 60Hz. — Continuous Ratings**

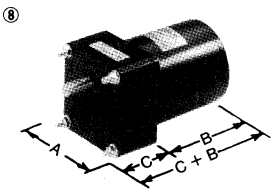
Model and Dimensions No.			Motor Specifications						Gearmotor	
			Output Power Watts	Rated Load			Starting Torque (oz-in)	Capacitor Mfd	Speed Range (rpm)	Torque Range (lb-in)
Motor	Gearhead			Amps	Rpm	Torque (oz-in)				
0IK05GK-AA	**0GK□KA**	①	0.5	0.1	1200	0.56	0.69	0.8	600 ~ 10	0.09 ~ 3.6
0IK1GK-BA	**0GK□KA**	②	1	0.1	3000	0.46	0.42	0.8	1200 ~ 20	0.07 ~ 3.0
2IJ3GA-AA	**2GA□KA**	③	3	0.2	1450	2.9	3.5	1.5	600 ~ 10	0.44 ~ 13
2IK6GK-AA	**2GK□KA**	④	6	0.25	1500	5.5	5.5	2.0	600 ~ 10	0.87 ~ 22
3IK15GK-AA	**3GK□KA**	⑤	15	0.4	1500	14.0	10.5	4.0	600 ~ 10	2.1 ~ 43
4IJ15GA-AA	**4GA□KA**	⑥	15	0.45	1550	13.2	10.4	3.0	600 ~ 10	2.0 ~ 43
4IK25GK-AA	**4GK□KA**	⑦	25	0.6	1500	23.0	15.5	4.5	600 ~ 10	3.5 ~ 69
5IK40GK-AA	**5GK□KA**	⑧	40	0.9	1550	36.0	28.0	8.0	600 ~ 10	5.5 ~ 87
4IK40GS-AFA	**4GS□K**	⑨	40	1.1	1500	36.0	28.0	8.0	600 ~ 10	9.5 ~ 87
5IK60GS-AFUL	**5GS□K**	⑩	60	1.3	1550	53.0	42.0	12.0	600 ~ 10	13 ~ 130

① ~ ④ UL recognized, impedance protected; ⑤ ~ ⑩ UL recognized, thermally protected.
The box (□) represents the desired gear ratio, which ranges from 3 to 180 as follows: 3, 3.6, 5, 6, 7.5, 9, 12.5, 15, 18, 25, 30, 36, 50, 60, 75, 90, 100, 120, 150, 180.
Please refer to Page 6 (Gearheads) to calculate speed and torque for a particular gearmotor.

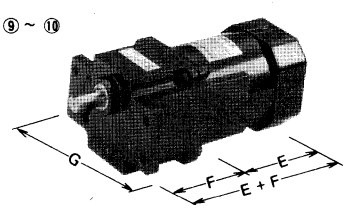
Dimensions (unit = inch)

Gearmotor	A	B	C
①	1.65	1.97	1.02
②	1.65	1.97	1.02
③	2.36	2.56	1.02/1.38
④	2.36	2.95	1.26/1.65
⑤	2.76	3.15	1.26/1.65
⑥	3.15	2.96	1.26/1.67
⑦	3.15	3.35	1.26/1.67
⑧	3.54	4.13	1.65/2.36
Gearmotor	E	F	G
⑨	3.94	2.36	4.73
⑩	4.73	2.56	5.12

① ~ ⑧



⑨ ~ ⑩



Oriental Motor instrument quality AC motors are available in 5 types:
Induction motors AC PSC Reversible motors for continuous duty applications.
Instantly Reversible AC motors with friction brake for reversing and simple positioning.
Synchronous AC motors for precise speed regardless of load fluctuation.
AC Torque motors for applications requiring continuous stalling.
AC Speed control motors for adjustable speed over a 19:1 range without brushes.
All motors can use our modular gearheads for speed reduction and torque multiplication. Gear ratios from 3:1 to 180:1 and higher are available.

The list above is a partial list of the wide variety of motors that Oriental Motor produces. Our AC motors are also available made-to-order (shaft flats, special shaft lengths, custom windings, special lead wire colors, assembled with connectors, etc.) are available in moderate OEM quantities. Contact your local sales office for details.

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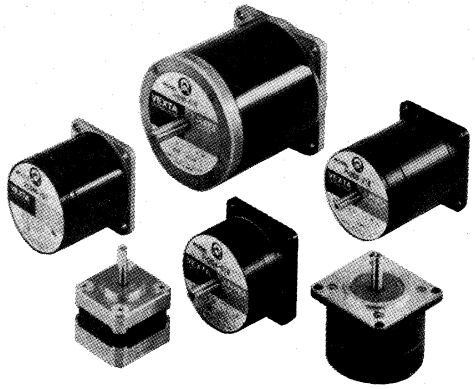
ORIENTAL MOTOR U.S.A. CORPORATION

FOR MORE INFORMATION CALL: LOS ANGELES (213) 515-2264; SAN JOSE (408) 988-2655; CHICAGO (312) 577-0310; NEW YORK (201) 882-0480

VEXTA® STEPPING MOTORS

These Hybrid stepping motors are designed and manufactured by Oriental Motor and are sold under our VEXTA brand name. They are used in a wide variety of applications ranging from Printers for Office Automation, to robots and assembly machines for Factory Automation. Many models are interchangeable with other step motors for improved quality and cost reduction. Oriental Motor is the premier step motor supplier to the world of motion control.

Available in quantities from one piece to the largest OEM volumes.
Backed by Oriental Motor reputation for award-winning quality.
Standard versions are available from stock or with 3 to 6 week lead times.
Step angle error is small and non-accumulative.
Rotating speed proportional to input pulse frequency.
Available from our nation-wide stocking distributor network.



1.8° AND 0.9° FULL STEP VERSIONS AVAILABLE!

Model Number		Voltage	Current per phase	Holding Torque		Resistance per phase ohm/phase	Inductance per phase mH/phase	Rotor Inertia		Installing base size	Length	Weight
Single Shaft	Double Shaft	V.DC	A/phase	oz-in	N-cm			oz-in²	g-cm²	in.sq. (mm.sq)	in. (mm)	lbs (kg)
PXB43H-01AA	PXB43H-01BA	4	0.95	15.3	10.8	4.2	2.2	8.8×10^{-2}	16	1.65 (42)	1.30 (33)	0.44 (0.2)
-02AA	-02BA	9.6	0.4			24	13					
PXB44H-02AA	PXB44H-02BA	6	0.8	22.2	15.7	7.5	6.5	13.1×10^{-2}	24	1.65 (42)	1.54 (39)	0.55 (0.25)
-03AA	-03BA	12	0.4			30	28					
-04AA	-04BA	24	0.2			120	105					
PX245-01AA	PX245-01BA	4	1.2	30.6	21.6	3.3	2	0.19	35	1.65 (42)	1.85 (47)	0.73 (0.33)
-02AA	-02BA	6	0.8			7.5	4.7					
-03AA	-03BA	12	0.4			30	17.6					
PH264-01	PH264-01B	4	1.1	40.3	28.4	3.6	3.6	0.3	57	2.22 (56.4)	1.54 (39)	0.88 (0.4)
-02	-02B	12	0.4			30	30					
-03	-03B	24	0.2			120	130					
PH265-01	PH265-01B	6	0.85	58.3	41.2	7.1	9	0.6	110	2.22 (56.4)	2.01 (51)	1.2 (0.54)
-02	-02B	12	0.42			29	36					
-03	-03B	24	0.21			114	144					
-04	-04B	5	1			5	6.3					
-05	-05B	1.4	3.8			0.37	0.5					
PH266-01	PH266-01B	6	1.2	83.3	58.8	5	8	0.74	135	2.22 (56.4)	2.13 (54)	1.3 (0.6)
-02	-02B	12	0.6			20	32					
-03	-03B	24	0.3			80	128					
PH268-21	PH268-21B	5.4	1.5	125	88.2	3.6	6	1.1	200	2.22 (56.4)	2.99 (76)	2.1 (0.95)
-22	-22B	12	0.68			17.7	30					
-23	-23B	24	0.34			70.6	120					
PH2610-01	PH2610-01B	6	1.88	150	105.8	3.2	7	1.75	320	2.22 (56.4)	3.98 (101)	2.64 (1.2)
-02	-02B	12	0.94			12.8	28					
-03	-03B	24	0.47			51.0	115					
PH296-01	PH296-01B	1.8	4.5	174	123	0.4	1.4	3.1	560	3.27 (83)	2.44 (62)	3.3 (1.5)
-02	-02B	5.5	1.25			4.4	14					
-03	-03B	14	0.7			20	60					
PH299-01	PH299-01B	3	4	306	216	0.75	4.5	6.0	1100	3.27 (83)	3.68 (93.5)	5.5 (2.5)
-02	-02B	6	2			3	18					
-03	-03B	12	1			12	72					

The list above is only a partial list of the wide variety of stepping motors that Oriental Motor produces. Our VEXTA brand of step motors are also available in:

"M" version 0.9° Full step 0.45° Half step versions for 400 and 800 steps per revolution for smoother moves and better accuracy.
8 lead wire versions of the motors listed above are available for maximum flexibility in driver selection.
"L" Lamination versions are available for lower noise and microstepping compatibility.
Step motors that are made-to-order (shaft flats, special shaft lengths, custom windings, special lead wire colors, assembled with connectors, etc.) are available in moderate OEM quantities. Contact your local sales office for details.

And best of all, it's backed by Oriental Motor's award winning quality and century of manufacturing experience. FOR MORE INFORMATION CALL ORIENTAL MOTOR AT (213) 515-2264.

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SUPER VEXTA®

A NEW GENERATION OF HIGH PERFORMANCE EASY-TO-USE MOTION CONTROL PRODUCTS

UMD STEP MOTOR DRIVER PACKAGE SERIES

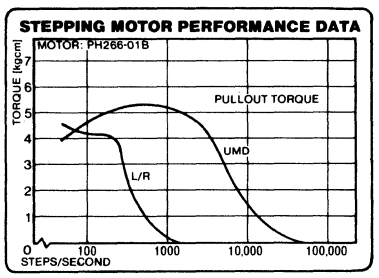
UMD ⟶ Unit=Motor+Driver

Each of the UMD motor/drivers includes a self-contained compact chopper driver and precision stepping motor integrated into one convenient high performance package. The UMD driver is a stepping motor translator, driver and power supply all-in-one, which has been factory adjusted to match the motor included in the package. This all-in-one design and factory motor driver matching makes installation and hook up a snap.

FEATURES:

- Highly efficient chopper driver maintains high torque at high speeds
- UMD Motor/Driver packages come in Holding torques from 25 to 300 ozin.
- User-friendly driver is factory pre-adjusted to match the motor included in the package for fast and easy set up.
- Compact high-tech design uses custom ICs and MOSFET technology for high power from a small package.

Excellent High Speed Performance!



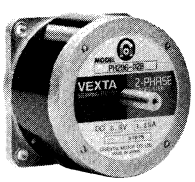
AVAILABLE UMD MOTOR/DRIVER PACKAGES

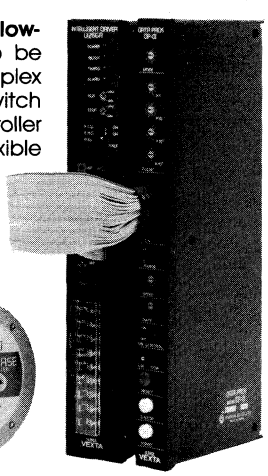
Model Number		Step Angle	Holding Torque	
Single Shaft	Double Shaft	deg.	oz-in	N-cm
UMD264-01	**UMD264-01B**	1.8	40.3	28.4
UMD266-01	**UMD266-01B**		83.8	58.8
UMD268-21	**UMD268-21B**		125	88.2
UMD264M-31	**UMD264M-31B**	0.9	25.0	17.6
UMD266M-E1.2	**UMD266M-E1.2B**		80	56.4
UMD268M-E1.5	**UMD268M-E1.5B**		118	83.3
UMD926H-AA	**UMD296H-BA**	1.8	150	106
UMD299H-AA	**UMD299H-AA**		300	212

INTELLIGENT DRIVER-UI215GA

The **UI215GA** "INTELLIGENT DRIVER" is a **complete low-cost single-axis motion solution.** Designed to be easy-to-hook up – easy-to-use, there are no complex languages to learn. It is "programmed" by switch closures, which means Programmable Controller compatibility, and yet makes the UI215GA flexible enough to meet a wide variety of motion control applications.

The UI215GA has everything built-in: from the microprocessor for pulse generation to the translator and motor/logic power supplies. Because everything is contained in a single package, the UI215GA and DP-01 can be out of the box and **up and running in minutes.**





The DP-01 Data Pack converts the UI215GA into a preset-indexer, repeating the same movement with each "start" signal. The "start" signals can be issued by a PLC or a switch, or the UI215GA/DP-01 pair can be used as a stand-alone unit.

The UI215GA is probably the best price/performance single-axis motion solution available. It is available from your local member of our nation-wide network of stocking SUPER VEXTA distributors. And best of all, it's backed by Oriental Motor's award winning quality and century of manufacturing experience.

FOR MORE INFORMATION CALL ORIENTAL MOTOR AT (213) 515-2264.

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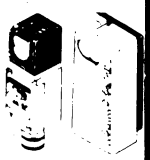
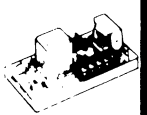
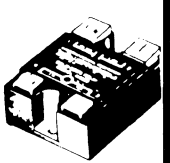
TOGGLE SWITCHES

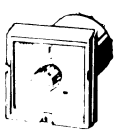

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS


TEMPERATURE CONTROLS

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BUD

CIRCUIT BREAKERS
Airpax
Aromat
Heinemann
Potter & Brumfield

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AMP
Amphenol
Aromat
Curtis
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Idec
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Panduit
Potter & Brumfield
Souriau
Vernitron-Beau
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Carlingswitch
Cherry Electric
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Electronic Comp. Group
Grayhill
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PROXIMITY
Agastat
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POTS & RESISTORS
Clarostat
Ohmite

SOLENOID
Dormeyer
Guardian
Line Electric

TIMERS
ATC
Agastat
Amperite
Antex
Crouzet
Eagle Signal
Guardian
Industrial Timer
Magnecraft
Master Electronics
Midtex
National Controls
Omron
Potter & Brumfield
SSAC
Struthers-Dunn
Syracuse Electronics

TERMINAL BLOCKS
Beau
Buchanan
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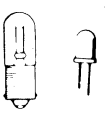
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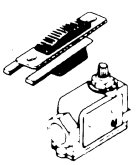
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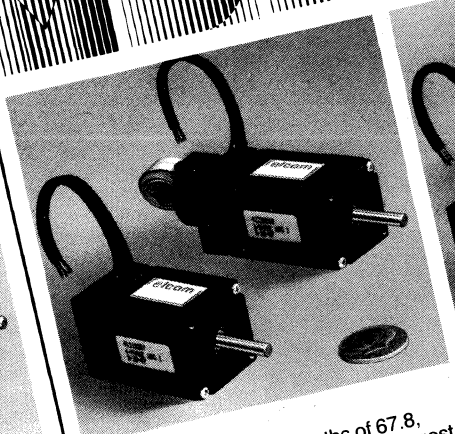
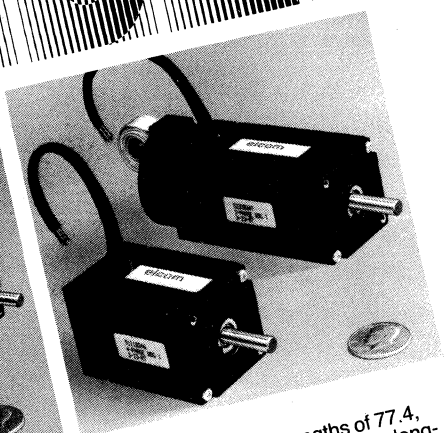
DEMONSTRABLY SUPERIOR BRUSHLESS SERVO MOTORS

Series 3000
30mm sq. frame size; lengths of 55.2 and 65.4mm. At 7,200 rpm, longest motor develops 1/15 hp, continuous duty, with normal heat sink.



Series 4000
40mm sq. frame size; lengths of 67.8, 75.3, and 83.0mm. At 7,200 rpm, longest motor develops 1/6 hp, continuous duty, with normal heat sink.



Series 5000
50mm sq. frame size; lengths of 77.4, 90.1, and 102.8mm. At 7,200 rpm, longest motor develops 1/3 hp, continuous duty, with normal heat sink.

All motors are available with your choice of 3-phase or 4-phase stator winding connections. Options include optical encoders and/or planetary gearheads. Get the whole story on unique Pittman® ELCOM® electronically commutated servo motors by calling (215) 256-6601. TWX: 510-661-8696. FAX: (215) 256-1338.

- **Samarium cobalt rotor construction**
- **Exceptional thermal efficiency**
- **Negligible magnetic cogging**
- **Very low winding inductances**
- **High torque-to-inertia ratios**
- **Low mechanical time constants**
- **Standard motor speeds to 25,000 rpm**
- **Optional patented 12-step drive for minimum commutation torque ripple**

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HARLEYSVILLE, PA 19438-0003 USA
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45-C

COMPUTER TESTED BRUSH-COMMUTATED

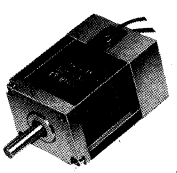
Now all Pittman® motors are available optionally with optical encoders. Every motor is thoroughly tested by a sophisticated computer-controlled instrument array that checks eight vital performance pararneters and records the measured values. And every unit is composed of standardized sub-components pre-assembled to extremely demanding specifications. That's Pittman, applying the latest in mass production techniques to reliable, precision motion control products to assure you of a welcome combination of performance and economy. Choose the motor type you need. Then contact us for complete data and application assistance. Call (215) 256-6601. TWX: 510-661-8696. FAX: 215-256-1338.

Series 8000 LO-COG® Servo Motors. 7-slot armatures. Voltage inputs to about 40 VDC. Nominal O.D. 1.2 in.; 3 lengths to 2.4 in. overall. Stall torques to 12 oz.-in. Mechanical time constants about 21 ms.

Series 9000 LO-COG® Servo Motors. 7-slot armatures. Voltage inputs to about 40 VDC. Nominal O.D. 1.6 in.; 3 lengths to 2.5 overall. Stall torques to 24 oz.-in. Mechanical time constants as low as 14.9 ms. (some models).

Series 9030 Servo Motors. 7-slot armatures. Voltage inputs to about 40 VDC. Nominal O.D. 1.6 in. Stall torques to 41 oz.-in. Mechanical time constants as low as 9.2 ms (some models).

Series 14000 Servo Motors. 11-slot armatures. Voltage inputs to about 40 VDC. Nominal O.D. 2.13 in.; 4 lengths to 5.2 in. overall. Stall torques to 286 oz.-in. Mechanical time constants as low as 6.2 ms. (some models).



Series 7000 Servo Motors. 13-slot armatures. 4 pole, samarium cobalt fields. Voltage inputs to about 40 VDC. 1 in. x 1.25 in. cross section; lengths to 1.85 in. overall. Stall torques to 24 oz.-in. Mechanical time constants as low as 4.8 ms (some models).

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46-C

GEAR MOTORS

SPUR GEARHEAD

Series GM8700 Gearmotors. Output torques to 100 oz.-in. with standard gearing. Uses selected 8000 Series servo motor plus spur gearbox. Eleven available ratios from 6.3:1 to 1804:1. 1.37″ o.d.; lengths to 3.6″ overall depending on motor and gearbox specification. Optional gearing permits output torques to 160 oz.-in.

Series GM9400 Gearmotors. Torque to 175 oz.-in. with standard gearing. Uses selected 9000 or 9030 Series servo motor plus spur gearbox. Fourteen available ratios from 5.9:1 to 4730:1. 2.0″ o.d.; lengths to 3.96″ overall depending on motor and gearbox specification. Optional gearing permits output torques to 500 oz.-in.

PLANETARY GEARHEAD

This family of planetary gearheads is designed to provide reliable delivery of up to 125 lb.-in. of torque at the output shaft, dependent upon ratio and the thermal characteristics of the selected motor. Any brush-commutated DC motor in PITMO® 9000, 9030, or 14000 Series can be mated with these gearheads or, for exceptional performance in smallest size, choose any ELCOM® brushless servo motor from Series 3000, 4000, or 5000.

Eleven ratios from 4:1 to 31104:1 are available. Gears are precision hobbed from 4140 steel to AGMA 10 tolerances. Output shafts are Fatigue-Proof® steel, running in generously sized, oil-impregnated, sintered bronze bearings. Ball bearings or roller bearings are available optionally.

For a specific recommendation of a gearmotor to suit your application, please contact your local Pittman sales representative or call us at (215) 256-6601. TWX: 510-661-8696. FAX: 215-256-1338.

Fatigue-Proof® is a registered trademark of LaSalle Steel Co., Chicago, Ill.

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47-C

POWR UPS

DC MOTOR CONTROL

Selector Guide

FULL WAVE ONE QUADRANT UNIDIRECTIONAL

MODEL NUMBER	MOTOR VOLTAGE	H.P. RANGE	SPEED INPUT TYPE	OTHER FEATURES
2746	90 180	to 1 HP to 2 HP	Isolated Analog and Digital	Inhibit input; independent ACCEL/DECEL; Dip switch HP select Quick removable barrier block connections
2747	90 180	to 1 HP to 2 HP	External 5 K Potentiometer	Inhibit input; independent ACCEL/DECEL; Dip switch HP select Quick removable barrier block connections
2746-12 **2746-24** **2746-130**	12 24 130	to 1/8 to 1/4 to 1/4	Isolated Analog and Digital	Inhibit input; independent ACCEL/DECEL; Dip switch HP select Quick removable barrier block connections Plug in, external transformer required.
2747-12 **2747-24** **2747-130**	12 24 130	to 1/8 to 1/4 to 1/4	External 5 K Potentiometer	Inhibit input; independent ACCEL/DECEL; Dip switch HP select Quick removable barrier block connections Plug in, external transformer required.

HALF WAVE FOUR QUADRANT REGENERATIVE

100	90	to 1/8 HP	Isolated 8 Bit Parallel Digital	Lowest cost regens; Fail Safe/Inhibit input; independent CW/CCW torque limit; removable ribbon cable/barrier block connections
110	90	to 1/8 HP	Isolated Analog Voltage Ratio	Lowest cost regens; Fail Safe/Inhibit input; independent CW/CCW torque limit; removable ribbon cable/barrier block connections
1015 **1023**	90 180	to 1/2 to 1 HP	Isolated 8 Bit Parallel Digital	Open frame regens; Fail Safe/Inhibit input; independent CW/CCW torque limit; removable barrier block connections
1015-3 **1023-3**	90 180	to 1.5 to 3 HP	Isolated 8 Bit Parallel Digital	Open frame higher power regens; Fail Safe/Inhibit input; independent CW/CCW torque limit; externally fused; barrier block connections
1115 **1123**	90 180	to 1/2 to 1HP	Isolated Analog Selectable range	Open frame regens; Fail Safe/Inhibit input; independent CW/CCW torque limit; removable barrier block connections
1115-3 **1123-3**	90 180	to 1.5 to 3 HP	Isolated Analog Selectable range	Open frame higher power regens; Fail Safe/Inhibit input; independent CW/CCW torque limit; externally fused; barrier block connections
10115 **10230**	90 180	to 1/2 to 1 HP	Isolated 8 Bit Parallel Digital	Enclosed case regens; Fail Safe/Inhibit input; independent CW/CCW torque limit; removable barrier type connections
11115 **11230**	90 180	to 1/2 to 1 HP	Isolated Analog Selectable range	Enclosed case regens; Fail Safe/Inhibit input; independent CW/CCW torque limit; removable barrier type connections
310	90	to 1/2 HP	10 turn adj. pot on unit's panel	LCD display regen; Low profile; Speed/Torque readout; independent CW/CCW torque limit; IR comp, max speed adjust; internal barrier strip

FULL WAVE FOUR QUADRANT REGENERATIVE

2745-DL	90	1/30 to 1/4 HP	Isolated 10 Bit Parallel Digital	Open frame full wave regens; Fail Safe/Inhibit input; independent CW/CCW torque limit; plug in ACCEL/DECEL option; removable barrier block connections; off board transformer may be req.; other voltage options
2745-D	90 180	to 1 HP	Isolated 10 Bit Parallel Digital	Open frame full wave regens; Fail Safe/Inhibit input; independent CW/CCW torque limit; plug in ACCEL/DECEL option; removable barrier block connections; off board transformer may be req.; other voltage options
2745-D3	90 180	to 3 HP	Isolated 10 Bit Parallel Digital	Open frame full wave regens; Fail Safe/Inhibit input; independent CW/CCW torque limit; plug in ACCEL/DECEL option; removable barrier block connections; off board transformer may be req.; other voltage options
2745-AL	90	1/30 to 1/4 HP	Isolated Analog +/– 5 VDC	Open frame full wave regens; Fail Safe/Inhibit input; independent CW/CCW torque limit; plug in ACCEL/DECEL option; removable barrier block connections; off board transformer may be req.; other voltage options
2745-A	90	to 1 HP	Isolated Analog +/– 5 VDC	Open frame full wave regens; Fail Safe/Inhibit input; independent CW/CCW torque limit; plug in ACCEL/DECEL option; removable barrier block connections; off board transformer may be req.; other voltage options
2745-A3	90 180	to 3 HP	Isolated Analog +/– 5 VDC	Open frame full wave regens; Fail Safe/Inhibit input; independent CW/CCW torque limit; plug in ACCEL/DECEL option; removable barrier block connections; off board transformer may be req.; other voltage options
2748	24	to 1/4 HP	Isolated 10 Bit Parallel Digital or +/– 5 VDC	24 VDC output full wave regens; Fail Safe/Inhibit input; independent CW/CCW torque limit; plug in ACCEL/DECEL option; removable barrier block connections; selectable analog/digital input; other voltage options Replace PWM drives in many applications.
2749	90 180	to 1 HP to 2 HP	External 5 K Potentiometer	Lowest cost full wave regen; Inhibit input; ACCEL/DECEL adj.; IR Comp; torque limit; off board transformer may be req. For applications requiring frequent and/or rapid reversals.

CALL FOR ADDITIONAL INFORMATION

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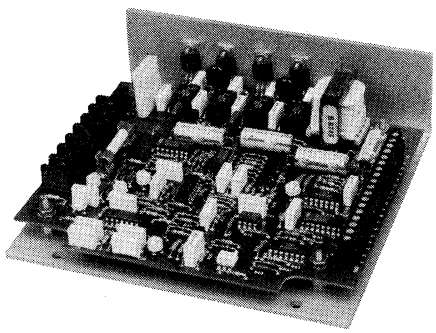
MOTOR CONTROLS

For Industrial and Robotics Applications

SERIES 2745 FULL WAVE FOUR QUADRANT REGENERATIVE DC MOTOR DRIVES



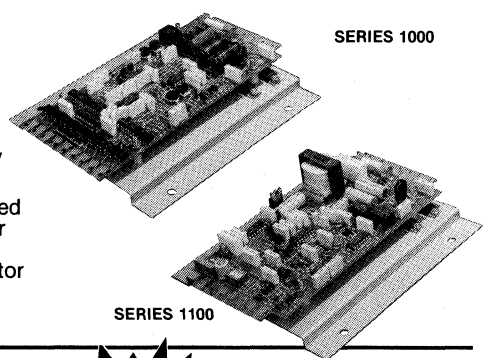
The 2745 series motor controls are full wave, static reversible, regenerative units that control the speed and direction of shunt wound or permanent magnet (PM) DC motors with outputs ranging from 1/6 to 3.0 horsepower.

Digital input controls are designed to be easily interfaced to microprocessors or TTL digital circuitry. Logic input signals are opto-isolated from the motor with a minimum isolation voltage of 1500 VDC. This eliminates the possibility of grounding or noise problems.

A 10 bit parallel command selects motor direction as well as 9 bit (1 part in 512) control of speed. A failsafe circuit de-energizes the motor if the control power is not present. Analog input versions operate from an isolated +/− 5 VDC speed command signal.

Model 2745 is supplied for operation from 115 or 230 VAC 50/60 Hz mains and drives DC motors with 12, 24, 48, 90, 130 and 180 VDC armature ratings.

SERIES 1000/1100 HALF WAVE FOUR QUADRANT REGENERATIVE DC MOTOR CONTROLS



SERIES 1000

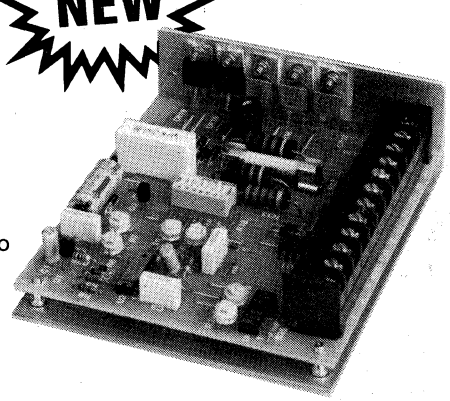
SERIES 1100

Series 1000/1100 controls are rugged, economical half wave reversible regenerative units that control DC motor speed and direction up to 3 horsepower. These units have been constantly refined over many years of satisfactory production experience.

Series 1000/1100 controls feature isolated digital or analog speed inputs and are designed to be easily interfaced to computers or analog voltage sources. Input signals have 1500 VDC isolation from the motor and power lines. A failsafe feature removes motor power if the signal source is not present.

2746/2747 FULL WAVE UNIDIRECTIONAL CONTROLS

NEW



Model 2746 and 2745 motor controls are full wave single quadrant units. Model 2746 has an isolated speed command input and Model 2747 controls use an external 5 K ohm speed command potentiometer. These controls operate 90 and 180 VDC motors, as well as 12, 24 and 130 VDC motors when used with a plug-in auxilliary transformer.

2746 controls are designed to be easily interfaced to low level analog or digital circuitry. Signal input signals are 1500 VDC opto-isolated from the motor and AC line. 2747 controls are similar, except for the external potentiometer input.

Using Model 2746 for analog inputs, motor speed is proportional to the isolated input signal, suitable for precise speed control within a closed loop system or for applications requiring isolation at low cost. Using Model 2746 for digital inputs, the input port may be pulse width modulated with a 1 to 100 kHz logic level signal to control motor speed. The input pulse width vs. motor voltage is very linear. An isolated motor inhibit signal is also provided on both 2746 and 2747 units.

Adjustments for min speed, max speed, current/torque limit, IR compensation (speed regulation), acceleration and deceleration are provided. Horsepower settings are easily set by the user by dip switch selection from 1/30th to 2 HP.

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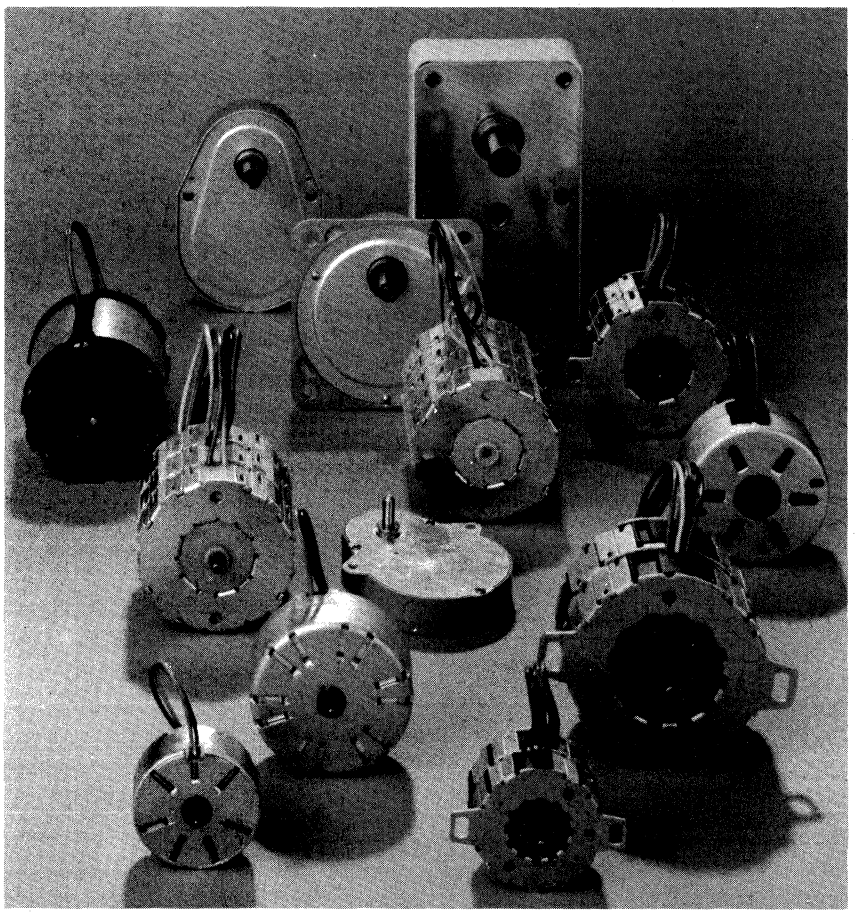
Stepper & Synchronous Motors

Step'n sync with SAIA



SAIA AG, with factories located in Murten, Switzerland, has developed complementary lines of same-size synchronous and stepper motors with interchangeable gear boxes. That makes for a commonality which means economy for you. But what's uncommon about these economical motors is their versatility: two-phase and four-phase steppers; unidirectional and reversible synchronous. And with "snap-on" reduction gears (with optional clutch) that meet any mechanical and electrical variant, you can be sure of a solution to your particular needs. Manufactured to Swiss standards of precision and quality, you can also be sure of reliability and long life.

Use this short-form catalog to specify your general requirements on the enclosed business reply card. We will send you detailed data sheets and offer engineering assistance in the selection of the right motor for your application.

SYNCHRONOUS MOTORS

UBS 1 (AMY 7)...distinguished by especially silent running and long life, this motor is used in timing relays, registering instruments, sychronous clocks. The direction of running is controlled by means of auxiliary poles.

UDS 1 (AMY 81)...an economically-priced synchronous motor with an effective ratio of size to torque. A reverse-running stop assures rapid starting in the correct direction at high torque.

UDS 5 (AMY 81-W)...a brushless DC motor that is a combination of the AMY 81 unirotational motor and an electronic circuit which enables it to be connected to DC, resulting in a brushless DC motor having the advantages of a synchronous motor--no brush wear, long life, and speed not load-dependent.

UDS 7...totally new design with non-reverse device, high torque and very high efficiency (40%). Features of the new design are the fixed permanent magnets and rotating soft iron armature. Applications include power drive for actuators, valves, flaps, feed systems, domestic appliances, office machinery, and vending machines.

UBR 1...electrically reversible, permanent magnet synchronous motor with 48 stator poles. Motor is fitted with maintenance-free sintered bronze bearings encased in a plastic housing to protect the bearings from dirt and prevents leakage of bearing lubricant by capillary action. Applications include HVAC, and time-synchronized drive in recording, medical, laboratory, and analyzing devices and apparatus.

UDR 1 (AMY 9)...an electrically-reversible motor of heavy duty design and wide running range. Applications include valve actuators, phono-units, copying machines, assembly robots, medical devices, registering instruments.

UFR 1/3/4 (AMY 12/13/14)...these reversible motors are especially suitable for power drives featuring long life and silent running. Applications include actuating valves, ring-type transformers, pumps, label printing machines, medical and optical instruments, electro-pneumatic converters, antenna drives, machine automation, registering instruments, sound devices.

STEPPER MOTORS

UBB 1/2/5/6...two-phase and four-phase motors with 15 degree step angles; holding torque up to 1.5 cNm.

UBD 1/2/5/6...two-phase and four-phase motors with 7.5 degree step angles; holding torque from 1.0 cNm to 1.5 cNm.

UDB 1/2 (AMA 9)...slightly larger motor with 15 degree step angles; holding torque up to 2.3 cNm; two- and four-phase versions available.

UFB 1/2/3/4 (AMA 12/14)...step angles of 15 degrees; holding torque up to 8.2 cNm and external dimensions up to 51.3 x 56 mm.

UFD 1/2 and **UHD 1/2**...largest 7.5 degree step angle motor; two- and four-phase operation with holding torques up to 16.0 cNm.

Typical applications for SAIA stepping motors are recording instruments, facsimile equipment, peristaltic pumps, as well as printers and electronic typewriters.

REDUCTION GEARS

High quality reduction gears, as modular clip-on gearboxes, are constructed for multistage, spur gear reduction. The gear wheels rotate on hardened and highly-polished steel shafts lubricated for life, and are therefore absolutely maintenance free. Internal roller bearing one-way and two-way slipping clutches allow the output shaft to be rotated while the motor is stationary.

SAIA

SAIA Inc.
P.O. Box 3030
Elkhart, IN 46515-3030
Telephone (219) 262-4418
Telefax (219) 262-8819

SYNCHRONOUS MOTORS

UNIROTATIONAL	Dimensions (mm) inches	Rotor Speed rpm (50Hz) 60Hz	Running Torque at 60Hz (cNm) oz.in.	Power Input Watts/Volts-Amps (50Hz) 60Hz	Operating Voltages ± 10% at 50/60Hz	Gearboxes Combinable
UBS 1	(35x15) 1.4x.59	(375) 450	(.049) .069	(1.3W/1.4VA) 1.2W/1.3VA	12, 24, 48-50, 110 220, 240V	A, D
UDS 1	(48x18) 1.9x.73	(500) 600	(.414) .586	(2.5W/3.5VA) 2W/2.5VA	6, 12, 24, 36, 48, 110, 120, 220, 240V	A, D, K, B, F, V, J
UDS 7	(50x45) 2.0x1.8	(500) 600	(3.4) 4.82	(3.5W/5.5VA) 3W/4.2VA	6, 12, 24, 36, 48, 110, 120, 220, 240V	A, D, K, B, F, V, J
REVERSIBLE						
UBR 1	(35x21) 1.4x.85	(250) 300	(.41) .586	(1.5W/1.5VA) 2W/2VA	12, 24, 48, 110, 120, 220, 240V	A, D, K, B, F, V, J
UDR 1	(48x 24) 1.9x.94	(500) 600	(.64) .902	(2.5W/2.5VA*) 2.5W/2.5VA*	12, 24, 48, 110, 120, 220, 240V	A, D, K, B, F, V, J
UFR 1	(53x28) 2.1x1.1	(500) 600	(1.34) 1.90	(3.7W/3.7VA) 4W/4VA	24, 48-50, 110, 220, 240V	A, D, K, B, F, V, J
UFR 3	(53x43) 2.1x1.7	(500) 600	(2.0) 2.8	(6VA/6W) 5.5W/5.5VA	24, 48-50, 110, 220, 240V	F, V, J
UFR 4	(53x55) 2.1x2.2	(500) 600	(2.9) 4.10	(7W/7VA) 7.5W/7.5VA	24, 48-50,110, 220, 240V	F, V, J

STEPPER MOTORS

2-Phase (bipolar)	Dimensions (mm) in.	Holding torque (oz.in.)	Step angle ± 1°	Steps per revolution
UBB 1	(36x21) 1.44x.84	1.704	15°	24
UBB 5	(36x21) 1.44x.84	2.13	15°	24
UDB 1	(48x24) 1.92x.97	3.266	15°	24
UFB 1	(51x28) 2.05x1.12	6.39	15°	24
UFB 3	(51x56) 2.05x2.24	11.644	15°	24
UBD 1	(36x21) 1.44x.84	1.846	7.5°	48
UBD 5	(36x21) 1.44x.84	2.13	7.5°	48
UFD 1	(51x28) 2.05x1.12	7.10	7.5°	48
UHD 1	(59x35) 2.36x1.40	22.72	7.5°	48

4-Phase (unipolar)	Dimensions (mm) in.	Holding torque (oz.in.)	Step angle ± 1°	Steps per revolution
UBB 2	(36x21) 1.44x.84	1.42	15°	24
UBB 6	(36x21) 1.44x.84	1.704	15°	24
UDB 2	(48x24) 1.92x.97	2.84	15°	24
UFB 2	(51x28) 2.05x1.12	4.544	15°	24
UFB 4	(51x56) 2.05x2.24	8.52	15°	24
UBD 2	(36x21) 1.44x.84	1.42	7.5°	48
UBD 6	(36x21) 1.44x.84	1.988	7.5°	48
UFD 2	(51x28) 2.05x1.12	5.112	7.5°	48
UHD 2	(59x35) 2.36x1.40	18.46	7.5°	48

REDUCTION GEARS

	Dimensions [mm] in.	Maximum running torque (cNm)	Maximum running torque (oz.in.)	Running times (per revolution)	Characteristic
A	[55(62)x12] 2.2(2.4)x.47	32	45	5/12S to 24h	Metal gear
D	[55(65)x13] 2.2(2.6)x.51	32	45	5/12S to 403-1/5h	Plastic gear
K	[55(62)x24] 2.2(2.4)x.94	140	198	1-2/3S to 96h	Power gear
B	[58(82)x17] 2.3(3.2)x.67	250	354	4-1/6S to 23-11/15h	Power gear
V	[70(70)x17] 2.8(2.80)x.68	500	709	5/6S to 8M	Power gear
F	[58(82)x17] 2.3(3.2)x.67	500	709	5/12S to 20m	Power gear
J	[65(107)x28] 2.6(4.3)x1.12	1500	2126	5/12S to 100 days +	Power gear

DPi 13536

Tachometers, Encoders, Brushless Tach/Commutators.

dc tach generators

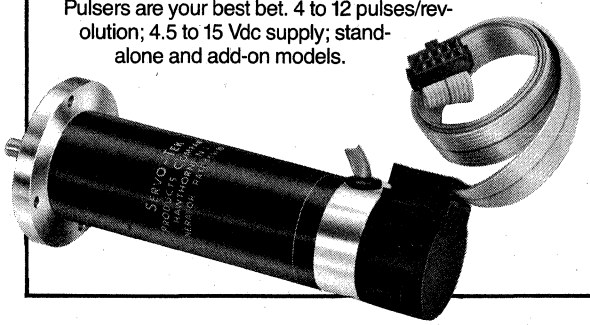
Servo-Tek 1.135″ OD tachometer generators are built to last. With silver-alloy commutators, stainless-steel shafts and bearings, brushes rated for 100,000-hour life, temperature compensation, and full factory run-in, our tachs deliver stable, long-term performance. A complete line with a variety of mechanical and electrical characteristics is available from stock. Output ratings from 1 to 45 V/1000 rpm.

incremental encoders

These high-resolution (100 to 512 pulses/revolution) optical encoders are offered both as options on 1.135″ Servo-Tek rotating components (pictured) and as stand-alone feedback devices. All configurations provide 3-channel (2 in quadrature and 1 index) LSTTL logic output. Combination units give position, speed, and direction feedback.

5 Vdc supply; 3.2 mA output standard; 16 mA with standard amplifier, others available, STTL.

For inexpensive single-pulse-train feedback, Servo-Tek Pulsers are your best bet. 4 to 12 pulses/revolution; 4.5 to 15 Vdc supply; stand-alone and add-on models.



tachsyn® brushless tach/ commutators

Does your brushless dc drive require

- High-accuracy commutation?
- Linear, low-noise tach signal?
- Elevated-temperature operation?
- No electronics in the motor?
- Low-inertia rotor?

The new patented Tachsyn tach/commutator from Servo-Tek may be the ideal transducer for your exacting requirements.

The Tachsyn brushless three-phase transducer is available in 4-, 6-, and 8-pole configurations to match your motor. With remote signal conditioning electronics, it provides accurate 6-step Hall-equivalent or sine-wave signals plus a low-ripple analog dc tachometer output.

The rotor is a low-inertia, passive component suitable for high speeds. Overhung mounting eases addition to your motor–no extra bearings or couplings are required.

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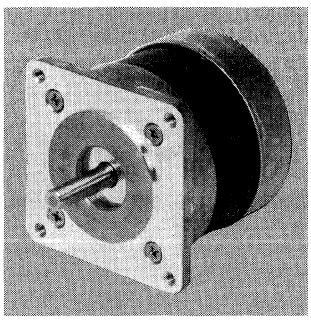
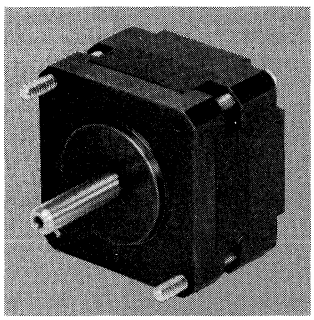
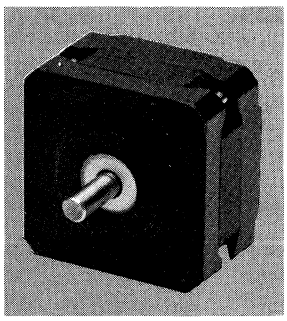
STEPPING MOTORS

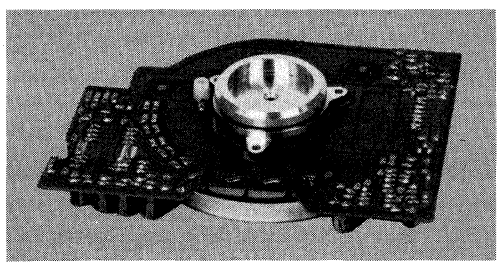
Sizes: 15 (35mm), 17 (39mm), 23 (56mm) & 34 (83mm). **Step Angles:** 0.9°, 1.8°, 3.6° & 3.75°. Hybrid, unipolar or bipolar, precision ball bearings 3% accuracy, state-of-the-art performance. **Applications:** Disk drive, tape streamer, printers, plotters, medical equip., office automation machines.



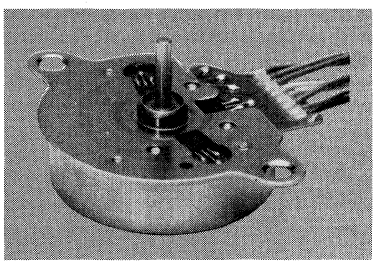




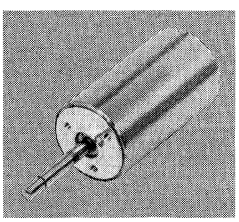
BRUSHLESS DC MOTORS

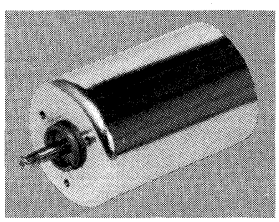


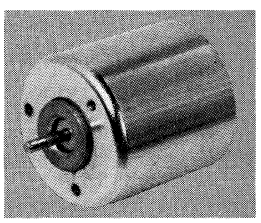
Inner & outer rotor types, 3 phase radial gap types, 42mm to 90mm dia, rare earth magnet, ball bearings, hall sensors. **Options:** Tachometer, encoder, integral driver. **Applications:** Disk drives, streamers, medical equip., computer peripheral equip., fan & blower drives.



CORELESS DC MOTORS

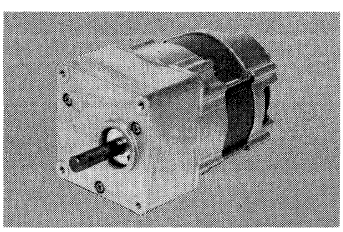






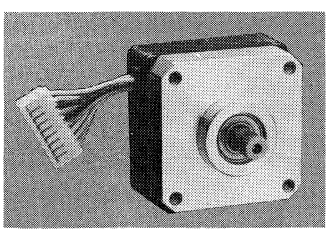
Ironless rotor, 12mm to 50mm dia., 8.5 to 1400 GM-CM starting torque. **Options:** Ball bearings, tachometer, terminals. **Applications:** Medical equip., office equip., recorders, small printers, plotters.

AC & DC GEARED MOTORS



Induction motors, frame sizes of 60 to 100 mm dia. 120 or 220 vac, 50 or 60 HZ, torque ratings up to 70 KG-CM at 70 RPM. DC motors, frame sizes of 50 & 70 mm, various voltage ratings, torque ratings up to 40 KG-CM at 82 RPM.

MOTOR-ENCODER



Brushless DC servo with precision optical encoder. Rare earth magnet, ball bearings, very low cogging, compact (39 mm sq x 21 mm long.) Ideally suited for precision positioning.

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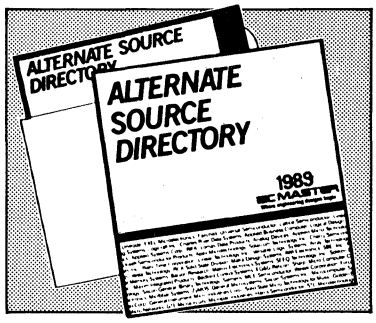

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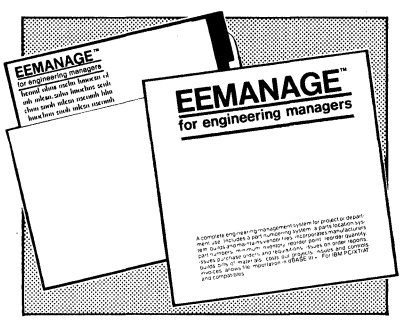

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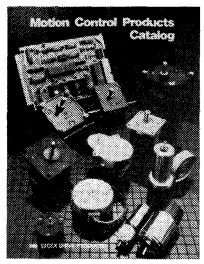

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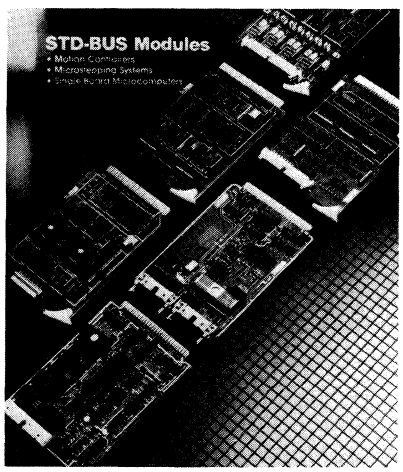
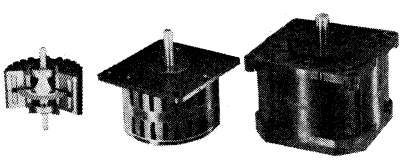
STD-BUS MOTION CONTROL MODULES



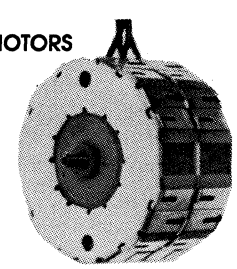
Control motor position, velocity or torque via RS-232, STD-BUS or local switch. Digital filtering. Ideal for robotics/automation. Commands in ASCII. Stepper control, linear or circular interpolation. Microstep to 12,800 steps/rev. 8031 microprocessors. Microstep DAC controls 4 dc motors. A complete family of control modules, cards and boards available off-the-shelf. Catalog TI-822.

THIN DISC PM STEPPER MOTORS



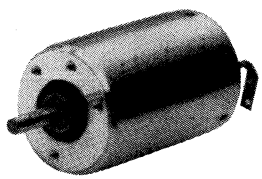
New technology stepper motors with samarium/cobalt permanent disc rotors. Up to 100KW/S power rate in 30, 50 & 70 mm diam. and step angles of 1.8° & 3.6° with peak holding torque up to 90 oz. in. Superior power rate to weight ratio. Weigh 50% less than comparable motors.

"TIN-CAN" PM STEPPER MOTORS



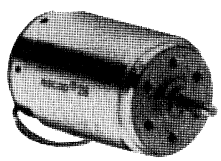
Permanent magnet motors for two and four phase operation. Step angles 7.5° & 15°. Holding torque from 1.0 up to 7.7 Ncm. Operate at 6, 12 or 24 Vdc and from −15°C to +55°C. Mount in any fixed position by means of expandable snap-on clip or screw clip. Available with a wide range of gearheads.

IRONLESS ROTOR DC MOTORS



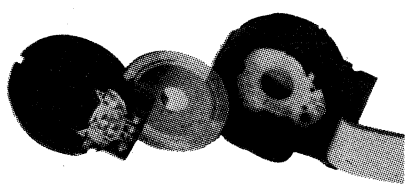
Permanent magnet ironless rotors provide up to 90% efficiency and high power/volume ratios. Many standard models from 16 to 36 mm diam. for 1.2 to 36 Vdc and up to 25.5 oz. in.

DC TACHOMETERS & MOTORS/TACHOMETERS



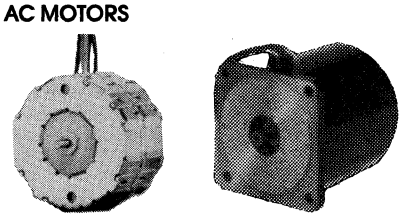
Ironless rotor construction ensures maximum reliability and performance. EMF constant 0.84 to 13.5 V/1000 rpm. Typ. ripple (pk-pk): 6–10%. Linearity & reversion error ±0.1%. Motor/tachs available with speed reducers.

OPTICAL ENCODERS



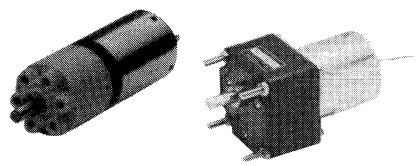
Available in two standard sizes: 28 mm O.D. with 100–512 cycles/rev.; 56 mm O.D. with 192–1024 cycles/rev. Digital output compatible with LSTTL logic, two and three channels. Also available with integral motor.

AC MOTORS



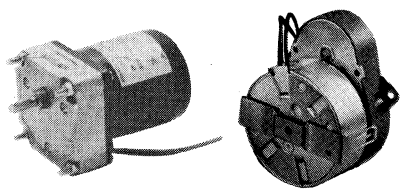
Available as synchronous reversing or unidirectional types. Also hysteresis or induction types. A wide variety of standard sizes and torques up to 1600 Ncm are available. For either 50 or 60 Hz operation and with UL, VDE and CSA approval.

DC GEARMOTORS



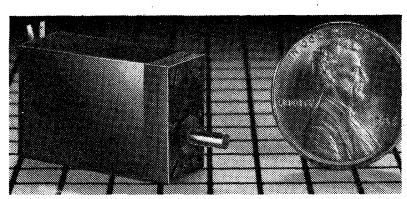
Supplied in either of two basic styles either with integral ironless rotor dc motors and gearheads or as assembled motors and gearbox components. A very wide range of torque and gear ratios.

AC GEARMOTORS



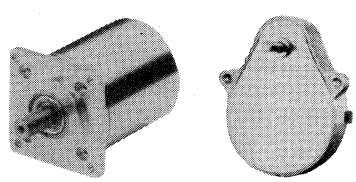
Available in wide range of reduction ratios to fit all standard AC motors and with precision gears and permanently lubricated bearings to ensure quiet long life. With or without one or two way slipping clutches.

MINIATURE DC GEARMOTORS



Tiny precision ironless rotor dc motors with an integral gearbox with a choice of reduction of 3.67 to 2430; 1 of the 7200 rpm 2 or 4 Vdc motors. Motor torque is 0.072 oz. in. @ 2V (0.068 @ 4V). Max. size is 9 mm wide × 15 mm high × 21.8 to 34.7 long. Wt.: 10 to 13 grams.

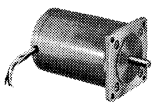
GEARHEADS/SPEED REDUCERS

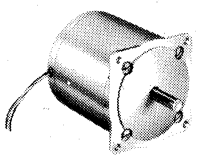


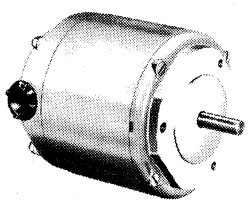
Precision construction in a variety of styles and ratios to fit most standard ac or dc motors. Ratios range from as little as 4.0625:1 up to 360,000:1. A wide range of output torques are available. See catalog SDP-823.

SLO-SYN® DC Stepping Motors

Permanent magnet type stepping motors that provide high torque-per-pound and torque-to-inertia ratios. Can be driven to speeds above 20,000 steps/second with low power input. Motors have Class B insulation and can be operated at an ambient temperature range of −40°C to +65°C. Continuous duty temperature is 65°C. Standard 1.8 degree step angle motors can be half-stepped or microstepped with accuracies of ± 5% or ± 3% noncumulative. Holding torque ratings from 53 to 5000 oz-in. To simplify installation and connections, new quick-connect, plug-in types are available. Motors have no brushes, ratches or gear and use shielded ball bearings to ensure reliability and long life.



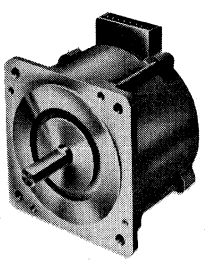


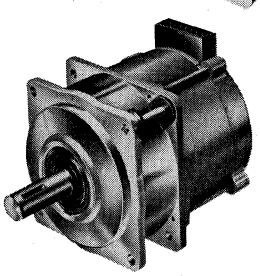


BASIC MOTOR SERIES	MINIMUM HOLDING TORQUE,(2)(5) OZ-IN(6) (kg-cm)	MINIMUM RESIDUAL TORQUE,(5) OZ-IN (kg-cm)	NOMINAL ROTOR INERTIA, LB-IN² (kg-cm²)	TYPICAL TORQUE TO INERTIA RATIO (RAD/SEC²)	SHAFT DIAMETER, INCHES (mm)	MAXIMUM OVERHANG LOAD, LBS (kg)	MAXIMUM THRUST LOAD, LBS (kg)
M061	53 (3,8)	1 (0,07)	0.04 (0,12)	32x10³ (3)	0.250 (6,35)	15 (6,8)	25 (11,3)
M062	100 (7,2)	1.4 (0,1)	0.08 (0,23)	30x10³ (3)	0.250 (6,35)	15 (6,8)	25 (11,3)
M063	150 (10,8)	2.5 (0,18)	0.11 (0,32)	33x10³ (3)	0.250 (6,35)	15 (6,8)	25 (11,3)
M091	150 (10,8)	2 (0,14)	0.23 (0,67)	15.6x10³ (3)	0.375 (9,53)	25 (11,3)	50 (22,7)
M092	300 (21,6)	3.9 (0,28)	0.42 (1,23)	17.2x10³ (3)	0.375 (9,53)	25 (11,3)	50 (22,7)
M093	450 (32,4)	6.9 (0,5)	0.64 (1,87)	16.8x10³ (3)	0.375 (9,53)	25 (11,3)	50 (22,7)
M111	625 (45)	6 (0,43)	1.34 (3,93)	11.2x10³ (3)	0.375 (9,53)	25 (11,3)	50 (22,7)
M112-FD	1125 (81)	12 (0,86)	2.75 (8,06)	9.8x10³ (3)	0.500 (12,7)	25 (11,3)	50 (22,7)
M112-FJ	1125 (81)	12 (0,86)	2.75 (8,06)	9.8x10³ (3)	0.625 (15,88)	25 (11,3)	50 (22,7)
M113	1550 (112)	20 (1,44)	4.1 (12,0)	9.1x10³ (3)	0.625 (15,88)	25 (11,3)	50 (22,7)
M172	2700 (194,4)	50 (3,6)	21 (61,5)	3.1x10³ (3)	0.625 (15,88)	50 (22,7)	100 (45,4)

(2) Both windings energized at rated current.
(3) Calculated from holding torque in oz-in and rotor inertia in oz-in-sec² (lb. in²/24).
(5) Values are subject to change without notice. Parameters used as part of a specification should be verified with the factory.
(6) Operation below rated current will reduce torque and may degrade step accuracy.

SLO-SYN® AC Synchronous & Gearmotors





Provide slow basic shaft speed synchronous with line frequency. Allow direct load coupling without gearing. Instantaneous starting, stopping and reversing eliminate clutching and braking. Simple single-pole, 3-position switch provides complete forward, reverse and off control. Will not overheat or be damaged if stalled. Starting and running currents nearly identical. Conventional motors have speeds of 72 and 200 rpm at 60 Hz and torque ratings from 25 to 1800 oz-in.

New **high torque models** provide more power per frame size than any other synchronous motors. Types offered in NEMA frame size 23 and 34 with minimum running torque ranging from 60 to 420 oz-in. Shaft speed is 72 rpm at 60 Hz, 60 rpm at 50 Hz. **AC gearmotor models** offer torque ratings to 5000 oz-in and shaft speeds as low as 0.72 rpm at 60 Hz. All are designed for quick-connect, plug-in connection with optional mating connectors having 36 in. minimum length leads.

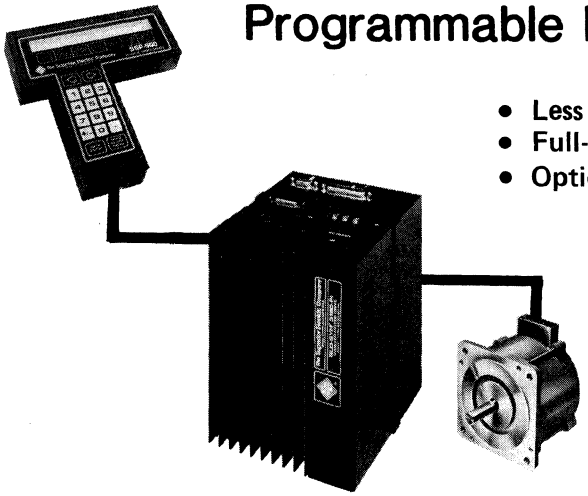
Write or call for complete information.

1-800-447-7171 (In Connecticut 1-800-446-6262)

Superior Electric 383M Middle Street Bristol, Connecticut 06010 USA

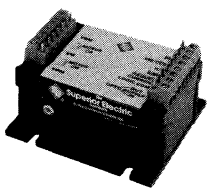
TEL:203/582-9561 TELEX:96-2446 TWX:710-454-0682 CABLE:SUPELEC FAX:203/584-1483

SLO-SYN® Micro Series Step Motor Drives & Programmable Motion Controls

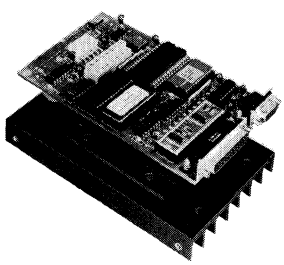


- Less than 1/8 the size of conventional controllers
- Full- or half-stepping plus microstepping in the 3180 Series
- Optional switch interface panels or hand-held programmers
- Full- or half-stepping in the 230 and 430 Series
- Standard pulse and direction interface
- Pulses may be either sourcing or sinking
- Optically isolated inputs protect against noise
- Optional heat sinks for heat dissipation
- Greater performance, increased flexibility

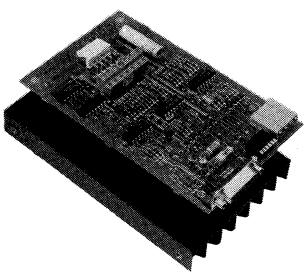
3180 Series Packaged Translators and Indexers — Provide maximum power to SLO-SYN® DC Stepping Motors. Translators have unique, proprietary current control method that improves speed/torque characteristics of many motors. Outperforms existing drives for microstepping, full- or half-stepping. Available with optional oscillator/pulse generator for manual control. Oscillator can be used as a digital pulse source for speed control, manual set-up or final positioning. Indexers are capable of full- or half-step, 1/10 or 1/125 microstep. Store up to 400 lines of program using industry standard motion language (RS274). May be programmed or edited through parallel switch panel ports or RS232 serial ports. Have 2 programmable inputs and outputs, overtravel limit switches and integral power supply.



Drive Modules — Optically isolated 20kHz chopper drives available in 2A and 3.5A per phase, 30VDC types. Can be operated at less than rated current. Use alone or as integral component on a PC board. Also available with heat sinks to dissipate heat and maintain drive integrity or packaged with power supply.

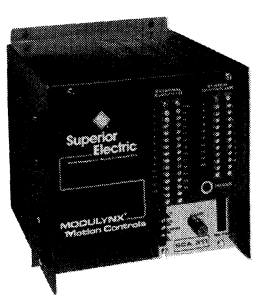


Programmable Indexer/ Drive Modules — Operate applications from single repetitive index to 400 lines. Up to 99 units can be daisy chained. Use industry standard motion language (RS274). Have 2 programmable inputs and outputs, overtravel limit switches. Programmed, edited and manipulated through parallel switch port or RS232 serial port. Also packaged with power supply.

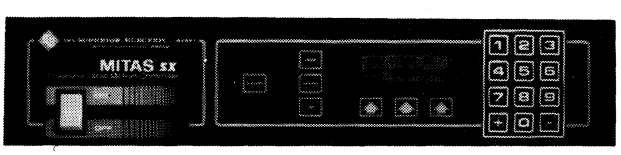


Oscillator/Pulse Generator Drive Modules — Oscillators serve as an alternate pulse source for manual setup and final positioning or as multiple range variable or constant speed drives. Can be remotely operated. All signal inputs optically isolated for maximum protection; have integral heat sinks. Also available as fully enclosed packaged units with integral power supply. Easy connections.

MODULYNX® & MITAS® Motion Controls



MODULYNX® Motion Controls — Permit user to select the appropriate circuit cards suited to individual needs. Up to 6 axes can be operated from each controller with up to 3.5HP available power. Controllers permit SLO-SYN DC Stepping Motors to be run at speeds to 20,000 steps/second with minimum power input. User selectable TTL levels and types of interface needed from RC232C or IEEE488 to simple switches.

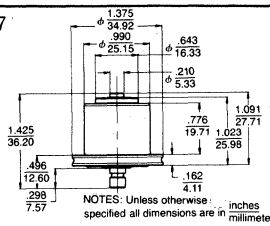


MITAS® Programmable Motion Controllers — Available in packaged single- or two-axis systems. Controllers can be operated from the front panel, a remote device or from an RS232 terminal. Units with or without drives are also available housed in enclosures that comply with NEMA 12 specifications for use in industrial environments. Single-axis systems have nonvolatile memory for storage of multiple programmed operations. User controls speed, move distance and acceleration/deceleration rates. Two-axis systems are capable of up to 3.5HP. Controllers have nonvolatile memory that permits programming in feet, inches, meters and degrees and allow storage of multiple programs.

SYNEKTRON
THE MOTION CONTROL COMPANY

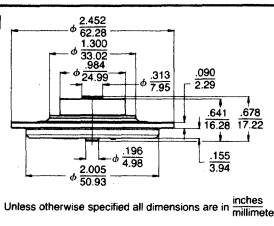
Spindle Motors

D007



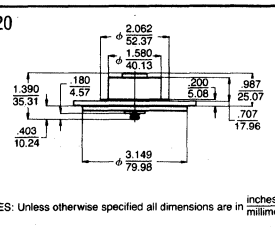
NOTES: Unless otherwise specified all dimensions are in inches millimeters.

D011



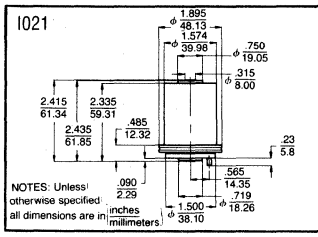
NOTES: Unless otherwise specified all dimensions are in inches millimeters.

I020



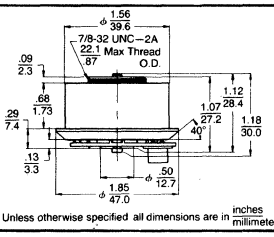
NOTES: Unless otherwise specified all dimensions are in inches millimeters.

I021



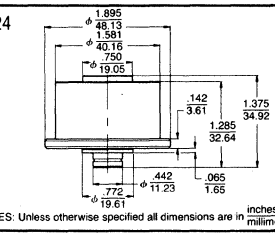
NOTES: Unless otherwise specified all dimensions are in inches millimeters.

I023



NOTES: Unless otherwise specified all dimensions are in inches millimeters.

I024



NOTES: Unless otherwise specified all dimensions are in inches millimeters.

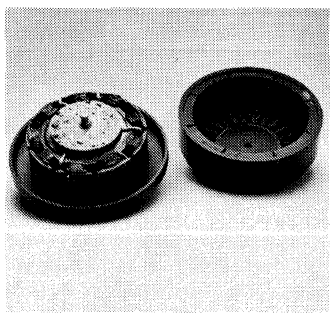
MOTOR MODEL NO.	UNITS	D007	D011	I020	I021	I023	I024
NO. OF POLES		8	8	8	8	8	8
V. MIN @ TERMINALS	VOLTS	9.6 to 12	9.1 to 11.6	10.3 − .24*I	10.3 − .44*I	10.3 − .24*I	10
R, RESISTANCE	OHMS	6	7	1.8 ± .18	1 ± 0.1	1.75 ± .17	2.15 ± 10%
L, mHENRIES	mH	1-3 mH	10 mH (Max)	.75 (Max)	.75 (Max)	.75 (Max)	1.5 ± 15%
MOTOR SPEED, NOMINAL	RPM	3600	3600	3600	3600	3600	3600
AVE KT	OZ-IN/AMP	2.63	2.48	2.9 ± .23	3.09 ± 0.08	2.92 ± .23	2.84 ± 0.1%
START TORQUE @	OZ-IN	2.4	1.7	4.6 (Min)	8.8 (Min)	4 (Min)	5 (Min)
START CURRENT	AMPS	1.2	0.7	2.5	4	2	2.5
T/ISQRT (WATT)	OZ-IN (I*SQRT(R))	1.07	.94	2.16	3.09	2.21	1.94
TIMING TYPE		Sensorless	Sensorless	Hall	Hall	Hall	Hall
HALL TYPE		N/A	N/A	Digital	Digital	Digital	Digital
BEARING							
SIZE	MM	6x15x5	5x13x4	8x16x5	8x22x5	8x16x5	8x16x5
PRELOAD	POUNDS	4		4.4 TO 7.7	10 TO 15	6 TO 7	4 TO 5
TYPE		Double Shield	1 Shield 1 Non-Contact Seal	Non-Contact Seal	Double Shield	Double Shield	Non-Contact Seal
GREASE		Multemp SRL	Multemp SRL	Multemp SRL	Multemp SRL	Multemp SRL	Multemp SRL
MAGNET MATERIAL		Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
SHAFT SEAL							
TYPE		Ferro Fluid	Labyrinth	Ferro Fluid	Ferro Fluid	Ferro Fluid	Ferro Fluid
PRESSURE	INCHES (water)	3	NA	7.0	7.0	7.0	6.0
REPETITIVE RUNOUT							
RADIAL	micro-in	500 (Max)	1000 (Max)	500 (Max)	500 (Max)	500 (Max)	500 (Max)
AXIAL	micro-in	500 (Max)	600 (Max)	N/A	500 (Max)	500 (Max)	300 (Max)
NON-REPETITIVE RUNOUT							
RADIAL	micro-in	20 (Max)	20 (Max)	20 (Max)	20 (Max)	20 (Max)	20 (Max)
AXIAL	micro-in	30 (Max)	25 (Max)	N/A	N/A	N/A	N/A

For more information about Synektron Spindle Motors and drives, write or call:

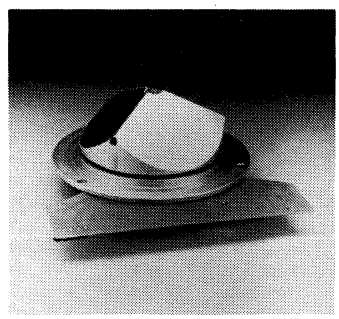
SYNEKTRON
THE MOTION CONTROL COMPANY
12000 Southwest Garden Place
Portland, Oregon 97223
Phone: 503•684•3090

SYNEKTRON
THE MOTION CONTROL COMPANY

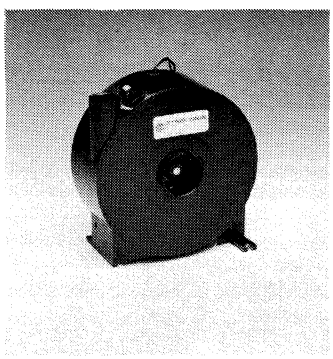
Variable-Speed, Brushless-Motors and Drives



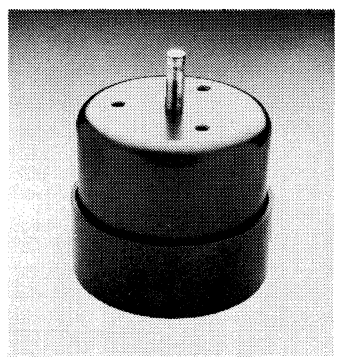
P/N F007



P/N S002



P/N F003



P/N H006

Synektron variable-speed, brushless-motors and drives save valuable space, reduce noise in products while increasing reliability and performance. The control electronics are integrated into the motor package.

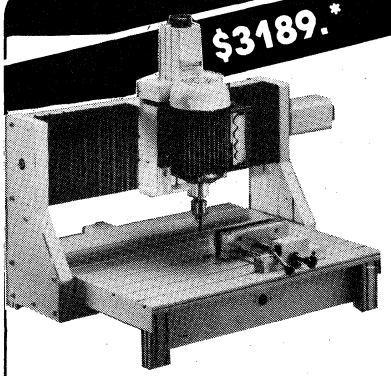
A variety of control schemes are available to optimize speed/torque requirements for various applications. Synektron motors feature outer-rotating rotors. This gives a positive means of magnet retention and increases your flexibility in motor design and packaging.

P/N	PEAK OUTPUT POWER (W)	SPEED RANGE (rpm)	MAX. TORQUE (oz - in)	SUPPLY VOLTAGE (V)	RATED CURRENT (A)	MOTOR CONSTANT $\left(\frac{\text{oz - in}}{\sqrt{\text{W}}}\right)$	TORQUE CONSTANT $\left(\frac{\text{oz - in}}{\text{A}}\right)$	EFFICIENCY	CONTROL METHOD	MOTOR LENGTH (in)	MOTOR DIAMETER (in)	SHAFT DIAMETER (in)
F007	132	0-3000	92	9-20 DC	18	19.1	5.8	60-70%	VOLTAGE	2.75	5.55	.31
S002	6.5	5800-6200	2.3	20 DC	.55	1.6	2.6	30%	SPEED	1.65	3.30	.24
F003	50	4,000-9,000	10	115 AC	1.3	2.43	14.6	55%	SPEED	2.45	5.90	.31
H006	180	0-1200	240	115 AC	1.0	45.3	405	80-90%	CURRENT	4.82	5.60	.50

For more information, write or call:

SYNEKTRON
THE MOTION CONTROL COMPANY
12000 Southwest Garden Place
Portland, Oregon 97223
Phone: 503•684•3090

$3189.*



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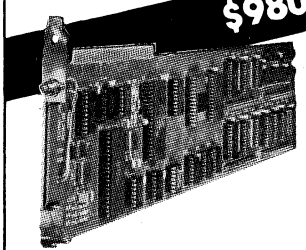
516-328-3970

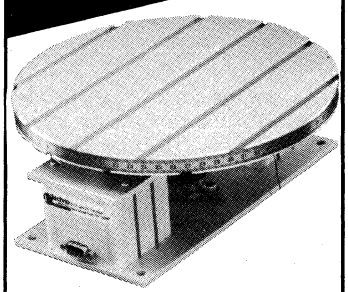
Gantry Type XYZ Table with Patented Linear Bearings
- ☐ Stepper motor and ball screw drives
- ☐ Available in 5 sizes from 9.8" x 15.7" x 4" * to 48" x 49" x 4"
- ☐ Drill and clamping device optional up to 400 lb. cutting thrust

$980.



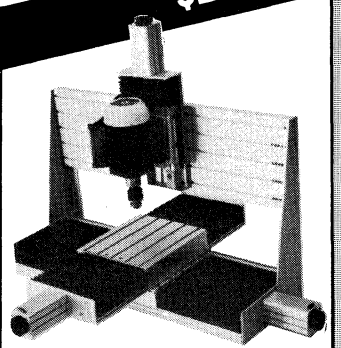
8 Axes Automation Controller Card For IBM-PC®
- ☐ Multitasking - Executes both motion and logic control programs simultaneously
- ☐ 32 inputs and 16 outputs
- ☐ 8 axes linear, 2 axes circular, plus elliptical interpolation
- ☐ User friendly text editor with on-line help screens to assist in writing your own programs.

$533.



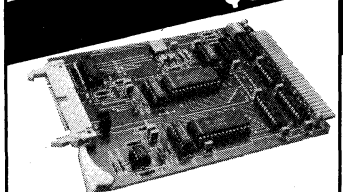
Rotary Table
- ☐ Stepper motor driven with 1:4 timing belt drive ratio
- ☐ Up to 13.5 minutes of arc accuracy per pulse
- ☐ 9.45" dia. top plate with "T" slots

$2654.*



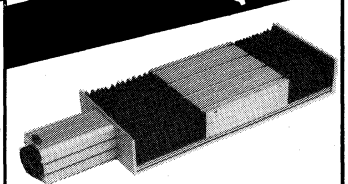
X/Y Table with Bridge Mounted Z Axis
- ☐ Stepper motor and ball screw drives
- ☐ Available in 2 sizes 7.8" x 11.8" x 4" * and 11.8" x 15.75" x 4"
- ☐ Drill and clamping device optional

$385.



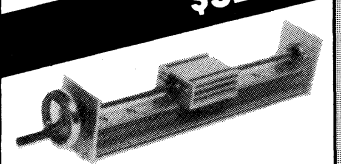
STD-BUS 2 Axes Servo Motor Control Card For IBM-PC®
- ☐ 32 bit resolution linear and circular interpolation
- ☐ Simultaneous motion and logic control

$640.



Single Axis Table with Patented Linear Bearings
- ☐ Available in strokes of 4" to 48"
- ☐ Static load up to 1,000 lbs
- ☐ Slides include stepper motor, ball screw and home sensor

$321.*



Narrow Profile Series Drive Tables
- ☐ Stocked in stroke lengths of 9.8" * to 49"
- ☐ Also available with stepper motor and ball screw drive
- ☐ Maximum static load 200 lbs.
- ☐ Up to 30"/sec. travel with fast helix screw

Prices shown are typical within each product group. Pleated protective covers optional. Repeatability for all tables is .0004". Accuracy is .0004". per inch.

Techno a DSG company

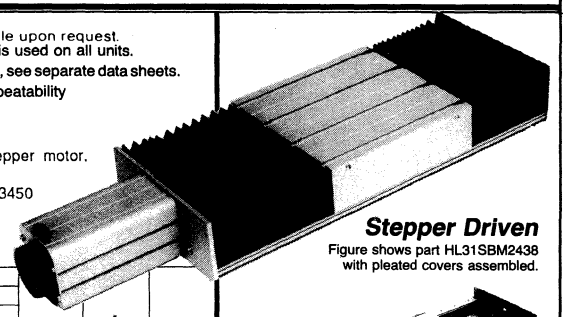
2101 Jericho Turnpike, New Hyde Park, NY 11040
Phone: (516) 328-3970 • FAX: 516-326-8827

Linear Slides

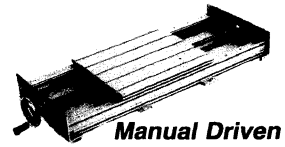
- Longer strokes, up to 1250 mm (49.2) available upon request.
- Patented linear precision guide rail system is used on all units.
- For motor specifications and drive electronics, see separate data sheets.
- Home sensor (switch) is provided with a repeatability better than 1/100 mm (.0004)
- T-slot work surfaces standard on all units.
- Manual or driven with HL2100M3455 stepper motor.

* These slides are driven with HL2100M3450 stepper motor.

- Could be mounted in any orientation



Stepper Driven
Figure shows part HL31SBM2438 with pleated covers assembled.



Manual Driven
Figure shows part HL31MTM2444☐ with hand crank and without pleated cover.

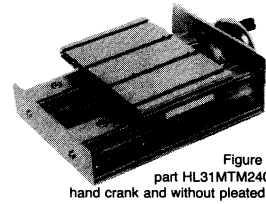


Figure shows part HL31MTM2402 with hand crank and without pleated cover.

Catalog Number	Description: Drive: Manual	Drive: Stepper Motor: Supplied	Drive: Stepper Motor: Holding torque N cm	Lead Screw: Trapezoidal	Lead Screw: Ball Screw	Specifications	Working area size	* Stroke	Price $
HL31MTM2402	•			•			175mm wide (6.89) 120mm long (4.72)	100mm (3.94)	265.-
HL31STM2404		•	55	•		ø12x2mm			426.-
HL31SBM2406		•	55		•				640.-
HL3400M1321	Pleated, black cover, assembled (one side only)						To be used for all 3 above models		37.-
HL31MTM2412	•			•			175mm wide (6.89) 180mm long (7.09)	100mm (3.94)	372.-
HL31STM2414		•	110	•		ø16x4mm			586.-
HL31SBM2416		•	110		•				854.-
HL3400M1323	Pleated, black cover, assembled (one side only)						To be used for all 3 above models		41.-
HL31MTM2426	•			•			175mm wide (6.89) 180mm long (7.09)	200mm (7.87)	426.-
HL31STM2432		•	110	•		ø16x4mm			640.-
HL31SBM2436		•	110		•				907.-
HL3400M1325	Pleated, black cover, assembled (both sides)						To be used for all 3 above models		85.-
HL31MTM2428	•			•			175mm wide (6.89) 180mm long (7.09)	300mm (11.81)	479.-
HL31STM2434		•	110	•		ø16x4mm			693.-
HL31SBM2438		•	110		•				961.-
HL3400M1327	Pleated, black cover, assembled (both sides)						To be used for all 3 above models		127.-
HL31MTM2444☐	•			▲●		ø16x1, 2 or 4	250mm wide (9.84) 275mm long (10.83)	300mm (11.81)	586.-
HL31MBM2446☐	•				■●	ø16x2, 4 or 5			854.-
HL31SBM2448☐		•	110		■●				1068.-
HL3400M1345	Pleated, black cover, assembled (both sides)						To be used for all 3 above models		153.-
HL31MTM2445☐	•			▲●		ø16x1, 2 or 4	250mm wide (9.84) 275mm long (10.83)	400mm (15.75)	661.-
HL31MBM2447☐	•				■●	ø16x2, 4 or 5			961.-
HL31SBM2449☐		•	110		■●				1177.-
HL3400M1347	Pleated, black cover, assembled (both sides)						To be used for all 3 above models		202.-

*Stroke slightly reduced when pleated covers are added.

Lead Screw Pitches available for above.
Parts HL31 _ _ M2444 ☐ thru HL31 _ _ M2449 ☐

▲ Trapezoidal Lead Screws

Available Pitches	Pitch Code
ø16x1mm	A
ø16x2mm	B
ø16x4mm	C

■ Ball Screws

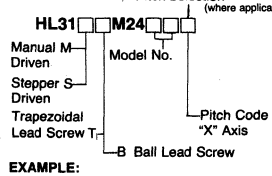
Available Pitches	Pitch Code
ø16x2mm	B
ø16x4mm	C
ø16x5mm	D

Dimensions in ( ) are inch.
Load Carrying Class: A
**These slides are load carrying class: B (see Technical Section)

Performance Data: For Half Step Mode

Lead Screw pitch		Linear motion per half step of stepper motor		Linear speed at 10,000 steps of stepper motor	
mm	inch	mm	inch	mm/sec	inch/sec
1	.0394	.003	.00010	25	0.985
2	.0787	.005	.00020	50	1.968
4	.1575	.010	.00040	100	3.938
5	.1969	.013	.00049	125	4.923

Catalog Number Designation



EXAMPLE:
HL31MTM2444C specifies a manual driven, trapezoidal type lead screw having a pitch of 4mm (.1575).

Techno a DSG company
2101 Jericho Turnpike, New Hyde Park, NY 11040
Phone: (516) 328-3970 • TWX: 510-223-0642 • FAX: 516-326-8827

Lead Screw Drive Tables

- Patented linear precision guide rail system.
- Double guides with two linear bearings.
- Stainless steel lead screw.
- Two axial bearings.
- Manual or driven with HL2100M3455 stepper motor.
- Home sensor switch provided with a repeatability better than 1/100 mm (.0004).
- T-slot work surfaces standard on all units.

Working Area: 90(3.5) x 75(3.0)

Catalog Number	Drive: Manual	Drive: Stepper Motor	Lead Screw: Trapezoidal	Lead Screw: Ball Screws	* Stroke	Length	Price $	Pleated Covers: Catalog Number	Pleated Covers: Price $
HL31MTM2170☐	•		•		250 (9.8)	425 (16.7)	321.-	HL3400M1305	95.-
HL31MTM2171☐	•		•		400 (15.7)	575 (22.6)	348.-	HL3400M1307	137.-
HL31MTM2172☐	•		•		500 (19.7)	675 (26.6)	369.-	HL3400M1309	159.-
HL31MTM2174☐	•		•		750 (29.5)	925 (36.4)	417.-	HL3400M1311	224.-
HL31MTM2176☐	•		•		1000 (39.4)	1175 (46.3)	465.-	HL3400M1315	306.-
HL31MTM2178☐	•		•		1250 (49.2)	1425 (56.1)	514.-	HL3400M1319	349.-
HL31SBM2180☐		•		•	250 (9.8)	425 (16.7)	829.-	HL3400M1305	95.-
HL31SBM2181☐		•		•	400 (15.7)	575 (22.6)	877.-	HL3400M1307	137.-
HL31SBM2182☐		•		•	500 (19.7)	675 (26.6)	904.-	HL3400M1309	159.-
HL31SBM2184☐		•		•	750 (29.5)	925 (36.4)	979.-	HL3400M1311	224.-
HL31SBM2186☐		•		•	1000 (39.4)	1175 (46.3)	1054.-	HL3400M1315	306.-
HL31SBM2188☐		•		•	1250 (49.2)	1425 (56.1)	1129.-	HL3400M1319	349.-

Lead Screw Pitches available for above.

Trapezoidal Lead Screws

Available Pitches	Pitch Code
ø16x1mm	A
ø16x2mm	B
ø16x4mm	C

Ball Screws

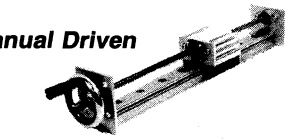
Available Pitches	Pitch Code
ø16x2mm	B
ø16x4mm	C
ø16x5mm	D

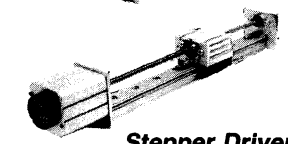
Fast Lead Screw 8mm (3/8") x 1" lead, and Delrin nut.
For rapid travel applications.

Working Area: 75(3.0) x 87(3.5)

Catalog Number	Drive: Manual	Drive: Stepper Motor	Lead Screw: Trapezoidal	Lead Screw: Ball Screws	* Stroke	Length	Price $	Pleated Covers: Catalog Number	Pleated Covers: Price $
HL31MFM2150	•		•		75 (2.9)	225 (8.9)	300.-	HL3400M1301	49.-
HL31MFM2151	•		•		175 (6.9)	325 (12.8)	321.-	HL3400M1303	74.-
HL31MFM2152	•		•		275 (10.8)	425 (16.7)	342.-	HL3400M1305	95.-
HL31MFM2153	•		•		425 (16.7)	575 (22.6)	375.-	HL3400M1307	137.-
HL31MFM2154	•		•		525 (20.7)	675 (26.6)	396.-	HL3400M1309	156.-
HL31MFM2155	•		•		675 (26.6)	825 (32.5)	428.-	HL3400M1310	199.-
HL31SFM2160		•	•		75 (2.9)	225 (8.9)	514.-	HL3400M1301	49.-
HL31SFM2161		•	•		175 (6.9)	325 (12.8)	535.-	HL3400M1303	74.-
HL31SFM2162		•	•		275 (10.8)	425 (16.7)	556.-	HL3400M1305	95.-
HL31SFM2163		•	•		425 (16.7)	575 (22.6)	589.-	HL3400M1307	137.-
HL31SFM2164		•	•		525 (20.7)	675 (26.6)	610.-	HL3400M1309	156.-
HL31SFM2165		•	•		675 (26.6)	825 (32.5)	642.-	HL3400M1310	199.-

Manual Driven



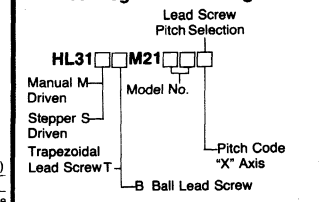


Stepper Driven

Performance Data: For Half Step Mode

Lead Screw pitch		Linear motion per half step of stepper motor		Linear speed at 10,000 steps of stepper motor	
mm	inch	mm	inch	mm/sec	inch/sec
1	.0394	.003	.00010	25	0.985
2	.0787	.005	.00020	50	1.968
4	.1575	.010	.00040	100	3.938
5	.1969	.013	.00049	125	4.923

Catalog Number Designation



EXAMPLE:
HL31MTM2170C specifies a manual driven, trapezoidal type lead screw having a pitch of 4mm (.1575).

Performance Data: For Half Step Mode
Fast Lead Screw

Lead Screw pitch		Linear motion per half step of stepper motor		Linear speed at 10,000 steps of stepper motor	
mm	inch	mm	inch	mm/sec	inch/sec
25.4	1	0.0635	0.0025	625	25

Dimensions in ( ) are inch.
Load Carrying Class: C
(see Technical Section)

Techno a DSG company
2101 Jericho Turnpike, New Hyde Park, NY 11040
Phone: (516) 328-3970 • TWX: 510-223-0642 • FAX: 516-326-8827

610 East Tenth Street
Oakland, CA 94606
FAX: (415) 452-3620

BRILL ELECTRONICS

1220 Olympic Boulevard
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Tel: (213) 452-8002

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VERNITRON CONTROLS

1601 Precision Park Lane • San Diego, CA 92073 • (619) 428-5581 TWX: 910-322-1862 FAX: 619-428-5090

Vernitron Controls is a leading supplier of Mil-Spec synchros and resolvers, and is a primary source for the more sophisticated, ultra-high-accuracy single, dual and multi-speed pancake-type componentry consistent with today's state of the art.

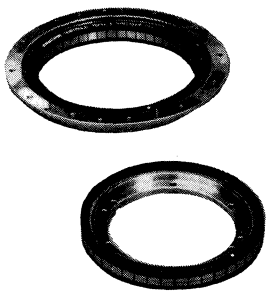
Vernitron Controls operates from a modern 60,000 square foot facility located on 4.6 acres in San Diego, California, specifically designed for the manufacture of electromagnetic devices.

Vernitron Controls has supplied products for such programs as Harpoon, TOW/-Cobra, FVS, A-6, Trident, Phalanx, Leopard II, DD963, CG47, and many more. Vernitron Controls' products are also found in many areas of industrial applications, including robotics, automatic machine tools, and computer disk drives.

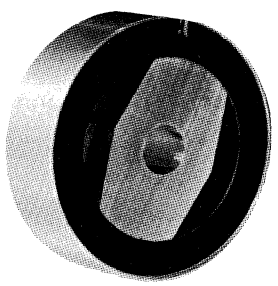
Product Lines from Vernitron Controls

Standard Mil-Spec Synchros and Resolvers Size 8 – Size 45

Hi-Accuracy Multispeed Pancakes

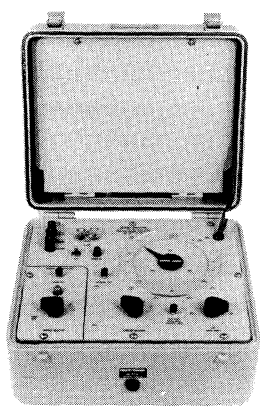


Limited Angle Brushless Torque Motors

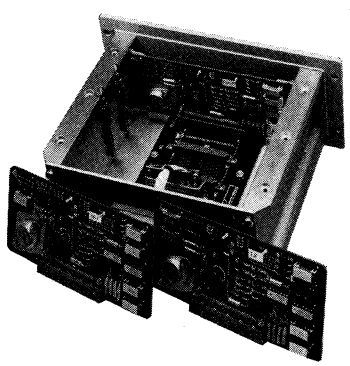


Torqsyn Remote Positioners Analog or Digital Input

Custom Subsystem Designs



Custom Electronics



Other Products:

- Digital Resolver (single turn absolute encoder, 16-bit output)
- 50 VA Solid State Synchro Amplifier
- RVDT
- Segment Resolver
- DC Motors and Tachometers through our Magnetic Technology Division, Canoga Park, California; Tel. (818) 887-7700; FAX (818) 887-9964

VERNITRON CONTROLS

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Pancake Synchros & Resolvers - Multispeed

VERNITRON TYPE NUMBER	FUNCTION	SPEED	ACCURACY (MAX. ERROR)	INPUT VOLTS	FREQUENCY (Hz)	TRANSFORMATION RATIO	PHASE SHIFT (DEGREES)	INPUT IMPEDANCE (Ohms)	OUTPUT IMPEDANCE (Ohms)	DIMENSIONS[1] A	B	C	D
VRP12-3 [2]	Resolver, RX	3	5′	5	2600	0.500	35	100 + j160	—	1.1875	0.5625	0.245	0.098
VRP12-6 [2]	Resolver, RX	3	1′/2′	5	960	0.454	60 max	85	—	1.1875	0.5625	0.245	0.098
VRP15-6	**Resolver, RX**	**4**	**2′**	**7**	**400**	**1.00**	**36**	**150 + j200**	**540 + j220**	1.500	0.700	0.325	0.125
VRP20-2	Resolver, RX	1 16	1′/6′ 12″/20″	26	400	0.250 0.200	24 64	205 + j135 (common)	115 + j18 410 + j215	1.842	0.834	0.600	0.300
VRP20-3	Resolver, RX	8	10″/15″	26	400	0.454	55	310 + j270	600 + j315	1.842	0.834	0.600	0.300
VRP23-1A [3]	Resolver, RX	16	10″/15″	14	1023	0.300	40	110 + j125	130 + j175	2.280	1.355	0.656	0.270
VRP23-1B [3]	Resolver, RX	16	12″/15″	26	400	0.354	60	415 + j235	1000 + j790	2.280	1.355	0.656	0.270
VSP25-5	Synchro, CX	3	20′	26	400	0.454	20 max	1000 min	2000 max	2.500	0.311	2.575	0.910
VSP25-6A	Resolver (RT)	2	1′	11.8	400	2.203	5.5	110 + j870	850 + j315	2.147	0.758	0.670	0.369
VRP25-8	**Resolver, RDX, Comp**	**2**	**15″**	**7**	**400**	**1.0000 ± 0.05%**	**0.5 max**	**1000 min**	—	2.149	0.758	0.750	0.280
VRP28-2	Resolver, RX	2	1′	26	400	0.454	22	190 + j410	100 + j45	2.213	1.300	0.495	0.215
VSP29-1	Synchro, CX	1 11	3° 45″ 50″ Spr.	15 26	400 400	0.283 0.454	5.5 25	1860 + j5510 44 + j105	—	2.713	1.270	0.780	0.400
VSP29-4	Synchro, CX	1 36	20′ 20″	26 26	400 400	0.454 0.454	8 55	200 + j4100 250 + j160	290 + j46 1840 + j600	2.713	1.021	0.798	0.423
VRP30-3 [2]	Resolver, Comp.	4	30″	8	2559	1.475	4	260 + j1130	680 + j850	2.902	1.821	0.390	0.156
VRP30-7	Resolver (RX)	2	2′	26	400	0.480	18	700 + j1840	365 + j125	2.757	1.735	0.600	0.230
VSP31-3	Resolver, RX	2	30″/100″	26	400	0.988	8	38 + j217	70 + j26	2.147	0.758	0.665	0.268
VRP34-8	**Resolver, RX**	**8**	**1′**	**26**	**2400**	**0.454**	**35**	**160 + j400***	**200 + j250***	1.885	1.311	0.198	0.098
VRP36-6	Resolver, RX	1 16	15′ 40″/60″	26	400	0.454 0.454	7.5 26.5	3880 + j6130 323 + j630	820 + j130 580 + j505	3.383	2.239	0.600	0.242
VRP36-10	Resolver (Comp., RT)	1 32	2°* 10″*	1.25 5	2048	0.454 0.120	4.5 0*	1100 + j5000 210 + j130	360 + j120 460 + j280	2.598	1.112	0.505	0.200
VRP37-1	Resolver, RX	1 16	5′ 10-15″	26	400	0.125 0.250	12 65	270 + j160 (common)	45 + j5 380 + j285	2.875	1.706	0.680	0.270
VRP37-2	Resolver, RT	8	10″ max 6″ RMS	13.7	400	0.4	35	800 + 1220	830 – j500	2.782	1.335	0.680	0.280
VSP37-10A	Synchro, CX	1 16	60′ 1.5′	26	400	0.454 0.454	10 4	70 + j323 (common)	198 + j28 400 + j28	3.470	1.625	0.805	0.322
VSP37-11	Synchro, CX	1 36	30′ 15″	26 26	400	0.60 0.43	6 40	390 + j950 300 + j340	120 + j35 1170 + j985	3.500	2.075	1.500	0.750
VSP38-6	Syncrho, CX	1 36	20′ 20″	26 26	400	0.454 0.454	8 55	1300 + 3200 220 + j160	—	2.713	1.021	0.850	0.423
VRP41-2	**Resolver, RX**	**1 64**	**14′ 8″**	**28**	**2400**	**0.171 0.171**	**8 38**	**5000 + j12600 300 + j370**	**240 + j75 720 + j1270**	3.630	2.600	0.500	0.200
VRP41-9	Resolver, RX	36	15″	10	2600	0.316	0	90 + j470	410 + j965	3.500	2.075	1.500	0.750
VRP45-1	**Resolver, RX**	**1 64**	**14′ 8″**	**28**	**2400**	**0.171 0.171**	**8 38**	**3400 + j6200 350 + j490**	**180 + j60 1000 + j1600**	3.910	2.870	0.500	0.200
VRP50-2 [2]	Resolver, RX	1 16	10′ 25″	26	400	0.25 0.26	14 32	190 + j290 (common)	110 + j24 110 + j70	4.994	3.4555	0.750	0.385
VRP50-4 [2]	**Resolver, RX,**	**16**	**12″**	**26**	**400**	**0.454**	**30**	**205 + j360**	**203 + j196**	4.994	3.4555	0.750	0.385
VRP64-1	Resolver, RX	1 16	75′ 20″	115	400	0.500 0.500	4 20	340 + j890 (common)	750 + j300 300 + j450	5.750	3.750	1.000	0.358
VRP67-1 [3]	**Resolver, RX**	**1 32**	**60′ 10″**	**26**	**2600**	**0.25 0.25**	**1 11**	**200 + j1000* (common)**	**230 + j170* 170 + j640***	6.610	5.200	0.650	0.32
VRP64-2	Resolver, RT	1 16	75′ 20″	57.5 57.5	400	1.00 1.00	1.5 19	31000 + j53000 1300 + j3550	8000 + j40000 5800 + j6500	5.750	3.750	1.000	0.358
VSP64-1	Synchro, CX	1 16	75′ 30″	26	400	0.454 0.454	1.5 7	90 + j450 (common)	52 + j18 310 + j90	5.750	3.750	1.000	0.358
VRP75-1	Resolver, RX	36	12″	10	2600	0.316	5	75 + j380	50 + j215	6.517	4.500	1.250	0.756
VRP75-3	**Resolver, RX**	**1 16**	**30′ 20″**	**26**	**400**	**0.313 0.313**	**5 30**	**260 + j460 (common)**	**400 + j200 120 + j85**	6.513	4.500	0.900	0.508
VRP81-1	**Resolver, RX**	**1 32**	**60′ 10″**	**26**	**2600**	**0.25 0.25**	**2 12**	**260 + j950* (common)**	**320 + j140* 106 + j470***	7.870	6.470	0.650	0.313
VRP83-1	Resolver, RX	1 16	100′ 12″	26	400	0.454 0.454	25 5	200 + j475 (common)	390 + j250 300 + j240	7.890	5.890	1.375	0.500
VSP98-1	Synchro, CX	1 16	20′ 25″	115	400	0.783 0.783	3.5 12.5	490 + j1700 (common)	380 + j1900 1050 + j1050	8.500	6.500	0.890	0.340
VSP104-1	**Synchro, CX**	**1 16**	**75′ 30″**	**26**	**400**	**0.454 0.454**	**6 20 max**	**260 min (common)**	**560 max 1000 max**	10.000	8.000	0.100	0.358

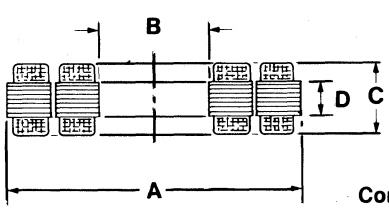
PANCAKES:

[1] All units are supplied with hubs and housings to achieve specified performance, unless otherwise noted. Units are without ball bearings. See separate chart for housed and/or brushless pancakes.

Dimensions provided are for rotor and stator only (ref). For exact configuration and more detailed specification information on any part number shown, consult factory for latest drawing.

[2] Units are supplied without hub and housing.

[3] Units supplied with hub, but no housing.



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VERNITRON CONTROLS

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vernitorq™ BRUSHLESS DC TORQUE MOTORS

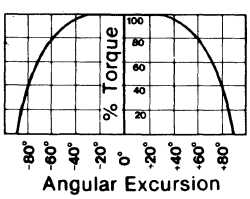
VERNITORQ™ BRUSHLESS DC TORQUE MOTORS
Brushless, direct drive, limited rotation motors available in two and four pole configurations, frameless or housed, for precise positioning, actuation and infinite control. Available with Alnico or air stabilized samarium cobalt magnets for ease of handling and assembly. All units are toroidally wound and encapsulated in a high temperature medium through a precision transfer molding process.

Vernitorq motors feature:
- Quick response
- Wide angular excursion
- Hi torque, lo input power
- Infinite resolution
- No slot effect

In addition to the above features, "Vernitorq" motors are friction free, explosion-proof, and offer no electrical or mechanical noise. They are ideally suited for such typical applications as:
- Mirror positioning in infra-red/thermal imaging systems
- Tension control on hi speed printers
- Disc drive head positioners
- Open/close valve actuators
- Medical scanning equipment
- Camera control mechanisms

"Vernitorq" motors are optimally designed to enhance system performance.

TYPICAL PERFORMANCE CURVES



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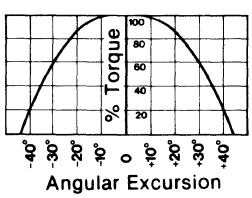

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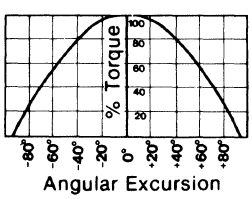

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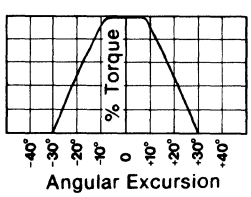
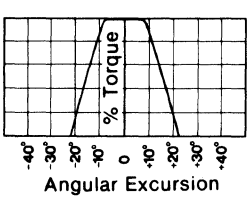
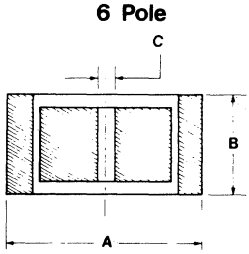


6 Pole



8 Pole



Vernitron Type Number	Peak Torque (Oz-in)	Power @ Peak Torque (Watts)	Continuous Torque (Oz-in)	Power @ Continuous Torque Watts	Input @ Continuous Torque (Volts)	Torque Sensitivity (Oz-in/amp)
VBTM9-C ④	2.9	25	1.3	5.0	8.0	2.1
VBTM10-A	1.3	16	0.5	2.4	12.0	2.5
VBTM10-A-1	1.3	12	0.5	1.8	11.0	3.0
VBTM10-B	6.0	175	1.5	11.0	44.0	6.0
VBTM10-D	1.3	16	0.5	2.4	11.7	2.4
VBTM10-E	1.3	17	0.3	0.9	4.7	1.6
VBTM10-G	6.0	115	1.4	6.3	5.4	1.2
VBTM10-K ④	1.8	9	1.2	4.0	5.3	1.6
VBTM10-L ① ④	14.5	420	1.7	6.0	10.0	2.9
VBTM10-M ④	1.8	9	1.2	3.7	6.7	2.14
VBTM10-N ④	1.8	21	0.6	2.3	9.6	2.5
VBTM10-R ④	1.8	20	0.6	2.1	11.8	3.3
VBTM10-S ④	6.0	85	1.5	5.3	5.6	1.6
VBTM12-B	4.5	37	0.9	1.5	3.7	2.25
VBTM12-C ②	2.5	26	1.2	6.0	19.5	4.0
VBTM12-E ①	14.0	154	3.0	7.0	5.2	2.2
VBTM15-A	5.0	28	2.8	9.0	23.6	7.5
VBTM16-A ④	7.0	27	2.0	2.1	5.0	4.8
VBTM16-B ④	6.0	25	1.7	2.1	5.6	4.6
VBTM17-A	18.0	70	8.0	14.0	12.8	7.5
VBTM17-B	6.7	69	2.8	12.0	24.6	5.7
VBTM17-C ④	18.0	55	8.0	11.0	11.5	8.4
VBTM17-C1 ④	18.0	55	8.0	11.0	15.8	12.4
VBTM18-A	12.0	68	4.0	7.5	15.0	8.0
VBTM18-B	18.0	75	8.0	14.0	13.0	7.5
VBTM18-C	18.0	83	6.5	11.0	8.2	5.0
VBTM18-D ④	20.0	131	7.0	16.0	13.3	5.8
VBTM23-B	25.0	63	7.0	4.9	7.0	10.0
VBTM23-D ④	25.0	73	5.0	2.9	6.8	11.7
VBTM23-E ④	13.0	20	8.6	8.7	6.0	5.9
VBTM23-E-1 ④	13.5	19	8.1	6.8	9.0	10.8
VBTM23-G ④	37.0	36	24.0	15.1	12.6	20.0
VBTM25-E ④	21.3	44	14.2	20	13.0	8.5
VBTM33-A	80.0	210	26.0	22.3	23.1	27.0
VBTM33-B	55.0	60	27.0	14.6	10.8	20.0
VBTM34-B	130.0	279	40.0	26.4	15.8	24.0
VBTM34-C	130.0	32.8	40.0	31.0	6.6	8.5
VBTM34-D	83.0	80	40.0	18.5	11.4	24.6
VBTM34-E-1	250.0	281	70.0	22.0	5.4	17.0
VBTM34-G	250.0	305	67.0	22.0	10.5	32.0
VBTM34-H	80.0	98	60.0	55.4	12.0	13.0
VBTM34-J	80.0	132	45.0	41.6	20.8	22.5
VBTM34-K	250.0	281	80.0	28.8	12.2	34.0
VBTM34-L ④	75.0	211	20.0	18.0	18.0	20.0
VBTM34-M ④	100.0	242	40.0	39.0	18.9	19.5
VBTM34-N ④	34.0	73	22.7	33	11.6	8.2
VBTM35-B ④	165	175	50	16.1	9.0	27.9
VBTM39-A ③	40.0	65	30.0	36.7	25.7	21.0
VBTM40-A	160.0	144	57.0	18.3	12.8	40.0
VBTM40-B ④	260	140	180	66	8.2	22
VBTM43-A ④	330	236	120	31.2	14.8	56.8
VBTM52-B ④	708.0	502	148.0	22.0	10.0	67.0
VBTM52-B-1 ④	708.0	394	148.0	17.2	7.5	64.8
VBTM80-A ④	1882	378	1286	175	11.8	86
VBTM100-A ④	2880	268	2496	200	13.3	165
VBTM140-A ③ ④	4608	258	4032	200	13.2	268
HOUSED MOTORS (Diameters are: A = Housing OD; B = Housing Length;						
VBTMH14-B-1	4.5	26.5	0.15	0.03	1.4	7.0
VBTMH15-A	6.0	65.4	0.9	1.5	3.7	2.25
VBTMH18-A	10.0	14.8	8.5	10.7	9.3	7.4
VBTMH38-B-1	80.0	210	26.0	22.3	23.1	27.0

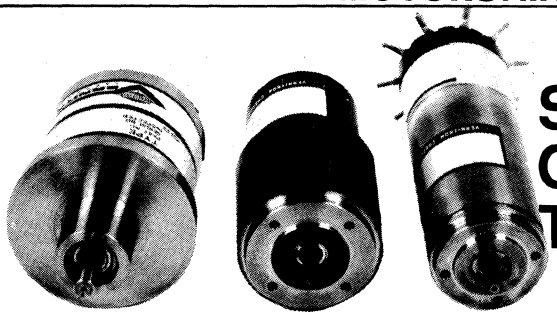
① Check with factory regarding duty cycle

VERNITECH

Division of VERNITRON CORPORATION

"TECHNOLOGY IN MOTION"

MOTORS/MOTOR GENERATORS



STANDARD DESIGNS OR CUSTOM DESIGNED TO YOUR REQUIREMENTS

HYSTERESIS SYNCHRONOUS MOTORS FOR LASER OPTICAL SCANNING POLYGON APPLICATIONS

VARIABLE FREQUENCY/SPEED
300 RPM To 48,000 RPM

BALANCED ROTORS
.0001 oz. inch

SHAFT RUNOUT & FLATNESS
.0001"

EXTENDED LIFE
10 Years without Relubrication

VOLTAGE RANGE
2.0 Volts to 280 Volts

THRU-BORE CONSTRUCTION
Precision Stator Bore

ALL UNITS WITH AND WITHOUT GEARHEADS

Servomotors Viscous Damped Motors Inertially Damped Motors Hysteresis Synchronous Motors*	Stepper Motors Motor Generators Rate Motor Tachometers	Computing Motor Tachometers Integrating Motor Tachometers Spin (Gyro) Motors

SIZES
BuOrd Size 5 (0.5" Dia.) to BuOrd Size 33 (3.250" Dia.)

SPEEDS
300 RPM to 48,000 RPM (Stepper Motors in Steps of 7.5°, 15°, 45°, and 90°)

FREQUENCY
30, 50, 60, 80, 400, 420, 800, 1000, and 1200 (Sine or Square Wave) Variable Frequency Motors are also standard at Vernitech

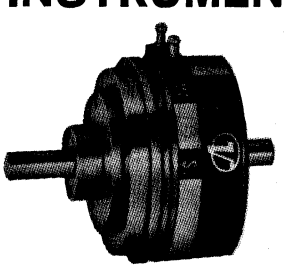
Poles — 2, 4, 6, 8, 12

VOLTAGES
2.0 Volts to 280 Volts

PHASES
1, 2, and 3
2, 3, and 4 (in Stepper Motors)

CLUTCHES AND BRAKES

PRECISION INSTRUMENT



These units are manufactured primarily to satisfy the high standards of Military requirements. Their above-standard quality is further emphasized by a high efficiency-to-size ratio. If precision is the need — then these are the instruments for you.

PERMANENT MAGNET HYSTERESIS CLUTCH

PMC Series

Designed for applications requiring repeatable torque and long life. Units can be utilized to comply with OSHA safety regulations and as a fail-safe device to protect other expensive components. In the 1.5 in. diameter frame size—torque is factory adjustable up to 8.5 oz. in. and can be held within 10% max., from unit to unit in speeds up to 10,000 R.P.M. Repeatability of torque level can be maintained within ±1%.

The PMC series will operate over a temperature range of −65°F to 260°F.

FAIL SAFE BRAKES (SBF SERIES)

DESIGN FEATURES

- ☐ Braking action occurs when coil is de-energized, or power fails.
- ☐ Unit is adjustable to compensate for wear.
- ☐ Zero backlash armature with spring release.
- ☐ Clamp-Lock hub for positive retention.
- ☐ Stationary field coil — no slip rings or brushes.
- ☐ Fast response time.

MANY INDUSTRIAL TYPES AVAILABLE

Refer to sections 2440, 4750, 5500 for additional product listings.

VERNITECH

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516-586-5100 • TWX 510-227-6089 • FAX 516-242-7940

Amperex®
a division of
NORTH AMERICAN PHILIPS CORPORATION
SLATERSVILLE, RI

PHILIPS DISCRETE SEMICONDUCTORS

OPTOCOUPLERS, INFRARED SENSORS, & TEMPERATURE SENSORS

OPTOCOUPLERS—Case Style SOT-90B

Type	CTR % min	I_F mA	V_{CE} V	V_{ISO} V_{AC}	V_{CE} (Sat) max V	I_F mA	I_C mA	t_{ON}/t_{OFF} µS @	I_C @ mA	V_{CC} V	R_L Ω	V_{BR} min V
Transistor Output												
4N25	20	10	10	2,500	0.5	50	2.0	3/3	2	10	100	30
4N25A	20	10	10	1,775[1]	0.5	50	2.0	3/3	2	10	100	30
4N26	20	10	10	1,500	0.5	50	2.0	3/3	2	10	100	30
4N27	10	10	10	1,500	0.5	50	2.0	3/3	2	10	100	30
4N28	10	10	10	500	0.5	50	2.0	3/3	2	10	100	30
4N35	100	10	10	3,550	0.3	10	0.5	7/5	2	10	100	30
4N36	100	10	10	2,500	0.3	10	0.5	7/5	2	10	100	30
4N37	100	10	10	1,500	0.3	10	0.5	7/5	2	10	100	30
H11A1	50	10	10	2,500	0.4	10	0.5	3/3[3]	2	10	100	30
H11A2	20	10	10	1,500	0.4	10	0.5	3/3[3]	2	10	100	30
H11A3	20	10	10	2,500	0.4	10	0.5	3/3[3]	2	10	100	30
H11A4	10	10	10	1,500	0.4	10	0.5	3/3[3]	2	10	100	30
H11A5	30	10	10	1,500	0.4	10	0.5	3/3[3]	2	10	100	30
MCT26	6	10	10	4,400[2]	0.5	60	1.6	3/3[3]	2	10	100	30
MCT2	20	10	10	4,400[2]	0.4	16	2.0	5/10		note 4		30
CNY57U	20	10	0.4	4,300	0.4	10	2.0	3/3	2	5	100	30
CNY57AU	40	10	0.4	4,300	0.4	10	4.0	3/3	2	5	100	30
CNX35U	40-90	10	0.4	4,400[2]	0.4	10	2.0	3/3	2	5	100	30
CNX36U	80	10	0.4	4,400[2]	0.4	10	4.0	7/5	2	5	100	30
CNX39U	60-90	10	0.4	4,400[2]	0.4	10	2.0	5/4	2	5	100	30
High Voltage Transistor Output												
4N38	10	10	10	1,500	1.0	20	4.0	5/5	2	10	100	80
4N38A	10	10	10	2,500	1.0	20	4.0	5/5	2	10	100	80
CNY17-1	40-80	10	5.0	4,400[2]	0.3	10	2.5	5/5	2	10	100	70
CNY17-2	63-125	10	5.0	4,400[2]	0.3	10	2.5	5/5	2	10	100	70
CNY17-3	100-200	10	5.0	4,400[2]	0.3	10	2.5	5/5	2	10	100	70
CNY17-4	160	10	5	4,400	0.3	10	2.5	5/5	2	10	100	70
CNX38U	70-210	10	10	4,400[2]	0.4	16	2.0	5/5	4	5	100	80
Darlington Transistor Output												
H11B1	500	1	5.0	2,500	1.0	1	1	125/100	10	10	100	25
H11B2	200	1	5.0	2,500	1.0	1	1	125/100	10	10	100	25
H11B3	100	1	5.0	2,500	1.0	1	1	125/100	10	10	100	25
H11B255	100	10	5.0	1,500	1.0	50	50	125/100	10	10	100	55
MCA230	100	10	5.0	3,550	1.0	50	50	5/100	10^5	5	100	30
MCA231	200	1	5.0	3,500	1.2	10	50	5/100	10^5	5	100	30
MCA255	100	10	5.0	3,550	1.0	50	50	5/100	10^5	5	100	55
4N29	100	10	10	4,400[2]	1.0	8	2	.7/25		note 7		30
4N30	100	10	10	4,400[2]	1.0	8	2	.7/25		note 7		30
4N31	50	10	10	4,400[2]	1.2	8	2	.7/25		note 7		30
4N32	500	10	10	4,400[2]	1.0	8	2	.7/35		note 7		30
4N33	500	10	10	4,400[2]	1.0	8	2	.7/35		note 7		30

Note: 1 = V_{RMS}; 2 = V_{DC}; 3 = t_{RISE}/t_{FALL}; 4 = I_F(15 MA, V_{CC}5V, R_B100kΩ, R_L2kΩ); 5 = I_F; (Note); 7 = I_F(200mA; v_{CC} = 10V, R_L = 180Ω).

Type	Package Outline	Current Transfer Ratio (CTR) % min	AT I_f mA	V_{CE} Volts	V_{IORM} d.c. Volts	V_{CE}(SAT) max Volts	AT I_f mA	I_c mA	$t_{ON}t_{OFF}$ Typical µs	ATI$_C$ mA	V_{CC} Volts	R_L Ohm	$V_{(BR)}$ CEO min Volts
For Power Supply Applications													
CNX71	SOT-90B	40	10	0.4	5,300	0.19	10	4	20/20*	2	10	100	30
CNX62A	SOT-230	40	10	0.4	5,300	0.19	10	4	3/3	2	5	100	50
CNX72A	SOT-229	40	10	0.4	5,300	0.19	10	4	26/2.5*	2	5	1,000	30
CNX82A	SOT-231	40	10	0.4	5,300	0.19	10	4	3/3	2	5	100	50
CNX83A	SOT-231	40	10	0.4	5,300	0.19	10	4	3/3	2	5	100	50
CNY17G-1	SOT-231	40	10	5	5,300	0.19	10	4	3/3	2	10	100	70
CNY17G-2	SOT-231	63	10	5	5,300	0.19	10	4	3/3	2	10	100	70
CNY17G-3	SOT-231	100	10	5	5,300	0.19	10	4	3/3	2	10	100	70
CNY17G-4	SOT-231	160	10	5	5,300	0.19	10	4	3/3	2	10	100	70
CNY17GF-1	SOT-231	40	10	5	5,300	0.19	10	4	3/3	2	10	100	70
CNY17GF-2	SOT-231	63	10	5	5,300	0.19	10	4	3/3	2	10	100	70
CNY17GF-3	SOT-231	100	10	5	5,300	0.19	10	4	3/3	2	10	100	70
CNY17GF-4	SOT-231	160	10	5	5,300	0.19	10	4	3/3	2	10	100	70
CNW82	SOT-228	40	10	0.4	8,340	0.19	10	4	3/3	2	5	100	50
CNW83	SOT-228	40	10	0.4	8,340	0.19	10	4	3/3	2	5	100	50
CNX21	SOT-211	20	10	0.4	10,000	0.19	10	4	3/3	2	5	100	30

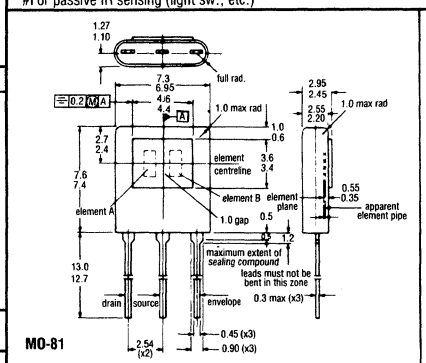
PTC (Positive Temp Coefficient) SILICON PLANAR TEMPERATURE SENSORS

Type	Pkg	Tol ± +	Temp Range °C	R @ 25°C Ω	Thermal Time Cnst (Seconds) Air	Liquid	TC %/°C
KTY81-110	TO-92	1	−55+150	1k	50	5	0.75
KTY81-120	TO-92	2	−55+150	1k	50	5	0.75
KTY81-210	TO-92	1	−55+150	2k	50	5	0.75
KTY81-220	TO-92	2	−55+150	2k	50	5	0.75
KTY83-110	DO-34	1	−55+175	1k	40	1	0.75
KTY83-120	DO-34	2	−55+175	1k	40	1	0.75
KTY84-130	DO-34	3	0+300	1k	40	1	0.75
KTY84-150	DO-34	5	0+300	1k	20	1	0.75
KTY85-110	SOD-80	1	−25+125	1k	20	1	0.75
KTY85-120	SOD-80	2	−25+125	1k	20	1	0.75
KTY85-150	SOD-80	5	−25+125	1k	20	1	0.75
KTY86-205	VO-69	5	−55+175	2k	30	1	0.75

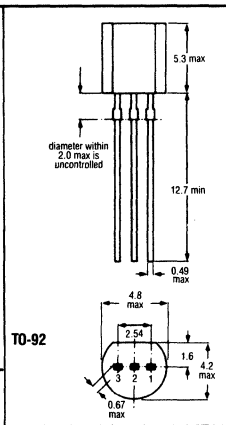
See Philips Power Semiconductors in Vol. A, Section 4800 and Liquid Crystal Displays (LCDs) in Vol. B, Section 2450.

Type	Pkg	Spectral Response µm	Noise Peak/ Peak µV	Peak Sgnl µV	Field of View (deg)
PYROELECTRIC INFRARED SENSORS (CERAMIC) Oper. Voltage: 3-10, Freq. Range: 0.1-20 Hz					
RPW100* Dual Series Opposed	TO-5	6-14 Daylite Filter Silicon Window	25	800	135
RPY222* Series Conn. Inter-digitated pairs	TO-5	6-14 Daylite Filter Silicon Window	26	890	115
KRX10*# Dual Element Series Opposed	Low Profile MO-81	6-14 Daylite Filter Silicon Window	25	930	140
KRX11# Dual Element	Low Profile MO-81	6-14 Optim. Uncoated Silicon Window	30	850	140
Single element types					
RPY109#	TO-5	1-15	15	385	110
P5062#	TO-5	8-14	20	480	110

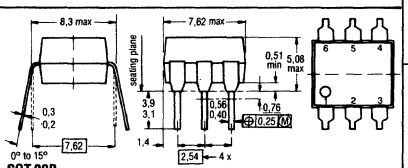
*For passive IR intruder alarms & critical motion sensing.
#For passive IR sensing (light sw., etc.)



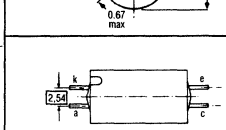
MO-81

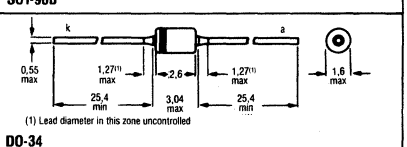


TO-92

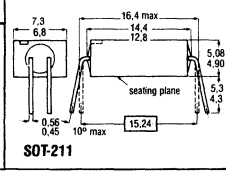


SOT-90B

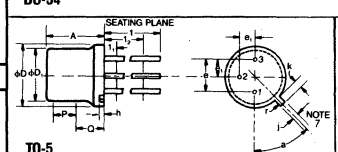




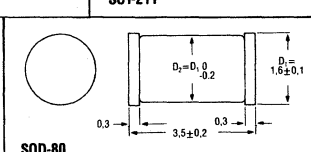
DO-34



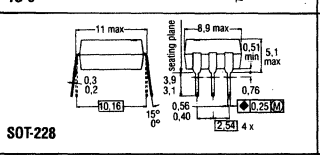
SOT-211



TO-5



SOD-80



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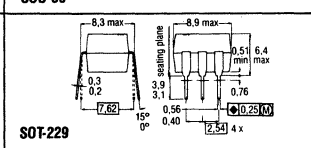

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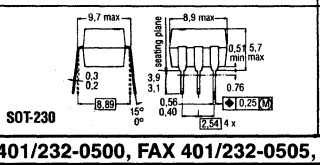

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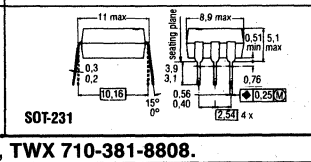

SOT-231

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SLATERSVILLE, RI

PHILIPS DISCRETE SEMICONDUCTORS

OPTOCOUPLERS, INFRARED SENSORS, & TEMPERATURE SENSORS

Type	Package Outline	Nominal Resistance Value (Ω)	Measuring Temperature Range (°C)
TEMPERATURE SENSORS			
KTY81-100 SERIES	SOD-70	1000	−55 to +150
KTY81-200 SERIES	SOD-70	2000	−55 to +150
KTY83-100 SERIES	SOD-68	1000	−55 to +175
KTY84-100 SERIES	SOD-68	1000	0 to +300
KTY85-100 SERIES	SOD-80	1000	−40 to +125
KTY86-205 SERIES	VO-69	2000	−40 to +150

Type	Package Outline	Operating Voltage (V)	Spectral Response (μm)
INFRARED SENSORS STANDARD DUAL ELEMENT			
RPW100	SOT-49E	3 to 10	6.5±0.5 to >14
RPW101	SOT-49M	3 to 10	6.5±0.5 to >14
LOW COST DUAL ELEMENT			
KRX10	MO-81	3 to 10	6.5±0.5 to >14
KRX11	MO-81	3 to 10	Optimized 6 to 14
SINGLE ELEMENT			
P5062	SOT-49H	3 to 10	8.0±0.5 to >14
RPY109	SOT-49H	3 to 10	1.0 to >15

INFRARED LEDS

Type	Package Outline	λ_p Typ (nm)	I_F Max. (mA)	I_{FRM} Max. (mA)	V_R Max. (V)	ϕ_e and I_e at I_F Typ (μW)	(mW/sr)	(mA)	$\theta^1/_2$ Typ (°)	t_r Typ (ns)	t_f Typ (ns)	Crystal
ROUND, 3mm DIAMETER												
CQW58A-1 CQW58A-2	SOD-53F	830	60	1000[1]	5	1000	1 to 5 >3	20	15	30	30	GaAlAs
CQY58A CQY58A-1 CQY58A-2	SOD-53F	930	50	200[1]	5	1000	>2 1 to 5 >3	20	20	3000	3000	GaAs
ROUND, 5mm DIAMETER												
CQW89A CQW89A-1 CQW89A-2	SOD-63D2	830	130	2500[1]	5	8000	>9 >12 >15	100	40	30	30	GaAlAs
CQW89B	SOD-94	830	130	2500[1]	5	8000	>20	100	12	30	30	GaAlAs
CQY89A CQY89A-1 CQY89A-2	SOD-63B2	930	130	1000[2]	5	12000	>9 >12 >15	100	40	1000	1000	GaAs
RECTANGULAR WITH ROUND END												
CQY89F CQY89F-1 CQY89F-2	*	930	130	1000[2]	5	8000	>9 >12 >15	100	30[3]	1000	1000	GaAs

[1]Pulse width = ≥10 μs; δ = 0,01
[2]Pulse width = ≥50 μs; δ = 0,05
[3]Beamwidth = 30° in the plane of the leads and 25° perpendicular to that plane.
*consult data sheet

Type	Package Outline	Lens	V_F @ I_F=10mA (V)	I_F Max (mA)	Luminous Intensity, I_V I_F=2mA (mcd) Min.	Max.	I_F=10mA (mcd) Min.	Max.
GREEN λ=565nm, GaP:N								
PLED-G313A-6	SOD-53E	Directive	2.1	60	—	—	10	22
-7					—	—	16	35
PLED-G314A-3	SOD-53E	Diffusing	2.1	60	—	—	1.6	3.5
-4					—	—	3	7
PLED-G511C-8	SOD-63D	Directive	2.1	60	—	—	30	70
-9					—	—	50	120
PLED-G513C-7	SOD-63D	Directive	2.1	60	—	—	16	35
-8					—	—	30	70
PLED-G514B-4	SOD-63A	Diffusing	2.1	60	—	—	3	7
-5					—	—	5	12
PLED-G541CL-8	SOD-63L	Directive	2.1	60	—	—	30	70
-9					—	—	50	120
PLED-G543CL-7	SOD-63L	Directive	2.1	60	—	—	16	35
-8					—	—	30	70
PLED-G544CL-4	SOD-63L	Diffusing	2.1	60	—	—	3	7
-5					—	—	5	12
PLED-G544KL-4	SOD-85AL	Diffusing	2.1	60	—	—	3	7
-5					—	—	5	12
PLED-G544LL-4	SOD-85BL	Diffusing	2.1	60	—	—	3	7
-5					—	—	5	12
PLED-GR14E-2	SOD-75B	Diffusing	2.1	60	—	—	1	2.2
-3					—	—	1.6	3.5
PLED-GR14F-2	SOD-76A	Diffusing	2.1	60	—	—	1	2.2
-3					—	—	1.6	3.5
PLED-GR14G-2	SOD-77A	Diffusing	2.1	60	—	—	1	2.2
-3					—	—	1.6	3.5

Type	Package Outline	Lens	V_F @ I_F=10mA (V)	I_F Max (mA)	Luminous Intensity, I_V I_F=2mA (mcd) Min.	Max.	I_F=10mA (mcd) Min.	Max.
VISIBLE LEDS CON'T GREEN λ=565nm, GaP:N								
PLED-GR44DL-2	SOD-74L	Diffusing	2.1	60	—	—	1	2.2
-3					—	—	1.6	3.5
PLED-GR44EL-2	SOD-75BL	Diffusing	2.1	60	—	—	1	2.2
-3					—	—	1.6	3.5
PLED-GR44FL-2	SOD-76L	Diffusing	1.75	100	—	—	1	2.2
-3					—	—	1.6	3.5
PLED-GR44GL-2	SOD-77L	Diffusing	2.1	60	—	—	1	2.2
-3					—	—	1.6	3.5

Type	Package Outline	Lens	V_F @ I_F=10mA (V)	I_F Max (mA)	Luminous Intensity, I_V I_F=2mA (mcd) Min.	Max.	I_F=10mA (mcd) Min.	Max.
HYPER RED, λ=650nm, GaAlAs								
PLED-H313A-D	SOD-53E	Directive	1.75	100	3	7	—	—
-E					5	12	—	—
-7					—	—	16	35
-8					—	—	30	70
PLED-H314A-B	SOD-53E	Diffusing	1.75	100	1	2.2	—	—
-C					1.6	3.5	—	—
-5					—	—	5	12
-6					—	—	10	22
PLED-H511C-F	SOD-63D	Directive	1.75	100	10	22	—	—
-G					16	35	—	—
-9					—	—	50	120
-10					—	—	100	220
PLED-H514B-B	SOD-63A	Diffusing	1.75	100	1	2.2	—	—
-C					1.6	3.5	—	—
-5					—	—	5	12
-6					—	—	10	22
PLED-H514CL-9	SOD-63L	Directive	1.75	100	—	—	50	120
-10					—	—	100	200
PLED-H544CL-5	SOD-63L	Diffusing	1.75	100	—	—	5	12
-6					—	—	10	22
PLED-HR14E-3	SOD-75B	Diffusing	1.75	100	—	—	1.6	3.5
-4					—	—	3	7
PLED-HR14F-3	SOD-76A	Diffusing	1.75	100	—	—	1.6	3.5
-4					—	—	3	7
PLED-HR14G-3	SOD-77A	Diffusing	1.75	100	—	—	1.6	3.5
-4					—	—	3	7
PLED-HR44DL-3	SOD-74L	Diffusing	1.75	100	—	—	1.6	3.5
-4					—	—	3	7
PLED-HR44EL-3	SOD-75BL	Diffusing	1.75	100	—	—	1.6	3.5
-4					—	—	3	7
PLED-HR44FL	SOD-76L	Diffusing	1.75	100	—	—	1.6	3.5
-4					—	—	3	7
PLED-HR44GL-3	SOD-77L	Diffusing	1.75	100	—	—	1.6	3.5
-4					—	—	3	7
YELLOW, λ=590nm, GaP: As								
PLED-Y313A-4	SOD-53E	Directive	2.1	30	—	—	3	7
-5					—	—	5	12
PLED-Y314A-2	SOD-53E	Diffusing	2.1	30	—	—	1	2.2
-3					—	—	1.6	3.5
PLED-Y511C-7	SOD-63D	Directive	2.1	30	—	—	16	35
-8					—	—	30	70
PLED-Y513C-6	SOD-63D	Directive	2.1	30	—	—	10	22
-7					—	—	16	35
PLED-Y514B-4	SOD-63A	Diffusing	2.1	30	—	—	3	7
-5					—	—	5	12
PLED-Y541CL-7	SOD-63L	Directive	2.1	30	—	—	16	35
-8					—	—	30	70
PLED-Y543CL-6	SOD-63L	Directive	2.1	30	—	—	10	22
-7					—	—	16	35
PLED-Y544CL-4	SOD-63L	Diffusing	2.1	30	—	—	3	7
-5					—	—	5	12
PLED-Y544KL-3	SOD-85AL	Diffusing	2.1	30	—	—	1.6	3.5
-4					—	—	3	7
PLED-Y544LL-4	SOD-85BL	Diffusing	2.1	30	—	—	3	7
-5					—	—	5	12
PLED-YR14E-2	SOD-75B	Diffusing	2.1	30	—	—	1	2.2
-3					—	—	1.6	3.5
PLED-YR14F-2	SOD-76A	Diffusing	2.1	30	—	—	1	2.2
-3					—	—	1.6	3.5
PLED-YR14G-2	SOD-77A	Diffusing	2.1	30	—	—	1	2.2
-3					—	—	1.6	3.5
PLED-YR44DL-2	SOD-74L	Diffusing	2.1	30	—	—	1	2.2
-3					—	—	1.6	3.5
PLED-YR44EL-2	SOD-75BL	Diffusing	2.1	30	—	—	1	2.2
-3					—	—	1.6	3.5

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PHILIPS DISCRETE SEMICONDUCTORS

OPTOCOUPLERS, INFRARED SENSORS, & TEMPERATURE SENSORS

Type	Package Outline	Lens	V_F @ I_F=10mA (V)	I_F Max (mA)	Luminous Intensity, I_V I_F=2mA (mcd) Min.	Max.	I_F=10mA (mcd) Min.	Max.
VISIBLE LEDS CON'T. YELLOW, λ=590nm, GaP: As								
PLED-YR44FL-2	SOD-76L	Diffusing	2.1	30	—	—	1	2.2
-3					—	—	1.6	3.5
PLED-YR44GI-2	SOD-77L	Diffusing	2.1	30	—	—	1	2.2
-3					—	—	1.6	3.5
BI-COLOR: GREEN (λ=565nm, GaP:N) HYPER-RED (λ=650nm, GaAlAs)								
PLED-T512B	SOD-63A	Diffusing						
GREEN			2.1*	60	—	—	3*	—
HYPER-RED			1.75	100	—	—	3	—
PLED-TR12E	SOD-75B	Diffusing						
GREEN			2.1*	60	—	—	1*	—
HYPER-RED			1.75	100	—	—	1	—

Type	Package Outline	Lens	V_F @ I_F=10mA (V)	I_F Max (mA)	Luminous Intensity, I_V I_F=2mA (mcd) Min.	Max.	I_F=10mA (mcd) Min.	Max.
BI-COLOR GREEN CON'T								
PLED-TR12F	SOD-76A	Diffusing						
GREEN			2.1*	60	—	—	1*	—
HYPER-RED			1.75	100	—	—	1	—
PLED-TR12G	SOD-77A	Diffusing						
GREEN			2.1*	60	—	—	1*	—
HYPER-RED			1.75	100	—	—	1	—
PLED-TR42DL	SOD-74L	Diffusing						
GREEN			2.1*	60	—	—	1*	—
HYPER-RED			1.75	100	—	—	1	—

*I_F=20mA

NOTE: Each visible LED is also available at Lower Luminous Intensity than specified in the above tables. For these LEDs with no specified luminous intensity, the same type number is used, but with the last two characters left blank. For example, if a PLED-G313A-6 with no specified luminous intensity is required, the type number becomes PLED-G313A.

SEMICONDUCTOR LASERS (in order of wavelength)

Type	Package Outline	Wave-Lengths (μm)	Output Power (mW 2 drv/mA)	Theshold Current (mA)	Mode Pattern	Risetime (ns)	Spectral Linewidth (nm)	Beam Diverge (deg/NA)	Special Features
CQL73	T	0.79	1@50	40	Multi	0.5	≤2	≤0.6 mrad	Mini collimator pen
CQF22	T	0.79	2@50	40	Multi	0.5	≤2	—	FC or SMA connector
CQL30	T	0.79	2@60	40	Multi	0.5	≤2	≤0.3 mrad	Collimator pen
CQL20	T	0.79	3@50	40	Multi	0.5	≤2	35°×12°	SOT-241 (9mm)
CQL21	T	0.79	3@50	40	Multi	0.5	≤2	35°×12°	SOT-242 (5.6mm)
OF945	T	0.82	1@100	70	Multi	1.0	6	≤0.2 mrad	Collimator pen
CQF23	T	0.82	2@80	70	Multi	1.0	6	—	FC or SMA connector
CQL70A	T	0.82	2@90	70	Multi	1.0	6	≤0.3 mrad	Collimator pen
CQL75	T	0.82	2@90	70	Multi	1.0	6	≤0.3 mrad	Mini collimator pen
CQL60A	T	0.82	5@90	70	Multi	1.0	6	40°×35°	SOT-148D (9mm)
CQL71A	T	0.82	10@120	90	Multi	1.0	6	≤0.3 mrad	Collimator pen
CQL61A	T	0.82	20@120	90	Multi	1.0	6	32°×25°	SOT-148D (9mm)
CQL72A	T	0.82	20@130	100	Multi	1.0	6	≤0.3 mrad	Collimator pen
CQL62A	T	0.82	40@130	100	Multi	1.0	6	22°×7.5°	SOT-148D (9mm)
CQL31A	T	0.83	20@100	60	Single	1.0	0.5	≤0.3 mrad	Collimator pen
516CQF-B	SOT-184	0.85	3@90	70	Multi	0.5	6	—	TO-5; MM pigtail
CQF52	T	1.3	0.3@30	25	Multi	0.5	—	—	TO-5; SM pigtail
CQF51	T	1.3	1.5@35	25	Multi	0.5	4	—	TO-5; SM pigtail
CQF56	T	1.3	1.5@50	—	Multi	—	—	—	DIL-14; SM pigtail
CQF50	T	1.3	2@35	25	Multi	0.5	5	—	TO-5; MM pigtail
CQF55	T	1.3	2@50	—	Multi	—	—	—	DIL-14; MM pigtail
CQF58	T	1.55	1@60	—	Multi	—	—	—	DIL-14; SM pigtail
CQF53	T	1.55	1.5@40	25	Multi	0.5	6	—	TO-5; SM pigtail
CQF57	T	1.55	1.5@60	—	Multi	—	—	—	DIL-14; MM pigtail

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OPTOELECTRONIC DEVICES

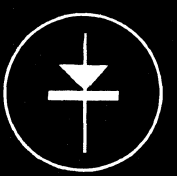
CLAIREX MAKES THEM ALL!

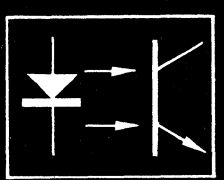
PHOTOCONDUCTIVE CELLS

Clairex offers a complete line of cells with spectral response in the visible and near infrared ranges. Units are available in a variety of sizes, in plastic, metal or glass packages with varying resistance and voltage combinations.

PHOTODIODES

A series of silicon planar photodiodes that may be operated in either the diode or voltaic mode as well as a series of monolithic integrated circuits for use as silicon digital output detectors.



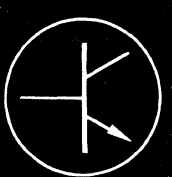


OPTOISOLATORS - OPTOCOUPLERS - PHOTOMODS ®

These three terms are used interchangeably to describe a device that utilizes a high quality, long-life light source with a photodetector in a single, light-tight encapsulated or hermetic package. Variations in output of the light source produce changes in the output of the photodetector. Thus the input and output circuits are isolated from each other electrically. Clairex offers a line of standard units with a variety of electrical characteristics in a variety of packages, as well as engineering assistance to produce custom units.

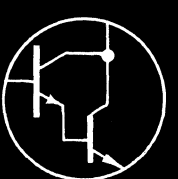
PHOTOTRANSISTORS

Clairex manufacturers several generic series of phototransistors in plastic and hermetically sealed packages that can be produced with or without lenses. In addition, custom units can be produced to meet your specific requirements.



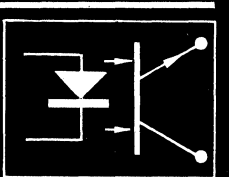
PHOTODARLINGTONS

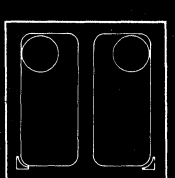
Standard and custom photodarlingtons are also available in the same variety of packages as transistors.



OPTICAL INTERRUPTERS

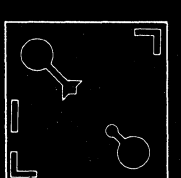
Optical interrupters are similar to optoisolators in that they contain a photodetector and a light source with an air gap between the two so that a light beam can be interrupted by a mechanical device. Clairex offers a wide variety of packages, mountings, and configurations with a variety of electrical characteristics in each package. Custom units available too.





OPTO ARRAYS

Clairex welcomes inquires for custom designed arrays of emitter and sensor chips. We supply arrays positioned in precise patterns or multiple chip patterns designed with close and precise spacing and with multiple lead headers, ceramic or PC board substrate or with molded boards and housings.

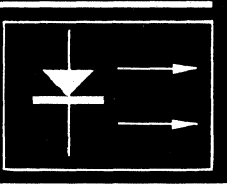


OPTO CHIPS

Clairex offers a broad range of standard designs of photovoltaic, photodoide phototransistor, and photodarlington chips. Custom chip design capabilities also exist. All chips have gold backing suitable for either eutectic or conductive epoxy ohmic die attachment.

LIGHT EMITTING DIODES

Clairex supplies a series of LED's that are designed for a variety of optoelectronic applications. Some units are designed to emit light in the visible red spectrum, some at 800 nanometers and others at 940 nanometers. Selection of the proper unit depends upon the application.



For detailed specifications, write or call

CLAIREX ELECTRONICS, A Division of Clairex Corporation

560 South Third Avenue, Mount Vernon, NY 10550

Telephone (914) 664-6602 • FAX: 914-664-6449

- Photoconductive Cells
- Interrupter Switches
- Phototransistors and Photodarlingtons
- Selenium Photovoltaic Cells
- Vactrols (Opto-Isolators)

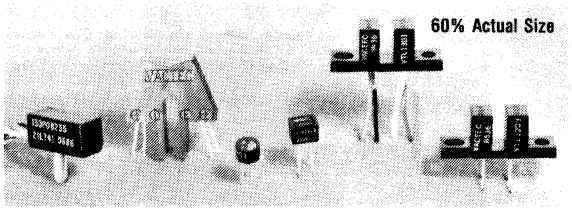
EG&G VACTEC

INDUSTRY'S BROADEST OPTOELECTRONIC LINE

- Standard Silicon and Blue-Enhanced Photovoltaic Cells, Blue-Enhanced Photodiodes, and PIN Photodiodes

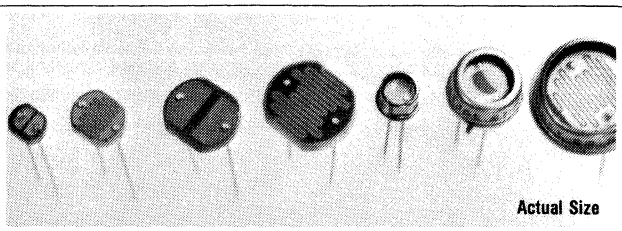
RETROREFLECTIVE & INTERRUPTER SWITCHES (SLOTTED)

Standard and custom optical switches—infrared GaAs LED and silicon phototransistor interrupters available in sealed housing of I-R transmitting plastic or opaque plastic with open apertures. Three retro styles: arrow, TO-18, and cubic.



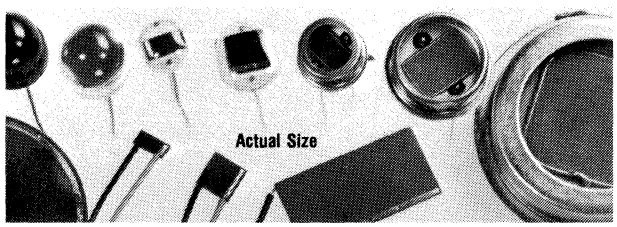
PHOTOCONDUCTIVE CELLS

Vactec light dependent resistors (LDR's) are available in three hermetic enclosures (TO-18, TO-5, TO-8) and 4 ceramic types. Ceramic types have automatically inserted wires which insure perfect contact integrity. Six materials of CdS, CdSe and CdSeS-CdS mixtures with spectral response peaks from 565-735 nm. Each material has a variety of sensitivities to satisfy all requirements.



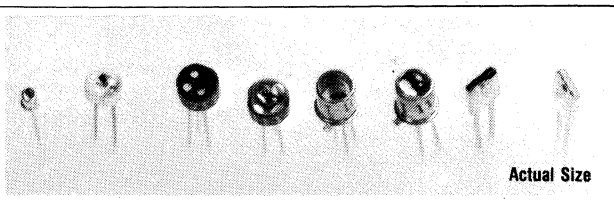
SILICON PHOTOVOLTAIC CELLS

Three processes: BLUE ENHANCED, LOW CAPACITANCE, STANDARD SOLAR. All available in a variety of hermetic, ceramic, as chips, or with flying leads. The BLUE ENHANCED cells are unique large area detectors with high U-V sensitivity to as low as 200 nm. Almost non-existent U-V enhancement effect with stability equivalent to high quality photodiodes. LOW CAPACITANCE cells have fast response less than 15μS with 10KΩ load. The high shunt impedance is desirable for driving amplifiers. SOLAR cells have high V_{OC} at low illumination (typ 200mV at .05mW/cm^2). Linear over wide illumination range.



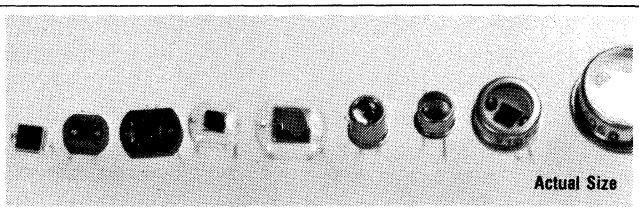
PHOTOTRANSISTORS — LED'S — PHOTODARLINGTONS — LIGHT ACTIVATED SWITCHES (LAS)

Phototransistors and photodarlingtons are NPN passivated—4 chip sizes of 25, 40, 50, and 60, mil square in TO-18, ceramic, coaxial, and lateral (side looking) packages. High light current at very low drive current ideal for instrumentation applications. GaAs I-R LED's with excellent stability in TO-18, T-1, T-1¾, lateral packages. LAS (light activated switches) have high sensitivity with Schmitt Trigger output. New—high power GaAlAs I-R LED's in TO-18, T-1, T-1¾ packages.



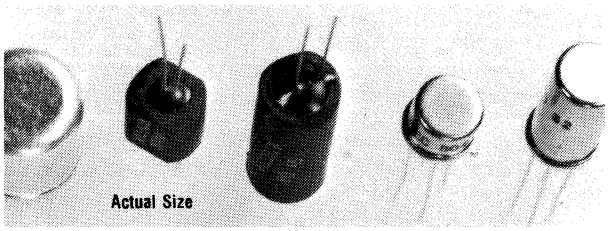
PHOTODIODES

BLUE ENHANCED photodiodes are extremely low dark current devices with excellent response in the U-V. Less than 10pA (I_D) for small chips. Large area diodes (VTB5051) 14.8mm^2 active area with 1.2A/(W/cm^2) at 365nm and I_D of 250pA max. FAST photodiodes have low capacitance. Use with reverse bias for fast response time and excellent linearity. Ideal for remote I-R sensor digital controls.



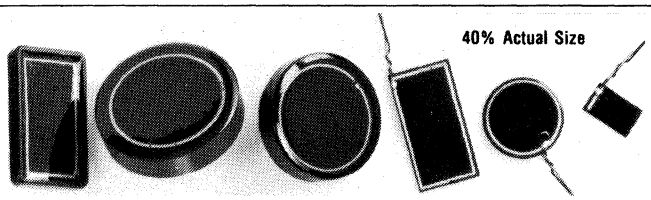
VACTROLS

Optical couplers using LED's, neons, or incandescent lamps as the emitter and Vactec photoconductive cells (LDR's) as the detector. For noiseless switching and signal monitors for audio. Neon types to sense telephone ring. LED types for triac gate control. Incandescent types for low cost true RMS sensor as voltage regulator or control of constant wattage heater. Five package types include 2 hermetic.



SELENIUM PHOTOVOLTAIC CELLS

Large area detectors for direct meter drive or in conjunction with amplifier. Spectral response peaks at 575 nm and is close to visible response. Available with integral #102 filter to match standard observer curve (CIE). Available in many flat or round cells with or without leads—also in 9 package styles including 2 hermetic.



WRITE FOR CUSTOM DETECTORS OR ASSEMBLIES ALL PRODUCTS

EG&G VACTEC 10900 Page Blvd. • St. Louis, Mo. 63132 • (314) 423-4900 • TWX 910-764-0811 • FAX (314) 423-3956

HEI inc.
HYBRID ELECTRONICS DIVISION

OPTICAL SWITCHES

Box 5000
1495 Steiger Lake Lane
Victoria, MN 55386
Phone: 612-443-2500
FAX: 612-443-2668

HEI has been designing and building optical switches and assemblies to the strictest industrial and military standards for 20 years. Today HEI produces standard optical switches in seventeen basic configurations with over 100 variations, including direct replacement parts for most industry standard switches.
The company is also a leader in designing and building custom optical switches for special application requirements. Compact, accurate and dependable HEI optical switches are suitable for any optical switching application.

OPTICAL SWITCH APPLICATIONS

- Optical Encoding
- Limit Switching
- Paper Tape Readers
- Paper Passage Detector
- Rotational Speed Monitoring
- Counter Circuits
- Flow Metering
- Precision Position Detection
- End-of-Tape Detection

OPTICAL SWITCH FEATURES

- Over 100 packaging and electrical variations
- TTL, DTL, CMOS and Analog Outputs
- Pin or Wire Leads (12-in. standard)
- Variety of Gap Sizes
- Special Aperture Designs

CUSTOM OPTICAL SWITCHES

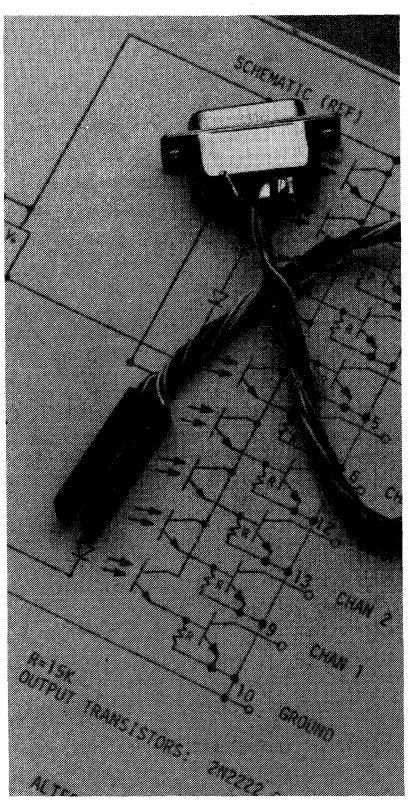
HEI also offers complete custom design and build services. From prototype to final production, HEI engineers assist customers in development of reliable and economical designs. The HEI custom optical switch process offers design options to customers in four categories. HEI engineers assist in setting specifications, and then develop prototypes for application testing.

Mechanical—
selection of housing size and format, mounting detail

Electrical—
signal characteristics, input/output requirements

Optical—
number of channels, light frequency, aperture size, sensor distance

Interface—
lead length-pin, wire or connector



HEI CUSTOM APPLICATION EXPERIENCE

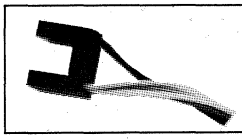
- Photo Arrays
- Vertical Format Readers
- Optical Encoders
- End-of-Tape Sensors
- Ribbon Edge Sensors
- Card and Tape Readers
- Drip Sensors
- Precision Position Sensing
- Indexing
- Linear Measurement

PARTIAL LIST OF 100 SWITCHES

Characteristic		I_C ON				I_C OFF		t ON	t OFF	$V_{CE\ (SAT)}$		$V_{F\ (LED)}$		BV_{CEO}	BV_{ECO}	I_C	GAP	Schematic	Output
Test Conditions		V_{CE}, I_F As Shown, R_L = 0				V_{CE} As Shown, I_F = 0		I_F = 20mA, R_L = 1k Ω		I_C As Shown, I_F = 35mA		I_F As Shown							
Units		mA			V	nA	V	μS		V (SAT)	mA	V	mA	V		mA	IN.		
	HEI	MIN	TYP	I_F	V_{CE}	TYP	V_{CE}	(t_d+t_r) TYP	$(t_{st}+t_f)$ TYP	MAX	I_C	MAX	I_F	MIN	MIN	MAX	NOM		
PKG13	10501	.5	1.0	35	5	<100	5	200	300	.4	.5	1.5	40	20	5	5	.060	12	Transistor
	*10503	.5	1.0	35	5	<100	5	200	300	.4	.5	1.5	40	20	5	5	.060	12	Transistor
	10509	1.5	2.0	35	5	<100	5	350	350	1.0	.5	1.5	40	20	5	5	.060	13	Darlington
	*10511	1.0	2.0	35	5	<100	5	350	350	1.0	.5	1.5	40	20	5	5	.060	13	Darlington
	10513	3.0	4.5	35	5	<100	5	20	120	<.1	.5	1.5	40	25	5	10	.060	14	Amplifier
	*10515	3.0	4.5	35	5	<100	5	20	120	<.1	.5	1.5	40	25	5	10	.060	14	Amplifier
PKG14	10502	.5	1.0	35	5	<100	5	200	300	.4	.5	1.5	40	20	5	5	.200	12	Transistor
	*10504	.5	1.0	35	5	<100	5	200	300	.4	.5	1.5	40	20	5	5	.200	12	Transistor
	10510	1.0	2.0	35	5	<100	5	100	250	1.0	.5	1.5	40	20	5	5	.200	13	Darlington
	*10512	1.0	2.0	35	5	<100	5	100	200	1.0	.5	1.5	40	20	5	5	.200	13	Darlington
	10514	3.0	4.5	35	5	<100	5	15	150	<.1	.5	1.5	40	25	5	10	.200	14	Amplifier
	*10516	3.0	4.5	35	5	<100	5	15	150	<.1	.5	1.5	40	25	5	10	.200	14	Amplifier
PKG15	10517		N1	2.0	5	N2	5	10	50	<.1	.5	1.5	40	30	5	50	.060	15	Schmitt Trigger
	*10519		N1	2.0	5	N2	5	10	50	<.1	.5	1.5	40	30	5	50	.060	15	Schmitt Trigger
	10529		N1	4.5	5	<100	5	20	120	<.1	.5	1.5	40	25	5	50	.060	16	Dual Amplifier
	*10531		N1	4.5	5	<100	5	20	120	<.1	.5	1.5	40	25	5	50	.060	16	Dual Amplifier
	*10535		N1	2.0	5	N2	5	10	50	<.1	.5	1.5	40	30	5	50	.060	17	Dual Schmitt
PKG16	10518		N1	3.0	5	N2	5	15	40	<.1	.5	1.5	40	30	5	50	.200	15	Schmitt Trigger
	*10520		N1	3.0	5	N2	5	15	40	<.1	.5	1.5	40	30	5	50	.200	15	Schmitt Trigger
	10530		N1	4.5	5	<100	5	15	150	<.1	.5	1.5	40	25	5	50	.200	16	Dual Amplifier
	*10532		N1	4.5	5	<100	5	15	150	<.1	.5	1.5	40	25	5	50	.200	16	Dual Amplifier
	*10536		N1	3.0	5	N2	5	15	40	<.1	.5	1.5	40	30	5	50	.200	17	Dual Schmitt
PKG17	10701	1.0 / .5	2.5 / 1.0	35	5	<100	5	20 / 150	250 / 250	.5	.5	1.5	40	25	5	15	.125 / .500	12	Transistor N3
	10702	2 / 2	4.5 / 3.0	35	5	<100	5	25 / 250	350 / 300	1.0	.5	1.5	40	20	5	30	.125 / .500	13	Darlington N3
	10703	4.5 / 2	4.5 / 4.5	35	5	<100	5	10 / 40	80 / 80	.1	.5	1.5	40	25	5	100	.125 / .500	14	Amplifier N3
	10704	N1	2.0 / 3.0		5	N2	5	50 / 50	25 / 35	.1	.5	1.5	40	30	5	50	.125 / .500	15	Schmitt Trigger N3
	10710											1.55	50						LED

THE HEI QUALITY COMMITMENT

HEI has instituted a statistical process manufacturing control system to insure that each component meets performance specifications dependably and consistently. The company performs 100-percent electrical inspection of every device before shipment. As a result of these quality assurance processes HEI has been qualified as a dock-to-stock supplier by a number of original equipment manufacturers.



* 12-inch 28-AWG wires custom lengths available

N1 Schmitt trigger typical switch threshold ($I_{F(ied)}$) mA
N2 Schmitt trigger quiescent current = 1.2mA TYP.
N3 10710 was used as the light source I_F = 35mA V_{CE} = 5V
Standard Aperture .060 GAP .010 x .040"
Standard Aperture .200 GAP .020 x .040"
ENVIRONMENTAL SPECIFICATIONS
Operating Temperature 0—70°C
Storage Temperature -40—+80°C

HEI inc.
HYBRID ELECTRONICS DIVISION
BOX 5000 • 1495 STEIGER LAKE LANE • VICTORIA MN 55386 • PHONE: 612-443-2500 • FAX: 612-443-2668

NEC Electronics Inc.
401 Ellis St., Mountain View, CA 94039 • 415/960-6000

OPTOELECTRONIC DEVICES

Light Emitting Diodes

Remote Control

Part Number	Material	Features	Absolute Maximum Ratings (T_a = 25°C)			Typical Characteristics (T_a = 25°C)			
			P_d (mW)	I_F (mA)	T_{stg} (°C)	V_F TYP. (V) (I_F = 30 mA)	I_R TYP. (μA) (V_R = 3 V)	λp TYP. (nm) (I_F = 30 mA)	P_o TYP. (mW) (I_F = 30 mA)
SE301A	GaAs	High output High reliability	150	100	−65 to +125	1.2 (I_F = 50 mA)	0.01	940 (I_F = 50 mA)	6 (I_F = 50 mA)
SE302A	GaAs	Mini size	75	50	−30 to +80	1.2	0.01	940	1.5
SE303A-C	GaAs	High output Wide radiation angle	150	100	−40 to +100	1.25 (I_F = 50 mA)	0.01 (V_R = 5 V)	940 (I_F = 50 mA)	8 (I_F = 50 mA)
SE304	GaAs	Lateral direction output	100	50	−40 to +100	1.2	0.01	940	1.5
SE306	GaAs	Lateral direction output with a lens	100	50	−40 to +100	1.1 (I_F = 10 mA)	0.01	940 (I_F = 10 mA)	0.5 mW/sr (I_F = 10 mA)
SE307-C	GaAs	ULTRA High output Narrow radiation angle	150	100	−40 to +100	1.25 (I_F = 50 mA)	0.01 (V_R = 5 V)	940 (I_F = 50 mA)	30 mW/sr (I_F = 50 mA)
SE308	GaAs	Small package Lateral direction output	100	50	−40 to +100	1.14 (I_F = 20 mA)	0.01	940 (I_F = 20 mA)	0.85 mW/sr (I_F = 20 mA)
SE310	GaAs	High output Small package	150	60	−40 to +100	1.25 (I_F = 50 mA)	0.01 (V_R = 5 V)	940 (I_F = 50 mA)	11 mW/sr (I_F + 50 mA)
SE313	GaAs	ULTRA High output Middle radiation angle	150	100	−40 to +100	1.25 (I_F = 50 mA)	0.01 (V_R = 5 V)	940 (I_F = 50 mA)	25 mW/sr (I_F = 50 mA)
SE1003-C	GaAlAs on GaAs	ULTRA High output Wide radiation angle	150	100	−40 to +100	1.27 (I_F = 50 mA)	0.01 (V_R = 5 V)	950 (I_F = 50 mA)	20 mW/sr (I_F = 50 mA)

PIN Photo Diodes

Remote Control

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Typical Characteristics (T_a = 25°C)		
		V_R (V)	P_D (mW)	T_{stg} (°C)	S_{IR} TYP* (μA) (V_R = 5 V)	I_R (nA) (V_R = 10 V)	t_r (ns) (R_L = 1 kΩ) (V_R = 5 V)
PH302	Low cost PIN photo diode	32	150	−40 to +80	6 (S = 50 nA/lx)	to 30	50
PH302B	Low cost PIN photo diode PH302 with visible cut filter	32	150	−40 to +80	5 (S = 32 nA/lx)	to 30	50
PH302C	Low cost PIN photo diode Built-in visible cut filter	32	150	−40 to +80	5 (S = 32 nA/lx)	to 30	50
PH309	Low cost PIN photo diode Small Package with Lens Built-in visible cut filter	32	150	−40 to +80	5 (S = 32 nA/lx)	to 10	30
PH310	Low cost PIN photo diode Ultra Small Package with Lens Built-in visible cut filter	32	150	−40 to +100	5 (S = 32 nA/lx)	to 10	30
PH320	Low cost PIN photo diode Ultra Small Package with Lens Built-in visible cut filter	32	150	−40 to +100	4.3	to 10	30

*Measured with an infrared LED (λp = 940 nm).
**Measured with a tungsten filament lamp operated at a color temperature of 2 854 K.

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OPTOELECTRONIC DEVICES

PIN Photo Diodes (cont.)

Optical Disk

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)				Typical Characteristics (T_a = 25°C)							
						I_D (nA)		S(A/W)			t_r, t_f (ns)		
		V_R (V)	P (mW)	T_{opt} (°C)	T_{stg} (°C)	V_R (V)	Max.	V_R (V)	λ (nm)	Typ.	V_R (V)	R (kΩ)	Typ.
PH311	Small Package Multi Detecting Area	20	20	−20 to +80	−40 to +100	15	4	15	780	0.3	15	1	1
PH312	Small Package Multi Detecting Area	20	20	−20 to +80	−40 to +100	15	4	15	780	0.52	15	1	1
PH313	Small Package Multi Detecting Area	20	20	−20 to +80	−40 to +100	15	4	15	780	0.52	15	1	1
PH314	Small Package Multi Detecting Area	20	20	−20 to +80	−40 to +100	15	4	15	780	0.52	15	1	1

Photo Transistors

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)				Typical Characteristics (T_a = 25°C)		
		P_C (mW)	I_C (mA)	V_{CEO} (V)	T_{stg} (°C)	I_{CEO} (nA) V_{CE} = 10 V L = 0	$V_{CE(sat)}$(V) (L = 1000 lx)	L_L (μA) V_{CE} = 2 V (L = 100 lx)
PH101	High sensitivity (Darlington Tr.)	100	50	20	−30 to +80	to 500 (V_{CE} = 15 V)	to 1.5	10 mA to
PH102	High speed	100	40	20	−30 to +80	to 200	to 0.3	50 to
PH103	High sensitivity (Darlington Tr.)	100	50	30	−40 to +100	to 400	to 1.5	2 mA to
PH104	High speed	100	40	30	−40 to +100	to 100	to 0.3	20 to
PH105	High reliability	150	50	30	−40 to +100	to 200	to 0.3	500 to (V_{CE} = 10 V)
PH106	High speed Built-in visible cut filter	100	40	30	−40 to +100	to 100	to 0.3	60 to
PH107	High sensitivity Built-in visible cut filter	100	50	30	−40 to +100	to 400	to 1.5	10 mA to
PH108	Small package High speed	100	40	30	−40 to +100	to 100	to 0.3 (I_C = 0.5 mA) (H = 5 mW/cm²)	0.3 mA to (V_{CE} = 5 V) (H = 0.5 mW/cm²)
PH110	Small package Built-in visible cut filter	100	40	30	−40 to +100	to 100	to 0.3 (I_C = 200 μA) (H = 5 μW/cm²)	200 μA to (V_{CE} = 5 V) (H = 0.5 μW/cm²)

Photo ICs

Photo Interrupter

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Typical Characteristic (T_a = 25°C)	
		V_{CC} (V)	I_{OL} (mA)	T_{opt} (°C)	I_{CCL} (mA) (V_{CC} = 5 V)	V_{OL}(V) (I_{OL} = 16 mA) (V_{CC} = 5 V)
PH502HR	Built-in Schmitt Trigger circuit Active "HIGH" Built-in pull up resistor	17	50	−30 to +85	to 5	to 0.4
PH502HC	Built-in Schmitt Trigger circuit Active "HIGH" Open collector output	17	50	−30 to +85	to 5	to 0.4 (R_L = 280Ω)

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OPTOELECTRONIC DEVICES

Photo ICs (cont.)

Photo Interrupter

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Typical Characteristic (T_a = 25°C)	
		V_{CC} (V)	I_{OL} (mA)	T_{opt} (°C)	I_{CCL} (mA) (V_{CC} = 5 V)	V_{OL}(V) (I_{OL} = 16 mA) (V_{CC} = 5 V)
PH502LR	Built-in Schmitt Trigger circuit Active "LOW" Built-in pull up resistor	17	50	−30 to +85	to 5	to 0.4
PH502LC	Built-in Schmitt Trigger circuit Active "LOW" Open collector output	17	50	−30 to +85	to 5	to 0.4 (R_L = 280Ω)

Optical Disk

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)				Typical Characteristics (T_a = 25°C)								
						f_T	V_{BIAS}				V_O (mV)		S (A/W)	
		V_R (V)	P (mW)	T_{opt} (°C)	T_{stg} (°C)	I_{CC} (nA) Typ.	R_1 (kΩ)	R_2 (kΩ)	(V)	(MHz) Typ.	I_{IN} (μA)	Min.	λ (nm)	Typ.
PH503	Built-in I-V Amplifiers Small transparent 16 pin plastic package	20	20	−20 to +80	−40 to +100	14.1	18	13	2.5 ± 0.1	2	1.7	80	780	0.3

Optoisolators

Can Type

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_C (mA)	CTR (%)	t_r (μs) (Typ.)	t_f (μs) (Typ.)
PS1001	5 pin, Hermetic CAN	1 k (DC)	60	50	20 to	5	5

Multichannel Type

Part Number*	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_C (mA)	CTR (%)	t_r (μs) (Typ.)	t_f (μs) (Typ.)
PS2501-1 PS2501L-1	4 pin DIP 1 channel	5 k	80	50	80 to 600	3	5
PS2501-2 PS2501L-2	8 pin DIP 2 channels						
PS2501-3 PS2501L-3	12 pin DIP 3 channels						
PS2501-4 PS2501L-4	16 pin DIP 4 channels						
PS2502-1 PS2502L-1	4 pin DIP 1 channel	5 k	80	200	200 to	100	100
PS2502-2 PS2502L-2	8 pin DIP 2 channels	5 k	80	160	200 to	100	100
PS2502-3 PS2502L-3	12 pin DIP 3 channels						
PS2502-4 PS2502L-4	16 pin DIP 4 channels						
PS2503-1 PS2503L-1	4 pin DIP 1 channel	5 k	50	30	100 to 400	8 (R_L = 10 kΩ)	60 (R_L = 10 kΩ)

*L suffix designates lead formed (gullwing) package for surface mount applications.

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OPTOELECTRONIC DEVICES

Optoisolators (cont.)

Multichannel Type (cont.)

Part Number*	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_C (mA)	CTR (%)	t_r (μs) (Typ.)	t_f (μs) (Typ.)
PS2503-2 PS2503L-2	8 pin DIP 2 channels	5 k	50	30	100 to 400	8 (R_L = 10 kΩ)	60 (R_L = 10 kΩ)
PS2503-3 PS2503L-3	12 pin DIP 3 channels						
PS2503-4 PS2503L-4	16 pin DIP 4 channels						
PS2505-1 PS2505L-1	4 pin DIP 1 channel	5 k	±80	50	80 to 600	3	5
PS2505a-2 PS2505aL-2	8 pin DIP 2 channels						
PS2505-3 PS2505L-3	12 pin DIP 3 channels						
PS2505-4 PS2505L-4	16 pin DIP 4 channels						
PS2506-1 PS2506L-1	4 pin DIP 1 channel	5 k	±80	200	200 to	100	100
PS2506-2 PS2506L-2	8 pin DIP 2 channels	5 k	±80	160	200 to	100	100
PS2506-3 PS2506L-3	12 pin DIP 3 channels						
PS2506-4 PS2506L-4	16 pin DIP 4 channels						

*L suffix designates lead formed (gullwing) package for surface mount applications.

Surface Mount Type

Part Number**	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_C (mA)	CTR (%)	t_r (μs) (Typ.)	t_f (μs) (Typ.)
PS2701-1 PS2701-1-E3 PS2702-1-E4	Surface mount 1 channel	2.5 k	50	80	50 to 300	3	5
PS2701-2	Surface mount 2 channels						
PS2701-4	Surface mount 4 channels						
PS2702-1 PS2702-1-E3 PS2702-1-E4	Surface mount 1 channel	2.5 k	50	200	200 to	100	100
PS2702-2	Surface mount 2 channels	2.5 k	50	160	200 to	100	100
PS2702-4	Surface mount 4 channels						
PS2703-1 PS2703-1-E3 PS2703-1-E4	Surface mount 1 channel	2.5 k	50	30	50 to 4000	10 (R_L = 1 kΩ)	10 (R_L = 1 kΩ)
PS2703-2	Surface mount 2 channels						

**E3, E4 suffix denote tape and reel versions. Please consult data book.

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OPTOELECTRONIC DEVICES

Optoisolators (cont.)

Surface Mount Type

Part Number**	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_C (mA)	CTR (%)	t_r (μs) (Typ.)	t_f (μs) (Typ.)
PS2703-4	Surface mount 4 channels	2.5 k	50	30	50 to 400	10 (R_L = 1 kΩ)	10 (R_L = 1 kΩ)
PS2705-1 PS2705-1-E3 PS2705-1-E4	Surface mount 1 channel	2.5 k	±50	80	50 to 300	3	5
PS2705-2	Surface mount 2 channels						
PS2705-4	Surface mount 4 channels						
PS2706-1 PS2706-1-E3 PS2706-1-E4	Surface mount 1 channel	2.5 k	±50	200	200 to	100	100
PS2706-2	Surface mount 2 channels	2.5 k	±50	160	200 to	100	100
PS2706-4	Surface mount 4 channels						
PS2707-1 PS2707-1-E3 PS2707-1-E4	Surface mount 1 channel	2.5 k	50	30	50 to 400	10 (R_L = 1 kΩ)	10 (R_L = 1 kΩ)
PS2707-2	Surface mount 2 channels						
PS2707-4	Surface mount 4 channels						

**E3, E4 suffix denote tape and reel versions. Please consult data book.

6 Pin Type

Part Number*	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_C (mA)	CTR (%)	t_r (μs) (Typ.)	t_f (μs) (Typ.)
PS2010 MCT2 4N25		2 k	80	100	20 to	4	4
PS2601 PS2601L	with base pin	5 k	80	50	80 to 600	3	5
PS2602 PS2602L							
PS2603 PS2603L	with base pin	5 k	80	200	200 to	100	100
PS2604 PS2604L							
PS2605 PS2605L	with base pin	5 k	±80	50	80 to 600	3	5
PS2606 PS2606L							
PS2607 PS2607L	with base pin	5 k	±80	200	200 to	100	100

*L suffix designates lead formed (gullwing) package for surface mount applications.

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OPTOELECTRONIC DEVICES

Optoisolators (cont.)

6 Pin Type

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_O (mA)	CTR (%)	t_{PHL} (μs) (Typ.)	t_{PHL} (μs) (Typ.)
PS2608 PS2608L	with base pin	5 k	±80	200	200 to	100	100
PS2621 PS2621L	with base pin	5 k	150	50	20 to 50	3	5
PS2622 PS2622L							
PS2625 PS2625L	with base pin	5 k	±150	50	20 to 50	3	5
PS2626 PS2626L							
PS2633 PS2633L	with base pin	5 k	80	150	1000 to 15000	100	100
PS2634 PS2634L							
PS2651	with base pin	5 k	80	50	50 to 400	3	5
PS2652							
PS2653	with base pin	5 k	80	200	200 to	100	100
PS2654							

*L suffix designates lead formed (gullwing) package for surface mount applications.

High Speed Type

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_O (mA)	CTR (%)	t_{PHL} (μs) (Typ.)	t_{PHL} (μs) (Typ.)
PS2006B (6N136)	8 pin DIP	3 k	25	8	15 to	0.3	0.8
PS2041	6 pin DIP	2.5 k	25	8	15 to	0.3	0.8
PS2043	8 pin DIP						
PS2044	8 pin DIP, (alternate pinout)						

Ultra High Speed Type

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)		
		BV ($V_{r.m.s.}$)	I_F (mA)	I_O (mA)	CTR (%)	t_{PHL} (μs) (Typ.)	t_{PHL} (μs) (Typ.)
PS2007B (6N137)	8 pin DIP, logic output	2.5 k (DC)	10	50	600	50	50

Photo SCR Coupler

Part Number	Features	Absolute Maximum Ratings (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)	
		BV ($V_{r.m.s.}$)	V_{DRM} (V)	I_T (mA)	I_{FT} (mA)	t_{on} (μs) (Typ.)
PS3001 (1)	6 pin	2.5 k	200	300	to 12	20 I_{FT} = 50 mA R_{GK} = 27 kΩ V_D = 6 V R_L = 10 Ω
PS3002(1)	6 pin	2.5 k	400	300	to 12	
PS3603	6 pin	5 k	600	300	to 10	

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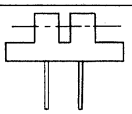
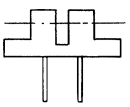
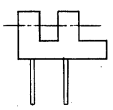
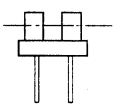
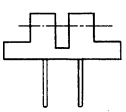
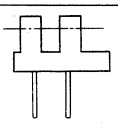
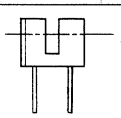
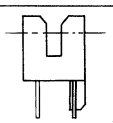
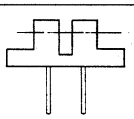
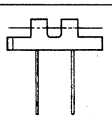
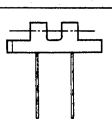
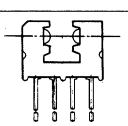
OPTOELECTRONIC DEVICES

Photo Interrupters

Transistor Output Type

Part Number	Outline	Characteristics (T_a = 25°C)			Features
		CTR (%)	I_F	V_{CE}	
PS4001		20 to	10 (mA)	2 (V)	Darlington Tr. Aperture: 1 mm□ 4 pin
PS4003		15 to	10	2	Darlington Tr. 4 pin
PS4005		20 to	10	2	Darlington Tr. 4 pin
PS4007		20 to	10	2	Darlington Tr. 4 pin
PS4008		0.5 to	10	2	Single Tr. High speed (t_r, t_f = 5 µs) 4 pin
PS4009		20 to	10	2	Darlington Tr. 4 pin
PS4010		20 to	10	2	Darlington Tr. 4 pin
PS4011		20 to	10	2	Darlington Tr. Aperture: 1 mm□ 4 pin
PS4014		0.5 to	10	2	Single Tr. High speed (t_r, t_f = 5 µs) 4 pin
PS4501		2.5 to	10	2	Single Tr. Aperture: 0.5 mm slit 4 pin
PS4502		200 to	5	2	Darlington Tr. Aperture: 0.5 mm slit High CTR 4 pin
PS4601		1.5 to	10	2	One-piece molded Single Tr. 4 pin

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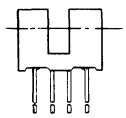
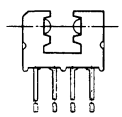
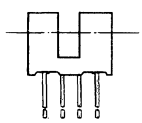
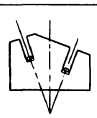
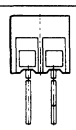
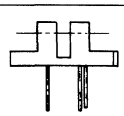
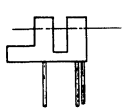
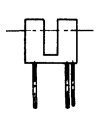
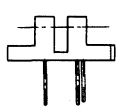
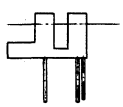
OPTOELECTRONIC DEVICES

Photo Interrupters (cont.)

Transistor Output Type

Part Number	Outline	Characteristics (T_a = 25°C)			Features
		CTR (%)	I_F	V_{CE}	
PS4602		1.5 to	10	2 (V)	One-piece molded PS4601 with a light-shielded case Single Tr. 4 pin in-line
PS4651		40 to	5	2	One-piece molded Darlington Tr. 4 pin
PS4652		40 to	5	2	One-piece molded PS4651 with a light-shielded case Darlington Tr. 4 pin
PS6001A		100 (μA) to	≈30	5	Photo Reflective Sensor Single Tr. 4 pin
			speculum reflecting surface		
PS6002		400 (μA) Typ.	10	2	Photo Reflective Sensor Single Tr. High sensitivity 4 pin
			white reflecting surface		

IC Output Type

Part Number	Outline	Characteristics (T_a = 25°C)		Features
		I_{FLH} (mA)	(V_{CC} (V)	
PS5001HC		to 5	5 R_L = 280 Ω	Built-in Schmitt Trigger circuit Active "HIGH" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5002HC		to 5	5 R_L = 280 Ω	Built-in Schmitt Trigger circuit Active "HIGH" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5003HC		to 5	5 R_L = 280 Ω	Built-in Schmitt Trigger circuit Active "HIGH" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5001HR		to 5	5	Built-in Schmitt Trigger circuit Active "HIGH" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5002HR		to 5	5	Built-in Schmitt Trigger circuit Active "HIGH" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin

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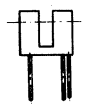
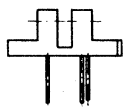
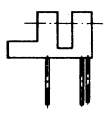
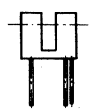
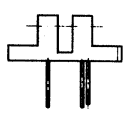
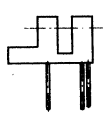
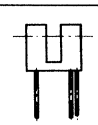
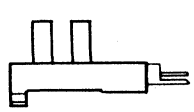
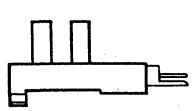
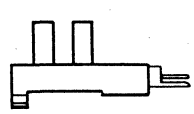
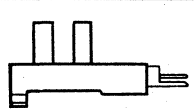
OPTOELECTRONIC DEVICES

Photo Interrupters (cont.)

IC Output Type (cont.)

Part Number	Outline	Characteristics (T_a = 25°C)		Features
		I_{FLH} (mA)	(V_{CC} (V)	
PS5003HR		to 5	5	Built-in Schmitt Trigger circuit Active "HIGH" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5001LC		to 5	5 R_L = 280 Ω	Built-in Schmitt Trigger circuit Active "LOW" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5002LC		to 5	5 R_L = 280 Ω	Built-in Schmitt Trigger circuit Active "LOW" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5003LC		to 5	5 R_L = 280 Ω	Built-in Schmitt Trigger circuit Active "LOW" Open collector output Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5001LR		to 5	5	Built-in Schmitt Trigger circuit Active "LOW" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5002LR		to 5	5	Built-in Schmitt Trigger circuit Active "LOW" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin
PS5003LR		to 5	5	Built-in Schmitt Trigger circuit Active "LOW" Built-in pull up resistor Aperture: 0.5mm slit (equivalent to 0.5mm□) 5 pin

Part Number	Outline	Characteristics (T_a = 25°C)		Features
		V_{OH} (mA)	Condition	
PS5501HC-1		V_{CC} × 0.8 to	opened aperture R_L = 47 kΩ	Built-in Schmitt Trigger circuit Housing with a connector** Active "HIGH" Open collector output Aperture: 0.5mm slit; 3 pin
PS5501HR-1		V_{CC} × 0.8 to	opened aperture	Built-in Schmitt Trigger circuit Housing with a connector** Active "HIGH" Built-in pull up resistor Aperture: 0.5mm slit; 3 pin
PS5501LC-1		V_{CC} × 0.8 to	closed aperture R_L = 47 kΩ	Built-in Schmitt Trigger circuit Housing with a connector** Active "LOW" Open collector output Aperture: 0.5mm slit; 3 pin
PS5501LR-1		V_{CC} × 0.8 to	closed aperture	Built-in Schmitt Trigger circuit Housing with a connector** Active "LOW" Built-in pull up resistor Aperture: 0.5mm slit; 3 pin

**CONNECTOR: EI 3 pin series 17825-3 made by AMP

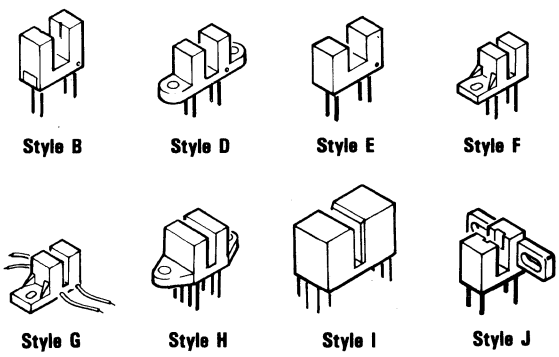
Optoelectronic Assemblies

OPTEK

Slotted Optical Switches

Part No.	Case Style	Slot Width Inches (mm)	Min. $I_{C(ON)}$ Slot Open
OPB804	B	0.155 (3.94)	500µA
OPB813S7	D	0.125 (318)	350µA
OPB813S5	D	0.125 (3.18)	250µA
OPB813S3	D	0.125 (3.18)	75µA
OPB818	E	0.20 (5.08)	100µA
OPB820	F	0.08 (2.03)	500µA
OPB20S10	F	0.08 (2.03)	400µA
OPB820S5	F	0.08 (2.03)	300µA
OPB21S3	F	0.08 (2.03)	170µA
OPB821	G	0.08 (2.03)	500µA
OPB821S10	G	0.08 (2.03)	400µA
OPB821S5	G	0.08 (2.03)	300µA
OPB821S3	G	0.08 (2.03)	170µA
OPB822S	H	0.10 (2.54)	250µA
OPB822SD	H	0.10 (2.54)	100µA
OPB830L55	J	0.125 (3.18)	500µA
OPB826S	I	0.10 (2.54)	250µA
OPB826D	I	0.10 (2.54)	100 µA

Slotted optical switches, also known as interrupter assemblies, are designed to provide non-contact sensing of linear or rotary motion as in optical encoders. Devices from Optek Technology consist of an infrared emitting diode and a silicon photosensor mounted on opposite sides of a slot in a molded plastic housing. Switching takes place whenever an opaque object passes through the slot. **All assemblies are available with wire leads. Contact Factory**



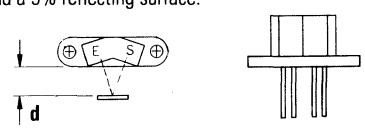
Style B **Style D** **Style E** **Style F**

Style G **Style H** **Style I** **Style J**

High Contrast Reflective Assemblies

Part No.	$I_{C(ON)}$	d"	$I_{C(OFF)}$	Contract Ratio
OPB750	500mA	.080	250nA	2000:1
	375mA	.150	250nA	1500:1
	250mA	.220	250nA	1000:1

Designed to decrease low-level gain while not affecting the high-level light gain. Photocurrent is measured using an Eastman Kodak neutral white test card as a reflective surface having a 90% diffuse reflectance. $I_{C(OFF)}$ is photocurrent measured with current to the input diode and a 5% reflecting surface.

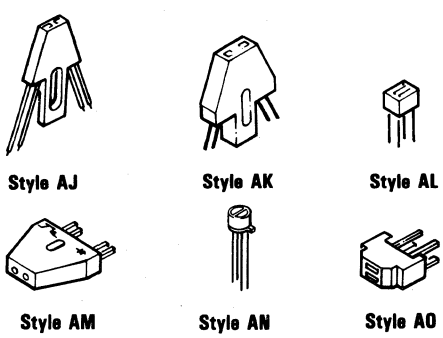


Reflective Assemblies

Part No.	Case Style	Max. V_F at Rated I_F	Min. $V_{(BR)CEO}$	Min. $I_{C(ON)}$
OPB701	AJ(2)	1.7V @ 50 mA	25V	2.0 mA
OPB700	AJ(1)	1.7V @ 50 mA	25V	25 µA
OPB703	AK(1)	1.7V @ 40 mA	30V	200 µA
OPB706A	AL(1)	1.7V @ 20 mA	30V	500 µA
OPB706B	AL(1)	1.7V @ 20 mA	30V	350 µA
OPB706C	AL(1)	1.7V @ 20 mA	30V	200 µA
OPB707A	AL(2)	1.7V @ 20 mA	15V	25 mA
OPB707B	AL(2)	1.7V @ 20 mA	15V	17 mA
OPB707C	AL(2)	1.7V @ 20 mA	15V	10 mA
OPB742	AM(1)	1.7V @ 40 mA	30V	10 µA
OPB746	AM(2)	1.7V @ 40 mA	15V	1.0 mA
OPB710	AJ(1)	1.7V @ 50 mA	30V	150 µA
OPB730	AN(2)	1.7V @ 50 mA	30V	1.0 mA
OPB711	AN(1)	1.7V @ 20 mA	30V	350 µA
OPB712	AO(2)	1.7V @ 20 mA	15V	20 mA

(1) Phototransistor output
(2) Photodarlington output

Reflective assemblies are designed to provide non-contact sensing of the presence of a reflective surface, or a change in surface reflectivity. Unfocused types, where the emitter and sensor are mounted on parallel optical axes, are best suited for sensing diffuse or rough surfaces. Focused types, where the emitter and sesor are mounted on converging optical axes are best suited for sensing specular or polished surfaces.



Style AJ **Style AK** **Style AL**

Style AM **Style AN** **Style AO**

Custom Assemblies

Designed to meet your exact requirements.

In order to develop new state-of-the-art products, customers often require special optoelectronic devices. In these cases, Optek engineers can design a part to meet the toughest mounting or electrical requirements.

Helping customers meet special design objectives is a specialty at Optek.

Bring your ideas, design proposals and application problems to Optex experienced design engineers. They will work with you to analyze your design objectives and develop a part that meets your needs. And, since Optek has manufacturing capability which extends from silicon chip to custom housings and circuit boards, you can be sure that Optek quality goes into every component and subassembly.

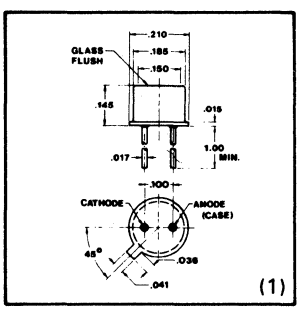
Optek Technology, Inc., 1215 West Crosby Road, Carrollton, TX 75006 (214) 323-2200 TLX 6716032 or 215849 FAX (214) 323-2396

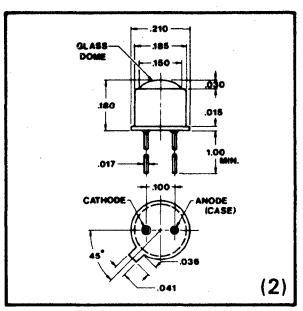
OPTO DIODE CORP.

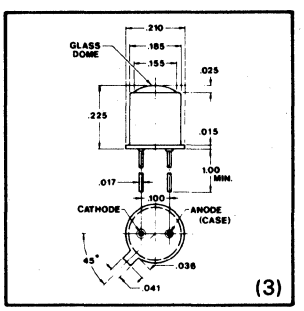
HIGH POWER GaAlAs INFRARED EMITTING DIODES

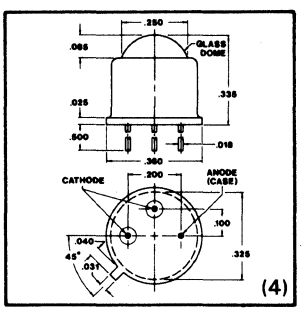
Opto Diode is a pioneer in the development and manufacture of high performance and high quality Galluim Aluminum Arsenide (GaAlAs) infrared emitting diodes. Not only is the power efficiency of Opto Diode products the highest in the market but the product's reliability is also the best in the industry. Today, Opto Diode Corporation is a leading supplier of GaAlAs IR emitter chips in the solid state relay market.

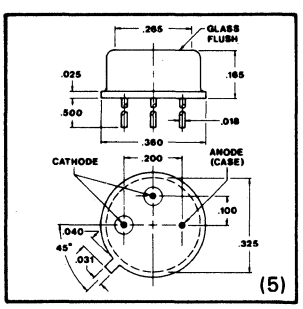
TYPE	CHARACTERISTICS							ABSOLUTE MAX RATINGS					PKG
	P_o (mW)	I_F (mA)	V_F (V)	I_F (mA)	λ_p (nm)	θ (deg)	t_r (μs)	P_D (mW)	I_F (mA)	I_{FP} (A)	V_R (V)	T_{op} (°C)	
OD-880W	20	100	1.65	100	880	90	0.5	190	100	3	5	-55°C-100°C	(1)
OD-880L	20	100	1.65	100	880	40	0.5	190	100	3	5	-55°C-100°C	(2)
OD-880F	17	100	1.65	100	880	10	0.5	190	100	3	5	-55°C-100°C	(3)
OD-820W	6	100	1.5	100	820	90	0.03	180	100	3	2	-55°C-100°C	(1)
OD-50L	50	500	1.65	500	880	10	0.7	1000	500	10	5	-55°C-100°C	(4)
OD-50W	75	500	1.65	500	880	120	0.7	1000	500	10	5	-55°C-100°C	(5)
OD-100	100	500	1.65	500	880	160	0.7	1000	500	10	5	-55°C-100°C	(6)
OD-8810	5.5	20	1.3	20	880	20	0.5	190	100	3	5	-55°C-100°C	(7)
OD-8811	5.5	20	1.3	20	880	60	0.5	190	100	3	5	-55°C-100°C	(7)
OD-8830	5.5	20	1.3	20	880	30	0.5	100	60	2	5	-55°C-100°C	(8)
OD-8870	3.0	50	1.4	50	880	35	0.5	180	100	3	5	-55°C-125°C	(9)
OD-880-C	2	20	1.3	20	880	—	0.5	190	100	3	5	-65°C-150°C	—
OD-663	170	300	4.5	300	880	—	1.0	1500	300	5	5	-55°C-100°C	(10)
OD-800W	3	100	1.45	100	810	90	0.06	180	100	3	3	-65°C-150°C	(1)
OD-800L	3	100	1.45	100	810	40	0.06	180	100	3	3	-65°C-150°C	(2)
OD-800F	2.5	100	1.45	100	810	10	0.06	180	100	3	3	-65°C-150°C	(3)
OD-800PP	0.8	50	1.4	50	810	35	0.06	180	100	3	3	-65°C-125°C	(9)
OD-880WJ	15	150	1.6	150	880	90	0.5	270	150	5	10	-65°C-150°C	(1)
OD-50J	50	600	1.7	600	880	130	0.7	1100	600	12	10	-65°C-125°C	(11)
OD-880PP	3	50	1.4	50	880	35	0.5	180	100	3	10	-65°C-125°C	(9)

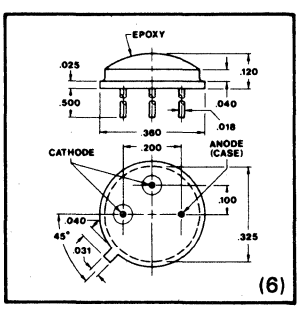


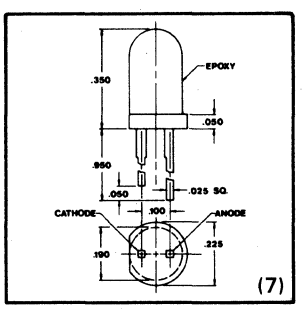


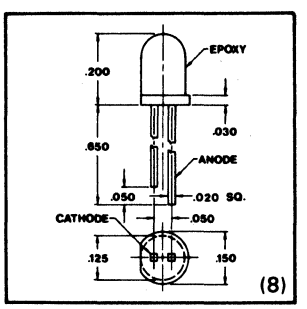


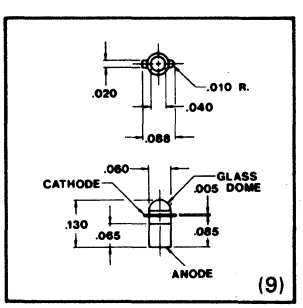


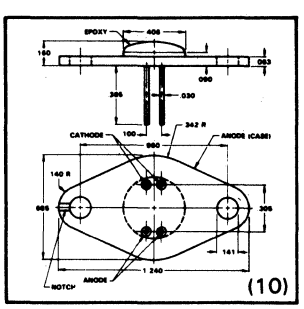


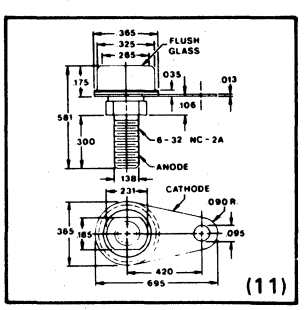












Ask for Our Optoelectronics Data Book

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SHARP® Optoelectronics

Photocouplers

Photocouplers

Features

Various output methods:
- Single phototransistor
- Darlington phototransistor
- OPIC*
- Bidirectional output transistor
- Phototriac
- Photothyristor

Various package formats:
- Standard dual-in-line package
- Flat package
- Mini-flat package
- Dual-in-line package for long creepage distance

Wide line-up of products approved by overseas safety standards: UL, VDE, TÜV, BS, SEMKO, DEMKO, EI
High isolation voltage: PC100/PC700/PC800 series, etc.

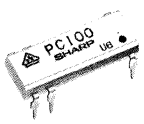
Classification chart

Photocouplers
- PC100 series — VDE approved (long creepage distance type)
- PC200 series — Mini-flat package type
- PC300 series — Opaque mini-flat package type
- PC400 series — Opaque mini-flat package type
- PC700 series — DIP 6-pin, Viso:5kVrms
- PC800 series — Opaque 4-pin x N (N = 1,2,3,4), Viso: 5kVrms
- PC900 series — OPIC*
- 6N series — Standard 6N series (OPIC*)

Phototriac couplers

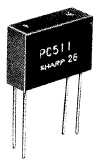
Photothyristor couplers

*OPIC is a registered trademark of Sharp and stands for Optical IC. It has a light detecting element and peripheral circuits integrated onto one chip
**In PC4N series, PC700 series, and PC800 series, the flat package products are also available in a wide variety.

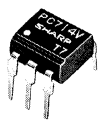


PC 100 (PC101)

PC110 (PC111, PC112, PC113)



PC511

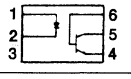
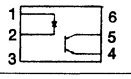
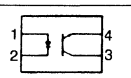
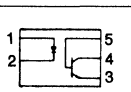
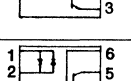


PC714V (PC702V, PC703V PC713V, PC723V, PC715V, PC716V PC724V, PC725V)

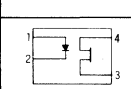
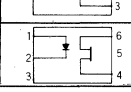
PC733H (PC733, PC619)

Lead forming product (e.g. PC818i)

(Ta = 25°C)

Type	Model No.	Internal connection diagram	Features	Approved by overseas safety standard: UL	TÜV	VDE	Package	Absolute maximum ratings: Forward current I_F (mA)	Isolation voltage (AC) Viso (Vrms)	Electrical characteristics: Current transfer ratio: CTR (%) MIN.	I_F (mA)	Response time: tr (μs) TYP.	R_L (Ω)
Single phototransistor	PC100		High isolation voltage long creepage distance *2	○		○	DIP 6-pin (Special)	50	5,000	25	10	6	100
	PC101		High isolation voltage, long creepage distance *2	○		○		50	5,000	25	10	6	100
	PC110		High isolation voltage, long creepage distance	○		○	DIP 6-pin	50	5,000	50	5	4	100
	PC112		High isolation voltage, long creepage distance, high collector-emitter voltage *2	○		○		50	5,000	40	10	4	100
	PC111		High isolation voltage, long creepage distance *2	○		○		50	5,000	50	5	4	100
	PC113		High isolation voltage, long creepage distance, high collector-emitter voltage *2	○		○		50	5,000	40	10	4	100
	PC120		High isolation voltage long creepage distance *2	○		○	DIP 4-pin	50	5,000	50	5	4	100
	PC121		High isolation voltage, long creepage distance, high collector emitter voltage *2	○		○	DIP 4-pin	50	5,000	50	5	4	100
	PC703V*1		High isolation voltage, high collector-emitter voltage (70V)	○	○		DIP 6-pin	50	5,000	40	10	4	100
	PC713V*1		High isolation voltage	○	○			50	5,000	50	5	4	100
	PC723V*1		High isolation voltage, high collector-emitter voltage (80V)	○	○			50	5,000	50	5	6	100
	PC733*1		High isolation voltage, AC input response	○				±50	5,000	15	±1	4	100
	PC733H		High isolation voltage, large input current drive, AC input response	○				±150	5,000	20	±100	4	100

★ 1 Lead forming type (I type) is also available. ★ 2 BS, SEMKO, DEMKO, EI approved: PC110, PC111, PC112, PC113, PC100, PC101, PC120, PC121

Type	Model No.	Internal connection diagram	Features	Approved by overseas safety standard: UL	TÜV	Package	Absolute maximum ratings: Forward current I_F (mA)	Isolation voltage (AC) Viso (Vrms)	Electrical characteristics: Turn-on, Turn-off: ton, toff (μs) MAX.	I_F (mA)	V^*_{ps} (V)	R_L (Ω)
Bi-directional output	PC419		Bi-directional high output resistant			Mini-flat package 4-pin	50	3,750	50	16	5	50
	PC619		Bi-directional linear output	○		DIP 6-pin	60	2,000	15	16	5	50

★ I_F = 200mA (tw ≈ 1.0ms)

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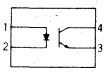
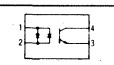
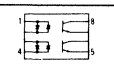
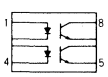
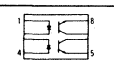
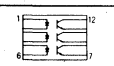
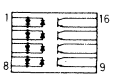
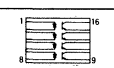
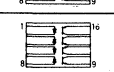
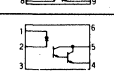
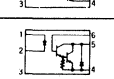
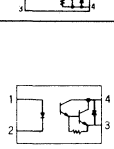
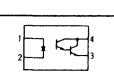
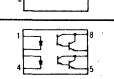
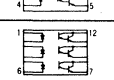
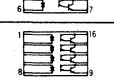
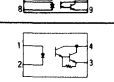
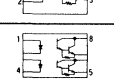
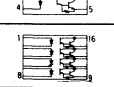
SHARP Optoelectronics

Photocouplers

Photocouplers

(Ta = 25°C)

Type	Model No.	Internal connection diagram	Features	Approved by overseas safety standard		Package	Absolute maximum ratings		Electrical characteristics			
									Current transfer ratio		Response time	
				UL	TÜV		Forward current I_F (mA)	Isolation voltage (AC) Viso (Vrms)	CTR (%) MIN.	I_F (mA)	tr (μs) TYP.	R_L (Ω)
Single phototransistor	PC810		High isolation voltage, high speed at high load	○		DIP 4-pin	50	5,000	60	1	10	1,000
	PC812		High isolation voltage, high noise resistivity				50	5,000	90	5	4	100
	PC816		High isolation voltage, high collector-emitter voltage (70V)	○			50	5,000	50	5	4	100
	PC817*3		High isolation voltage	○	○		50	5,000	50	5	4	100
	PC818*3		High isolation voltage, high speed at high load	○	○		50	5,000	10	1	7	1,000
	PC851		High isolation voltage, high collector-emitter voltage (300V)	○			50	5,000	40	5	4	100
	PC813		High isolation voltage, AC input response, (high noise resistivity)	○			±50	5,000	20	±1	4	100
	PC814*3		High isolation voltage, AC input response	○								
	PC823		High isolation voltage, AC input response, (high noise resistivity)	○		DIP 8-pin	±50	5,000	20	±1	4	100
	PC824		High isolation voltage, AC input response	○								
	PC826		High isolation voltage, high collector-emitter voltage (70V)	○			50	5,000	50	5	4	100
	PC827*1		High isolation voltage, AC input response, high isolation voltage (2-ch)	○	○		50	5,000	50	5	4	100
	PC829		High isolation voltage, symmetrical terminal configuration	○	○		50	5,000	50	5	4	100
	PC837*1		High isolation voltage (3-ch)	○	○	DIP 12-pin	50	5,000	50	5	4	100
	PC843		High isolation voltage, AC input response	○		DIP 16-pin	±50	5,000	20	±1	4	100
	PC844		High isolation voltage, AC input response, high noise resistivity	○								
	PC846		High isolation voltage, high collector-emitter voltage (70V)	○			50	5,000	50	5	4	100
	PC847*1		High isolation voltage (4-ch)	○	○		50	5,000	50	5	4	100
	PC849		High isolation voltage, symmetrical terminal configuration	○	○		50	5,000	50	5	4	100
Darlington phototransistor	PC715V*3		High isolation voltage, high sensitivity	○	○	DIP 6-pin	50	5,000	600	1	60	100
	PC716V*3		High isolation voltage, high sensitivity, high power	○	○		50	5,000	1,000	1	130	100
	PC725V*3		High isolation voltage, high sensitivity, high collector-emitter voltage (300V), high power	○	○		50	5,000	1,000	1	100	100
	PC852		High isolation voltage, high sensitivity, high collector-emitter voltage (300V), high sensitivity	○		DIP 4-pin	50	5,000	1,000	1	100	100
	PC853		High isolation voltage, high sensitivity, high collector-emitter voltage (300V), high power dissipation	○		DIP 4-pin	50	5,000	1,000	1	100	100
	PC853H		High isolation voltage, high sensitivity, high collector-emitter voltage (350V), high power dissipation	○		DIP 4-pin	50	5,000	1,000	1	20	100
	PC815*3		High isolation voltage, high sensitivity	○	○	DIP 4-pin	50	5,000	600	1	60	100
	PC825*2		High isolation voltage, high sensitivity (2-ch)	○	○	DIP 8-pin	50	5,000	600	1	60	100
	PC835*2		High isolation voltage, high sensitivity (3-ch)	○	○	DIP 12-pin	50	5,000	600	1	60	100
	PC845*2		High isolation voltage, high sensitivity (4-ch)	○	○	DIP 16-pin	50	5,000	600	1	60	100
	PC865		High isolation voltage, high sensitivity, low dark current	○		DIP 4-pin	50	5,000	1,000	1	100	100
	PC875		High isolation voltage, high sensitivity, low dark current (2-ch)	○		DIP 8-pin	50	5,000	1,000	1	100	100
	PC895		High isolation voltage, high sensitivity, low dark current (4-ch)	○		DIP 16-pin	50	5,000	1,000	1	100	100

*1 UL, TÜV approved as multi-channel of PC817 respectively. *2 UL, TÜV approved as multi-channel of PC815 respectively. *3 Lead forming type (I type) is also available.

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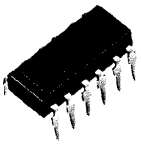
SHARP® Optoelectronics

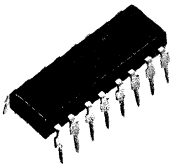
Photocouplers

PC817
(PC810, PC812, PC813, PC814, PC815, PC816, PC818, PC851, PC852, PC865, PC120, PC121,

PC827
(PC823, PC824, PC829, PC825, PC826, PC875, PC8D52



PC837
(PC835)



PC847
(PC843, PC844, PC849, PC845, PC846, PC895, PC8Q52

PC317Z
(PC314Z, PC315Z, PC316Z, PC400, PC401, PC410, PC417, PC419, PC452

PC3D17
(PC3D14, PC3D15, PC3D16

PC3Q17
(PC3Q14, PC3Q15, PC3Q16

Opaque mini-flat package type

Employs double transfer mold technology

(Ta = 25°C)

Type	Model No.	Internal connection diagram	Features	Package	Absolute maximum ratings		Electrical characteristics						
							Current transfer ratio			Response time			
					Forward current I_F (mA)	Isolation voltage (AC) Viso (Vrms)	CTR (%) MIN.	I_F (mA)	V_{CE} (V)	tr (μs) TYP.	I_C (mA)	R_L (Ω)	V_{CE} (V)
Single phototransistor	PC314Z*5		Opaque mini-flat package type, AC input response	Mini-flat package, 4-pin	±50	2,500	20	±1	5	4	2	100	2
	PC3D14		Opaque mini-flat package type, AC input response (2-ch)	Mini-flat package, 8-pin	±50	2,500	20	±1	5	4	2	100	2
	PC3Q14		Opaque mini-flat package type, AC input response (4-ch)	Mini-flat package, 16-pin	±50	2,500	20	±1	5	4	±2	100	2
	PC316Z*5		Opaque mini-flat package type, high collector-emitter voltage (V_{CEO}: 120V)	Mini-flat package, 4-pin	50	2,500	50	5	5	4	2	100	2
	PC3D16		Opaque mini-flat package type, high collector-emitter voltage (V_{CEO}: 120V)(2-ch)	Mini-flat package, 8-pin	50	2,500	50	5	5	4	2	100	2
	PC3Q16		Opaque mini-flat package type, high collector-emitter voltage (V_{CEO}: 120V)(4-ch)	Mini-flat package, 16-pin	50	2,500	50	5	5	4	2	100	2
	PC317Z*5		Opaque mini-flat package type, general purpose	Mini-flat package, 4-pin	50	2,500	50	5	5	4	2	100	2
	PC3D17		Opaque mini-flat package type, general purpose (2-ch)	Mini-flat package, 8-pin	50	2,500	50	5	5	4	2	100	2
	PC3Q17		Opaque mini-flat package type, general purpose (4-ch)	Mini-flat package, 16-pin	50	2,500	50	5	5	4	2	100	2
Darlington phototransistor	PC315Z*5		Opaque mini-flat package type, high sensitivity	Mini-flat package, 4-pin	50	2,500	600	1	2	60	2	100	2
	PC3D15		Opaque mini-flat package type, high sensitivity (2-ch)	Mini-flat package, 8-pin	50	2,500	600	1	2	60	2	100	2
	PC3Q15		Opaque mini-flat package type, high sensitivity (4-ch)	Mini-flat package, 16-pin	50	2,500	600	1	2	60	2	100	2
	PC452		Opaque mini-flat package type, high collector-emitter voltage (V_{CEO}: 300V)	Mini-flat package, 4-pin	50	2,500	1,000	1	2	100	20	100	2
	PC400		Opaque mini-flat package normal off	Mini-flat package, 5-pin	50	3,750	—	—	—	0.1	IF: 4	280	VCC: 5
	PC401		Opaque mini-flat package normal on	Mini-flat package, 5-pin	50	3,750	—	—	—	0.1	IF: 4	280	VCC: 5
	PC410		Opaque mini-flat package high speed (10Mb/s)	Mini-flat package, 5-pin	20	2,500	260	5	VCC: 5	30	IF: 7.5	350	VCC: 5
	PC417		Opaque mini-flat package high speed (1Mb/s)	Mini-flat package, 5-pin	25	2,500	19	16	VCC: 4.5	tphl 0.3	IF: 16	1,900	VCC: 5

*1 Lead forming type (I type) is also available. *2 MAX. *3 I_F = 200mA (tw≈1.0ms) *4 Vcc = 10V
*5 The versions for taping package specification are also available.
Model Nos. PC314, PC315, PC316, PC317 : Diameter of Reel φ370mm, Tape Width 12mm, Min. Increments 3000 pcs
PC314T, PC315T, PC316T, PC317T : Diameter of Reel φ178mm, Tape Width 12mm, Min. Increments 750 pcs

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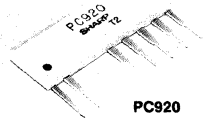
SHARP® Optoelectronics

Photocouplers

PC900V
(PC901V, PC930, PC931)
PC932, PC933, PC934, PC935

PC902
(PC904)
(PC905)

PC910
(PC921, 6N135, 6N136, 6N137, 6N138, 6N139, PC9D10, PC9D17, PC911, PC922)

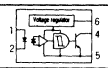
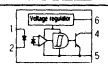
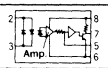
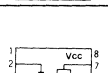
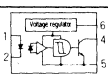
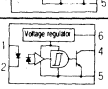
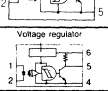
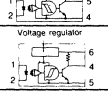
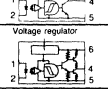
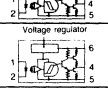


PC920

OPIC Photocouplers

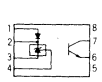
(OPIC is a registered trademark of Sharp and stands for Optical IC. It has a light detecting element and peripheral circuits integrated onto one chip.)

(Ta = 25°C)

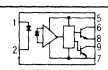
Model No.	Internal connection diagram	Features	Approved by overseas safety standard		Package	Absolute maximum ratings		*2Electrical characteristics						
								Low level output voltage				Threshold input current		
			UL	TÜV		Forward current I_F (mA)	Isolation voltage (AC) Viso (Vrms)	V_{OL} (V) MAX.	Ta (°C)	I_{OL} (mA)	I_F (mA)	I_{FHL} (mA) MAX.	I_{FLH} (mA) MAX.	R_L (Ω)
PC900V*1		Digital output, normal-off	○	○	DIP 6-pin	50	5,000	0.4	0 ~ +70	16	4	2.0	—	280
PC901V		Digital output, normal-on	○		DIP 6-pin	50	5,000	0.4	0 ~ +70	16	0	—	2.0	280
PC902		Built-in integration circuit, AC input response	○		DIP 8-pin	±20	5,000	0.4	0 ~ +70	6.4	±2	1.5	—	680
PC910		High speed (10Mb/s)	○		DIP 8-pin	20	2,500	0.6	0 ~ +70	13	5	5.0	—	350
PC911		High speed (10Mb/s) High CMR (Typ 10KV/ms)	○		DIP 8-pin	20	4,000	0.6	0 ~ +70	13	5	5.0	—	350
PC930		Connectable to C-MOS	○		DIP 6-pin	50	5,000	0.4	0 ~ +70	16	1	1.0	—	280
PC931		Connectable to C-MOS	○		DIP 6-pin	50	5,000	0.4	0 ~ +70	16	0	—	1.0	280
PC932		Connectable to C-MOS	○		DIP 6-pin	50	5,000	0.4	0 ~ +70	16	1	1.0	—	280
PC933		Connectable to C-MOS	○		DIP 6-pin	50	5,000	0.4	0 ~ +70	16	0	—	1.0	280
PC934		Connectable to C-MOS	○		DIP 6-pin	50	5,000	0.4	0 ~ +70	16	1	1.0	—	280
PC935		Connectable to C-MOS	○		DIP 6-pin	50	5,000	0.4	0 ~ +70	16	0	—	1.0	280

*3 Vcc = 5V

(Ta = 25°C)

Model No.	Internal connection diagram	Features	Approved by overseas safety standard		Package	Absolute maximum ratings			Electrical characteristics					
									Current dark current		Current transfer ratio			
			UL	VDE		Anode current I_A (mA)	Isolation voltage (AC) Viso (Vrms)	Collector-emitter voltage V_{CEO} (V)	I_{CEO} (A) MAX.	V_{CE} (V)	CTR (%) MIN.	V_K (V)	I_A (mA)	V_{CE} (V)
PC904		Built-in voltage deviation detection circuit	○		DIP 8-pin	50	5,000	35	1×10^{-7}	35	50	V_{REF}	10	5
PC905		Built-in voltage deviation detection circuit	○	○	DIP 8-pin	50	5,000	70	1×10^{-7}	35	40	V_{REF}	10	5

*1 BS SEMKO, DEMKO, E1 approved PC905

Model No.	Internal connection diagram	Features	Approved by overseas safety standard		Package	Absolute maximum ratings			Electrical characteristics					
									Propagation delay time					
			UL	TÜV		Forward current I_F (mA)	Isolation voltage (AC) Viso (Vrms)	Vo_1 Ouput current Io_1 (A)	t_{PHL} (μs) TYP.	t_{PLH} (μs) TYP.	Vcc (V)	I_F (mA)	R_{L1} (Ω)	R_{L2} (Ω)
PC920		For inverter-controlled air conditioner	○		SIP 7-pin	50	1,500	–0.8	3	3	Vcc_1 = 6	2	15	18
PC921		For inverter-controlled air conditioner	○		DIP 8-pin	25	2,000	0.5	2	2	6	5	5	10
PC922		For inverter-controlled air conditioner	○		DIP 8-pin	25	5,000	0.5	2	2	6	5	5	10

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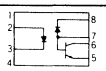
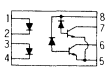
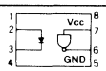
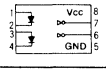
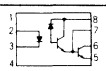
SHARP Optoelectronics

Photocouplers Phototriac Couplers/ Photothyristor Couplers

OPIC Photocouplers

Model No.	Internal connection diagram	Features	Approved by overseas safety standard		Package	Absolute maximum ratings		Electrical characteristics							
								Current transfer ratio				Propagation time*3			
			UL	TÜV		Forward current I_F (mA)	Isolation voltage (AC) Viso (Vrms)	CTR (%) MIN.	I_F (mA)	Vo (V)	Vcc (V)	t_{PHL} (μs) TYP.	t_{PLH} (μs) TYP.	R_L (Ω)	I_F (mA)
6N135		High speed (1Mb/s)	○		DIP 8-pin	25	2,500	7	16	0.4	4.5	0.4	0.7	4,100	16
6N136			○			25	2,500	19	16	0.4	4.5	0.3	0.5	1,900	16
PC917		High speed (1Mb/s)	○			25	2,500	19	16	0.4	4.5	0.3	0.3	1,900	16
6N137		High speed (10Mb/s)	○			20	2,500	TYP. 700	5	(R_L = 100Ω)	5	0.045	0.045	350	7.5
PC9D10		Ultra high speed (10Mb/s) 2 channels				15	2,500	TYP. 700	5	(R_L = 100Ω)	5	0.075 (MAX.)	0.075 (MAX.)	350	7.5
6N138		High speed, high sensitivity	○			20	2,500	300	1.6	0.4	4.5	1	4	2,200	1.6
6N139			○			20	2,500	400	0.5	0.4	4.5	5	5	4,700	0.5

*3 Vcc = 5V

Phototriac Couplers/Photothyristor Couplers

(Ta = 25°C)

Type	Model No.	Internal connection diagram	Features		Approved by overseas safety standard		Package	Absolute maximum ratings			Electrical characteristics		
											Minimum trigger current		
					UL	TÜV		On-state current I_T (Arms)	Repetitive peak off-state voltage V_{DRM} (V)	Isolation voltage (AC) Viso (Vrms)	I_{FT} (mA) MAX.	V_O (V)	R_G (kΩ)
For triggering	S12MD1V*2		Half wave control	120V line	○		DIP 6-pin	0.2	400	5,000	15	6	20
	S22MD1V*2			240V line	○	○	DIP 6-pin	0.2	600	5,000	10	6	20
	S12MD2			120V line, high noise resistivity (built-in gate resistor)	○		DIP 4-pin	0.2	400	1,500	10	6	—
	S12MD22				*1 ○		DIP 8-pin	0.2	400	1,500	10	6	—
	S22MD2			240V line			DIP 7-pin	0.2	600	5,000	8	6	20
	S11MS1			120V line	○		Mini-flat package, 4-pin	0.05	400	2,500	10	6	100
	S21MS1			240V line	○	○		0.05	600	2,500	10	6	100
	S11MS2			120V line, Built-in zero-cross circuit				0.05	400	2,500	10	6	100
	S21MS2			240V line, Built-in zero-cross circuit	○	○		0.05	600	2,500	10	6	100
	S11MD5V*2			120V line, high isolation voltage	○		DIP 6-pin	0.1	400	5,000	10	6	—
	S1M3023			120V line, high isolation voltage Low input current	○		DIP 5-pin	0.1	400	5,000	5	6	—
	S21ME3		Full wave control	240V line, low input current Conforms to overseas safety standard	VDE, BS, SEMKO, DEMKO, EI, UL		DIP 6-pin	0.1	600	5,000	7	6	—
	S21ME3F			240V line, low input current Conforms to overseas safety standard				0.1	600	5,000	7	6	—
	S21MD7T			240V line, low input current	○	○	DIP 5-pin	0.1	600	5,000	5	6	—
	S1M3043			120V line, low input current	○		DIP 5-pin	0.1	400	5,000	5	6	—
	S21ME4			240V line, low input current Conforms to overseas safety standard	VDE, BS, SEMKO, DEMKO, EI, UL		DIP 6-pin	0.1	600	5,000	7	6	—
	S21ME4F	Zero-cross circuit		240V line, low input current Conforms to overseas safety standard				0.1	600	5,000	7	6	—
	S1M3063			240 V line,, Built-in zero-cross circuit low input current	○	○	DIP 5-pin	0.1	600	5,000	5	6	—
	S11MD62			120V line 2 channels	○		DIP 8-pin	0.1	400	1,500	20	—	100

*1 S12MD22 is approved as multi-channel type of S12MD2. *2 Lead forming type is also available.

☛ Topr: – 308 + 100°C

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SHARP Optoelectronics

Photointerrupters

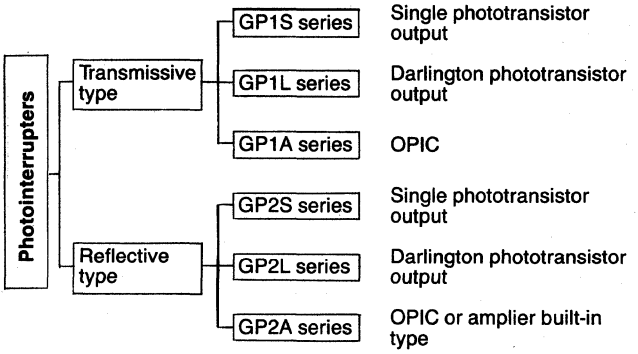
Photointerrupters

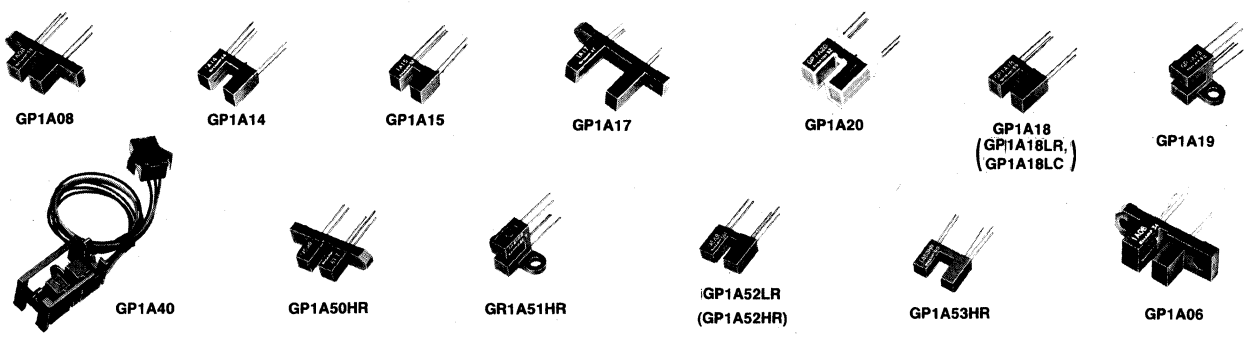
Features

- Various output methods
  - Single phototransistor
  - Darlington phototransistor
  - OPIC
    - Single-phase digital output
    - Two-phase digital output (transmissive type)
- Various mounting methods
  - Snap-in mounting type
  - PWB mounting type
  - Both-side mounting type
  - Either-side mounting type (transmissive type)
  - Side-mounting type (transmissive type)
- Transmissive type — Line-up of products with a detecting accuracy of slit width ranging from 0.15 to 2.5mm.
- Reflective type — Line-up of products with detecting distance ranging from 1 to 7mm (optimum).
- Transmissive type — Line-up of products having an object passing width ranging from the light emitter and detector gap of 0.9 to 13.2mm.

Versions with cover case, 3-pin connector terminal, and super-compact products are available to meet a variety of customer needs.

Classification chart

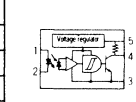
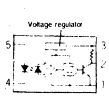
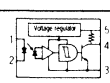
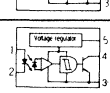




Transmissive type OPIC type

(OPIC is a registered trademark of Sharp and stands for Optical IC. It has a light detecting element and peripheral circuits integrated onto one chip.)

(Ta = 25°C)

Type	Model No.	Internal connection diagram	Features	Detecting and emitting gap (mm)	Slit width of resolution (mm)	Electrical characteristics: Threshold input current I_{FLH} (mA) MAX.	Threshold input current I_{FHL} (mA) MAX.	Threshold input current Vcc (V)	Propagation time t_{PLH} (µS) TYP.	Propagation time t_{PHL} (µS) TYP.	I_F (mA)	R_L (Ω)	Vcc (V)
OPIC	GP1A08		Both-side mounting type	3.0	0.5	5	—	5	3	5	5	280	5
	GP1A14		PWB mounting type	5.0	0.5	8	—	5	3	5	8	280	5
	GP1A15			3.0	0.25	10	—	5	3	5	10	280	5
	GP1A17		Both-side mounting type	10.0	2.0	7	—	5	3	5	7	280	5
	GP1A18		PWB mounting type	3.2	0.5	5	—	5	3	5	5	280	5
	GP1A19		Side mounting type	3.2	0.5	5	—	5	3	5	5	280	5
	GP1A20		PWB mounting type with cover case	3.0	0.5	9.5	—	5	3	5	10	280	5
	GP1A50HR		Both-side mounting type	3.0	0.5	5	—	5	3	5	5	280	5
	GP1A51HR		Either-side mounting type	3.0	0.5	5	—	5	3	5	5	280	5
	GP1A52HR		PWB mounting type	3.0	0.5	5	—	5	3	5	5	280	5
	GP1A53HR		PWB mounting type	5.0	0.5	8	—	5	3	5	8	280	5
	GP1A57HR		PWB mounting type	10.0	1.8	5	—	5	3	5	7	280	5
	GP1A18LR		PWB mounting type	3.2	0.5	—	5	5	5	3	5	280	5
	GP1A52LR		PWB mounting type	3.0	0.5	—	5	5	5	3	5	280	5
	GP1A18LC		PWB mounting type	3.2	0.5	—	5	*1 5	5	3	5	280	5

* Topr: −25 ~ +85°C (GP1A06: −20 ~ +85°C) *1 R_L = 280Ω

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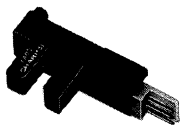
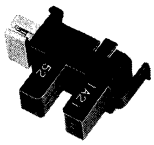
SHARP®
Optoelectronics

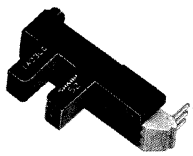
Photointerrupters



GP1A05
(GP1A05HR, GP1A31LC)



GP1A21

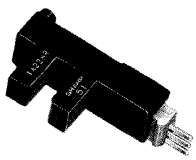


GP1A23LC

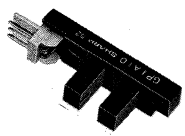
GP1A25LC

GP1A27LC

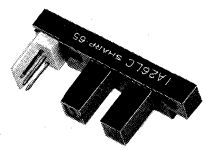
GP1A34LC



GP1A22HR
(GP1A22LC)



GP1A10

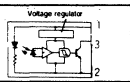
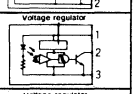
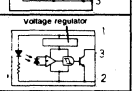
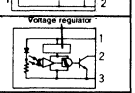
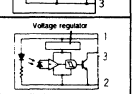
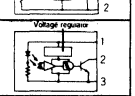
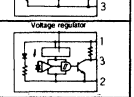
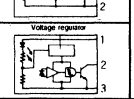


GP1A26LC

Transmissive Photointerrupters

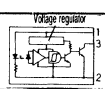
OPIC type with 3-pin connector terminal

(Ta = 25°C)

Type	Model No.	Internal connection diagram	Features		Detecting and emitting gap (mm)	Slit width or resolution (mm)	Electrical characteristics					
							Operating supply voltage Vcc (V)		Low level output voltage			
							MIN.	MAX.	V_{OL} (V) MAX.	Light cut-off	I_{OL} (mA)	Vcc (V)
OPIC	GP1A05		with 3-pin connector	Either-side mounting type	5.0	0.5	4.5	5.5	0.35	No	16	5
	GP1A21			Snap-in mounting type	5.0	0.5	4.5	5.5	0.35	No	16	5
	GP1A22LC			Either-side mounting type	5.0	0.5	4.5	5.5	0.35	No	16	5
	GP1A23LC			Either-side mounting type	5.0	0.5	4.5	5.5	0.35	No	16	5
	GP1A25LC			Either-side mounting type	5.0	0.5	4.5	5.5	0.35	No	16	5
	GP1A27LC			Snap-in mounting type	5.0	0.5	4.5	5.5	0.35	No	16	5
	GP1A31LC			15V line, both-side mounting type	5.0	0.5	13.5	16.5	0.35	No	16	15
	GP1A34LC			Snap-in mounting type	5.0	0.8	4.5	5.5	0.4	No	2.5	5
	GP1A05HR			Either-side mounting type	5.0	0.5	4.5	5.5	0.4	Yes	16	5
	GP1A22HR				5.0	0.5	4.5	5.5	0.4	Yes	16	5
	GP1A10			24V line, both-side mounting type	5.0	0.5	21	26	0.6	No	16	24
	GP1A26LC				5.0	0.5	21	26	0.6	No	16	24

* Topr: −20 ~ +75°C (GP1A10, GP1A26LC: 0 ~ +80°C)

(Ta = 25°C)

Type	Model No.	Internal connection diagram	Features	Absolute maximum ratings		Electro-mechanical characteristics								
				Supply voltage V_{CC} (V)	Output current I_O (mA)	Actuator lever operating load	Low level output voltage V_{OL} (V)	Low level dissipation current I_{CCL} (mA)	High level output voltage V_{OH} (V)	High level dissipation current I_{CCH} (mA)	Response time t_H (μA)	Response time t_L (μA)	Response time R_L (Ω)	Response time V_{CC} (V)
OPIC	GP1A40		With lever type actuator With connector	7	50	0.5 or more	0.4 MAX.	3.0 MAX.	100×0.9 MIN.	30 MAX.	166 MIN.	166 MIN.	280	5

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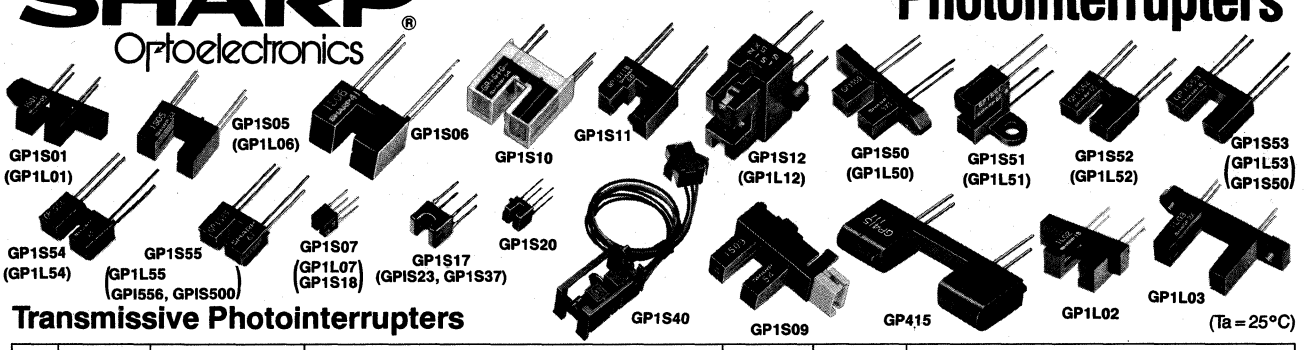
Photointerrupters



Transmissive Photointerrupters

(Ta = 25°C)

Type	Model No.	Internal connection diagram	Features	Detecting and emitting gap (mm)	Slit width or resolution (mm)	Electrical characteristics: Current transfer ratio CTR (%) MIN.	Current transfer ratio I_F (mA)	Current transfer ratio V_{CE} (V)	Response time tr (μS) TYP.	Response time I_C (mA)	Response time R_L (Ω)	Response time V_{CE} (V)
Single transistor	GP1S01*1		High speed detecting, both-side mounting type	3.0	2.0	10	20	5	3	2	100	2
	GP1S05		High resolution, PWB mounting, wide gap	5.0	0.5	2.5	20	5	3	2	100	2
	GP1S06		High resolution, PWB mounting type	3.0	0.25	0.5	20	5	38	0.5	1,000	2
	GP1S10		With cover case	3.0	0.5	2	20	5	3	2	100	2
	GP1S11		Holder with lens	3.0	—	11.5	20	5	3	2	100	2
	GP1S12		PWB mounting type with positioning pin	3.5	2.0	10	10	5	3	2	100	2
	GP1S50		High resolution, both-side mounting type	3.0	0.5	2.5	20	5	3	2	100	2
	GP1S51		High resolution, side-mounting type	3.0	0.5	2.5	20	5	3	2	100	2
	GP1S52		High resolution, PWB mounting type	3.0	0.5	2.5	20	5	3	2	100	2
	GP1S53		High resolution, PWB mounting type	5.0	0.5	2.5	20	5	3	2	100	2
	GP1S54		High resolution, PWB mounting type	3.0	0.5	2.5	20	5	3	2	100	2
	GP1S55		High resolution, PWB mounting type	2.0	0.15	3	20	5	5	2	100	2
	GP1S56		Compact, high sensing accuracy type with positioning pin	2.0	0.15	20	20	5	38	0.5	1,000	2
	GP1S560		Compact, high sensing accuracy type with positioning pin	2.0	0.15	1	20	5	38	0.5	1,000	2
	GP1S58		Compact, PWB mounting type	5.0	0.5	2.5	20	5	3	2	100	2
	GP1S07		Compact, PWB mounting type	0.9	0.8	4.3	1.5	5	50	0.1	1,000	5
	GP1S37		Compact, PWB mounting type	2.0	0.8	1	3	5	50	0.1	1,000	5
	GP1S41		Photointerrupter with spring lever type	—	—	2.5	20	5	3	2	100	2
	GP1S21		With mounting hole	1.0	0.8	1.8	1.5	5	50	0.1	1,000	5
	GP1S17		Compact, PWB mounting type	2.0	0.8	1	3	5	50	0.1	1,000	5
	GP1S18		Compact, high resolution, PWB mounting type	0.9	0.3	1.6	1.5	5	50	0.1	1,000	5
	GP1S22		With mounting hole, high resolution	1.0	0.3	2	5	5	50	0.1	1,000	5
	GP1S23		Compact PWB mounting type	2.0	0.3	0.8	5	5	50	0.1	1,000	5
	GP1S20		With positioning pin, high resolution, PWB mounting type	1.1	0.3	1.6	1.5	5	50	0.1	1,000	5
	GP1S40		With lever type actuator & connector	—	—	2.5	20	5	3	2	100	2
	GP1S09		Snap-in mounting type with connector	5.0	0.8	2.5	20	5	3	2	100	2
Darlington transistor	GP415		Wide gap	13.2	2.5	5	20	24	500	2	100	2
	GP1L01*1		High sensitivity, both-side mounting type	3.0	2.0	300	1	2	80	10	100	2
	GP1L02		High sensitivity, either-side mounting type	4.2	2.0	20	10	2	130	10	100	2
	GP1L03		Wide gap, both-side mounting type	10.0	2.0	100	1	2	80	10	100	2
	GP1L06		High resolution, PWB mounting type	5.0	0.5	30	1	2	130	2	100	2
	GP1L12		PWB mounting type with positioning pin	3.5	2.0	300	1	2	80	10	100	2
	GP1L50		High resolution, both-side mounting type	3.0	0.5	50	1	2	80	2	100	2
	GP1L51		High resolution, side-mounting type	3.0	0.5	50	1	2	80	2	100	2
	GP1L52		High resolution, PWB mounting type	3.0	0.5	50	1	2	80	2	100	2
	GP1L53		High resolution, PWB mounting type	5.0	0.5	30	1	2	130	2	100	2
	GP1L54		High resolution, PWB mounting type	3.0	0.5	50	1	2	80	2	100	2
	GP1L55		High resolution, PWB mounting type	2.0	0.15	30	2	2	80	2	100	2
	GP1L07		Compact, PWB mounting type	0.9	0.8	50	1	2	80	10	100	2
	GP1L21		With mounting hole	1.0	0.8	40	1	2	80	10	100	2
	GP1L22		With mounting hole high resolution	1.0	0.3	20	1	2	80	10	100	2

* Topr: −25 ~ +85°C ★ 1 Built-in visible ligh cut-off filter type (F-type) is also available.

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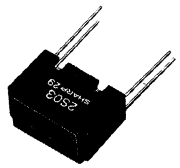
Photointerrupters

GP2A01

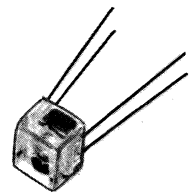
GP2A10 (GP2A12F)

GP2A11

GP2S01 (GP2L01)


GP2S03

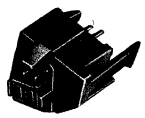
GP2S04 (GP2L04)

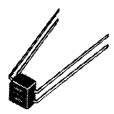

GP2S15

GP2S06 (GP2L06)

GP2S10

GP2S07


GP2S08D

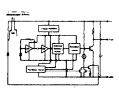
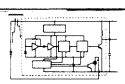

GL2S09 (GP2L09)

GP2L20(L)(R)

GP2S05

Reflective Photointerrupters

(OPIC is a registered trademark of Sharp and stands for Optical IC. It has a light detecting element and peripheral circuits integrated onto one chip.)

Type	Model No.	Internal connection diagram	Features	Optimum detecting distance	Electrical characteristics: Operating voltage Vcc (V) MIN.	Operating voltage Vcc (V) MAX.	Dissipation current Icc (mA) MAX.	Dissipation current Vcc (V)	Low level output voltage V_{OL} (V) MAX.	Low level output voltage Vcc (V)
OPIC	GP2A11		Multiple types of paper detectable, light modulation type, with connector	2~7	4.5	5.5	✻ 100	5	0.4	5
	GP2A20		Multiple types of paper detectable, light modulation type, with connector	3~7	4.75	5.25	30	5	0.4	5
	GP2A12F		Long focal distance, dust-proof visible light cut-off, detectable paper on platen, with connector	4~5	4.5	5.5	50	5	0.4	5

✻ Topr: −25~+70°C

Type	Model No.	Internal connection diagram	Features	Focal distance (mm)	Electrical characteristics: Current transfer ratio CTR (%) MIN.	I_F (mA)	V_{CE} (V)	Response time tr (μs) TYP.	Ic (mA)	R_L (Ω)	V_{CE} (V)
Single transistor	GP2S01*1		High speed detection	5	1	20	5	30	0.2	1,000	2
	GP2S03		Compact, visible light cut-off	5	0.8	20	5	30	0.2	1,000	2
	GP2S04		Compact (DIP), visible light cut-off	1	0.5	4	2	20	0.1	1,000	2
	GP2S05		Compact (DIP), with lens visible light cut-off	4	0.5	20	5	20	0.1	1,000	2
	GP2S15		Compact (DIP), with lens visible light cut-off type. Long lead	4	0.5	20	5	20	0.1	1,000	2
	GP2S06		Compact (flat package), visible light cut-off	1	0.5	4	2	20	0.1	1,000	2
	GP2S10		Compact (Short lead flat package) visible light cut-off type	1	0.5	4	2	20	0.1	1,000	2
	GP2S07		Compact (mini-mold type), visible light cut-off	1	0.5	4	2	20	0.1	1,000	2
	GP2S08D		With spacer, visible light cut-off	1	0.85	4	2	20	0.1	1,000	2
	GP2S09		Compact (DIP), longer lead version of GP2S04	1	0.5	4	2	20	0.1	1,000	2
	GP2S22		Compact type visible light cut-off	1	0.5	4	2	20	0.1	1,000	2
	GP2S24		Compact (DIP) type visible light cut-off	0.5~1	0.5	4	2	20	0.1	1,000	2
Darlington transistor	GP450*1		General purpose	3	5	20	2	130	10	100	2
	GP2L01*1		High sensitivity	5	30	10	2	80	10	100	2
	GP2L04		Compact (DIP), visible light cut-off	1	12.5	4	2	80	10	100	2
	GP2L06		Compact (flat package), visible light cut-off	1	12.5	4	2	80	10	100	2
	GP2L09		Compact (DIP), longer lead version of GP2L04	1	12.5	4	2	80	10	100	2
	GP2L20(L)(R)		Prism system conformable type DAT tape-end detection	—	5	20	5	80	2	100	2
	GP2L22		Compact type visible light cut-off	1	12.5	4	2	80	10	100	2
	GP2L24		Compact (DIP) type visible light cut-off	0.5~1	12.5	4	2	80	10	100	2

✻ Topr: −25~+85°C (GP500: −10~+60°C) *1 Built-in visible light cut-off filter type (F-type) is also available.

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Photodiodes
OPICs/OPIC Light Detectors

PIN Photodiodes

Model No.	Features	Package (Material)	Active area (mm^2)	Topr (°C)	Isc (μA) MIN.	E_V (lx)	Id (A) MAX.	V_R (V)	t_r, t_f (μs) MAX.	V_R (V)	R_L (kΩ)	λp (nm) TYP.
PD43PI	PIN type	Transparent epoxy resin	0.53	−25 ~ + 85	1.0	100	1×10^{-8}	10	0.1	10	1	920
PD49PI*1		Visible light cut-off resin	7.73	−25 ~ + 85	2.4	100	3×10^{-8}	10	—	—	—	1,000
PD410PI*1		Visible light cut-off resin with condensor	3.31	−25 ~ + 85	2.5	100	1×10^{-8}	10	0.2	10	1	1,000
PD480PI		Resin with lens (side viewing	—	−25 ~ + 85	1.0	100	1×10^{-8}	10	0.1	10	1	920
PD481PI*1		Visible light cut-off resin	7.73	−25 ~ + 85	3.5	100	3×10^{-8}	10	—	—	—	960
PD50PI		TO-18	0.96	−30 ~ +100	4	1,000	1×10^{-7}	30	0.08	30	1	700
PD80PI		TO-5	4.39	−30 ~ +100	18	1,000	1×10^{-8}	10	0.2	30	1	700
PD142PI	4 divisions on a chip for CD player	Transparent epoxy resin	0.25×4	−40 ~ + 80	1.2	1,000	1×10^{-9}	15	0.1	10	1	800
PD164PI	6 divisions on a chip for CD, VD players**	Transparent transfer mold package	0.032 ×2(A)*2 0.0062×4(B)	−25 ~ + 80	0.25(A) 0.06(B)	1,000	3×10^{-10}(A) 2×10^{-10}(B)	15	0.09	10	1	800
PD663PS			0.032 ×2(A)*2 0.007 ×4(B)	−25 ~ + 85	0.340(A) 0.080(B)	1,000	3×10^{-10}(A) 2×10^{-10}(B)	15	fc (typ) = 35MHz	10	0.50	840
PD666PS			0.038 ×2(A)*2 0.005 ×4(B)	−25 ~ + 85	0.4 (A) 0.07(B)	1,000	3×10^{-10}(A) 2×10^{-10}(B)	15	fc (typ) = 35MHz	10	0.50	840
PD322PI	2 divisions on a chip for auto focus	Transparent epoxy resin	1.71×2	−25 ~ + 80	1.2	100	2×10^{-8}	10	0.07	10	1	980

★1 Visible light cut-off filter is built-in. ★2 1 / 2 / 5 (A)···1,5 (B)···3,4,7,8

★ (OPIC is a registered trademark of Sharp and stands for Optical IC. It has a light detecting element and peripheral circuits integrated onto one chip.)

★★ Focus light detecting separation bandwidth .5μm

Semiconductor Color Sensors

(Ta = 25°C)

Model No.	Package	Topr (°C)	Isc_1 (μA) TYP.	Isc_2 (μA) TYP.	λ (nm)	Ee (μW/cm²)	Isc_2 / Isc_1 TYP.	λ (nm)	Id_1, Id_2 (A) MAX.	V_R (V)	V_{R1}, V_{R2} (V) MIN.	I_R (μA)
PD150	TO-18	0 ~ +70	0.75	0.19	600	50	0.25	600	1×10^{-8}	1	5.0	1
PD151*2	TO-18	0 ~ +70	0.65	0.16	600	50	0.25	600	1×10^{-8}	1	5.0	1
PD152	Resin with lens	−25 ~ +80	1.3	2.5	—	1,000	0.25	600	1×10^{-8}	1	5.0	1
PD153	TO-18	−15 ~ +70	4.5	10.0	—	1,000	0.24	600	1×10^{-8}	1	5.0	1

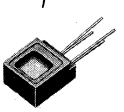
PD150 (PD151) (PD153)

PD152

★2 Infrared light cut-filter is built-in.

(Ta = 25°C)

Model No.	Package	Topr (°C)	I_{SCR} (μA) TYP.	I_{SCG} (μA) TYP.	I_{SCB} (μA) TYP.	CIE, A (lx)	TYP. (nm) λp (R)	Δλ (R)	λp (G)	Δλ (G)	λp (B)	Δλ (B)
PD170V1	Resin	−10 ~ +60	0.38	0.30	0.32	1,000	600	70	530	85	460	80



PD170V1

Blue-sensitive Photodiodes

(Ta = 25°C)

Model No.	Features	Package (material)	Active area (mm^2)	Topr (°C)	Isc (μA) MIN.	V_{OC} (V) MIN.	E_V (lx)	Id (A) MAX.	V_R (V)	λp (nm) TYP.
SBC102	Convert type	Metal	44.0	−10 ~ + 70	15.5	0.18	100	—	—	750
SBC111		Acryl resin	314	−10 ~ + 70	110	0.18	100	—	—	750
SBC255		—	12.5(*3 2.5×5.0)	−10 ~ + 70	4.4	0.18	100	—	—	750
SBC541		Phenol resin (Black)	200	−10 ~ + 70	70.00	0.18	100	—	—	750
BS112	Planar convert type	TO-5	11.9	−10 ~ + 60	5.5	0.25	100	1×10^{-7}	1	800
BS142		TO-8	41.8	−10 ~ + 60	18	0.25	100	1×10^{-7}	1	800
BS530UV		Ceramic	81.0	−10 ~ + 60	35	0.30	100	5×10^{-8}	1	800
BS500A	Planar type	Ceramic	5.34	−10 ~ + 60	3.3	—	100	2×10^{-9}	2	850
BS500B			5.34	−20 ~ + 60	0.4	—	100	1×10^{-11}	1	560
BS100C			1.55	−20 ~ + 60	0.14	—	100	1×10^{-11}	1	560
BS100D			1.55	−10 ~ + 60	0.80	—	100	1×10^{-10}	1	880
BS120		Resin (Black)	1.55	−20 ~ + 60	0.14	—	100	1×10^{-11}	1	560
BS520			5.34	−20 ~ + 60	0.40	—	100	1×10^{-11}	1	560
BS521			5.34	−20 ~ + 60	0.65	—	100	3×10^{-12}	0.01	560

OPEC Light Detectors

(OPIC is a registered trademark of Sharp and stands for Optical IC. It has a light detecting element and peripheral circuits integrated onto one chip.)

(Ta = 25°C)

Model No.	Features	Package	Absolute maximum ratings V_{CC} (V)	P (mW)	I_{OL} (mA)	Topr (°C)	Electro-optical characteristics E_{VLN} (1x) MAX.	E_{VLN} (1x) MAX.	V_{cc} (V)	t_{PLH} (μS) TYP.	t_{PHL} (μS) TYP.	V_{CC} (V)	E_V) (1x)	R_L (Ω)
IS431	Built in Schmitt trigger ckt amplifier and voltage regulator	Resin with lens	$-0.5 \sim +7$	250	50	−25 ~ +85	—	35	5	5	3	5	50	280
IS432			$-0.5 \sim +7$	250	50	−25 ~ +85	35	—	5	3	5	5	50	280
IS435			$-0.5 \sim +17$	250	50	−25 ~ +85	—	35	5	5	3	5	50	280
IS436			$-0.5 \sim +17$	250	50	−25 ~ +85	35	—	5	3	5	5	50	280
IS437			$-0.5 \sim +35$	250	50	−25 ~ +85	—	35	5	5	3	5	50	280
IS438			$-0.5 \sim +35$	250	50	−25 ~ +85	35	—	5	3	5	5	50	280
IS486			$-0.5 \sim +17$	250	50	−25 ~ +85	35	—	5	3	5	5	50	280

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SHARP®
Optoelectronics

OPICs/OPIC Light Detectors Phototransistors/ Photothyristors/Photodiodes

OPEC Light Detectors

(OPIC is a registered trademark of Sharp and stands for Optical IC. It has a light detecting element and peripheral circuits integrated onto one chip.)

(Ta = 25°C)

Model No.	Features	Package	Absolute maximum ratings				Electro-optical characteristics						
			V_{CC} (V)	P (mW)	I_{OL} (mA)	Topr (°C)	V_{OL} MAX. (V)	V_{OH} MIN. (V)	t_{PLH} MAX. (μS)	t_{PHL} MAX. (μS)	V_{CC} (V)	R_L (Ω)	External distributing light illuminance E_V(lx)
IS440	Pulse drive circuit and sync. detection circuit are built-in in the light emitting side	Transparent epoxy resin	−0.5 ~ +16	250	50	−25 ~ +60	0.35	4.97	670	670	4.5 ~ 16	280	7,200 TYP
IS441F	Pulse drive circuit and sync. detection circuit are built-in in the light emitting side	Transparent epoxy resin	−0.5 ~ +16	250	50	−25 ~ +60	0.35	4.97	670	670	4.5 ~ 16	280	4,500 TYP
IS450	Built-in amp circuit sync. signal circuit and modification circuit	Epoxy resin	−0.5 ~ +9	150	16	−25 ~ +60	0.35	4.97	670	670	4.5 ~ 16	280	7,200 TYP

Model No.	Features	Package	Absolute maximum ratings				Electro-optical characteristics								
			V_{CC} (V)	P (mW)	I_{OL} (mA)	Topr (°C)	I_{CC} (ma) MAX.	E_V (lx)	I_{01} (ma) MIN.	E_V (lx)	I_{02} (ma) MAX.	E_V (lx)	I_{OD} (ma) MAX.	E_V (lx)	λP (nm) TYP.
IS445	Linear output built in amplifier and voltage regulator	Transparent epoxy resin (side viewing)	−0.5 ~ +8	250	−10	−25 ~ +85	0.2	0	−6.5	10	−0.65	1,000	−500	0	700
IS455	Voltage regulator	Epoxy resin (top viewing)	−0.5 ~ +8	150	−10	−25 ~ +85	0.2	0	−6.5	10	−0.65	1,000	−500	0	700

Model No.	Features	Package	Absolute maximum ratings				Electro-optical characteristics							
			V_{CC} (V) MAX	V_{OH} (V)	I_{OL} (ma)	Topr (OL)	V_{OH} (V) MIN	V_{OL} (V) MAX	H&L Thresh illumin 1	H&L Thresh illumin 2	H&L Prop time TPHL	L&H Prop time TPLH	tr	tf
IS456	For laser beam printer	Epoxy resin	7	7	20	−25 ~ +80	4.9	0.6	600	5800	400 ns max	400 ns max	200 ns max	100 ns max

Model No.	Type	Package	Absolute maximum ratings			Electro-optical characteristics						
						Sensitivity Rp (mVμW) TYP.		Response frequency fc (MHz) TYP.				
			V_{CC} (V)	P (mw)	Top (°C)	V_A, V_B, V_C, V_D, V_E, V_F	VRF	V_A, V_B, V_C, V_D	V_E, V_F	VV_{RF}	R_R (kΩ)	C_L (Pf)
IS1603	6 divisions on a chip built in high speed amplifier	Transparent epoxy resin	6	210	−20 ~ +65	24.5	30	25	250	25	10	10

Phototransistors

(Ta = 25°C)

Model No.	Package	Absolute maximum ratings			Ic (mA)				I_{CEO} (A) MAX.		Δθ (deg.) TYP.	λP (nm) TYP.
		V_{CEO} (V)	Pc (mW)	Topr (°C)	MIN.	TYP.	V_{CE} (V)	Ee (mW/cm²)		V_{CE} (V)		
PT370	φ3 resin stem	35	75	−25 ~ + 85	0.1	0.3	5	100 lx	1×10^{-7}	20	±45	800
PT371		35	75	−25 ~ + 85	0.1	—	5	100 lx	1×10^{-7}	20	±65	800
PT372		35	75	−25 ~ + 85	3	—	2	100 lx	1×10^{-6}	10	±70	800
PT360	φ3 resin	35	50	−25 ~ + 85	0.075	0.2	5	100 lx	1×10^{-7}	20	±20	800
PT360F*1		35	50	−25 ~ + 85	0.075	0.2	5	0.52	1×10^{-7}	20	±20°	860
PT361	φ3 resin	35	50	−25 ~ + 85	0.1	0.2	10	2 1x	1×10^{-6}	10	±20	800
PT361F*1		35	50	−25 ~ + 85	0.1	0.2	10	0.01	1×10^{-6}	10	±20°	860
PT420F*1	Resin with lens	35	75	−25 ~ + 85	0.4	—	5	1	1×10^{-7}	20	±40	860
PT421F*1		35	75	−25 ~ + 85	0.8	—	2	0.1	1×10^{-6}	10	±40	860
PT483F1*1		35	75	−25 ~ + 85	1.5	—	2	0.1	1×10^{-6}	10	±13	860
PT430		35	75	−25 ~ + 85	0.4	1.7	5	1	1×10^{-7}	20	±13	800
PT430F*1		35	75	−25 ~ + 85	0.25	0.8	5	1	1×10^{-7}	20	±13	860
PT431		35	75	−25 ~ + 85	2	10.0	2	0.1	1×10^{-6}	10	±13	800
PT431F*1		35	75	−25 ~ + 85	1.3	8.0	2	0.1	1×10^{-6}	10	±13	860
PT480		35	75	−25 ~ + 85	0.4	1.7	5	1	1×10^{-7}	20	±13	800
PT480F*1		35	75	−25 ~ + 85	0.25	0.8	5	1	1×10^{-7}	20	±13	860
PT481		35	75	−25 ~ + 85	1.5	10	2	0.1	1×10^{-6}	10	±13	800
PT481F*1		35	75	−25 ~ + 85	0.9	—	2	0.1	1×10^{-6}	10	±13	860
PT491		35	75	−25 ~ + 85	0.3	0.6	2	Ev + 2lx	1×10^{-6}	10	±40°	800
PT491F*1		35	75	−25 ~ + 85	0.2	0.4	2	Ev + 2lx	1×10^{-6}	10	±40°	860
PT493		35	75	−25 ~ + 85	0.3	0.6	2	Ev + 2lx	1×10^{-6}	10	±40°	800
PT493F*1		35	75	−25 ~ + 85	0.2	0.4	2	Ev + 2lx	1×10^{-6}	10	±40°	860
PT4800		35	75	−25 ~ + 85	0.12	0.4	5	1	1×10^{-7}	20	±35°	800
PT4800F*1		35	75	−25 ~ + 85	0.08	0.25	5	1	1×10^{-7}	20	±35°	860
PT4810		35	75	−25 ~ + 85	0.12	—	5	1	1×10^{-6}	10	±35°	800
PT4810F*1		35	75	−25 ~ + 85	0.45	—	2	0.1	1×10^{-6}	10	±35°	860
PT4850F*1		35	75	−25 ~ + 85	0.27	—	2	0.1	1×10^{-7}	20	±35°	860
PT501	TO-18	45	75	−25 ~ +125	2.5	10	5	10	1×10^{-7}	30	± 6	800
PT510		35	75	−25 ~ +125	2.5	20.0	5	10	1×10^{-7}	30	± 6	800
PT550		35	150	−25 ~ +125	3	20.0	5	0.1	1×10^{-6}	10	± 6	800
PT550F		35	150	−25 ~ +125	3	20.0	5	1	1×10^{-6}	10	±50	800

★1 Visible light cut-off type

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Photodiodes
Light Detecting Units

SPD102

SPD110

SPD111

SPD331

SPD500

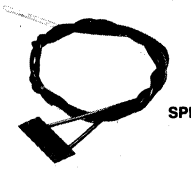
SPD511T

SPD530

SPD540

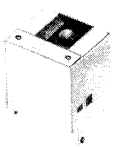
SPD541

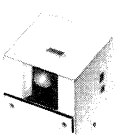
SPD550

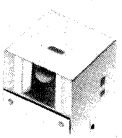

SPD570

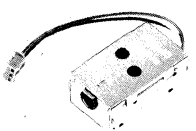
Photodiodes for Near Infrared Light

Model No.	Features	Package material	Element dimension (mm)	Active area (mm^2)	Topr (°C)	I_{SC} (μA) MIN.	V_{OC} (V) MIN.	E_V (lx)	Id (A) TYP.	V_R (V)	λp (nm) TYP.
SPD102	Mesa type	Metal	—	44.0	−10 ~ +70	238	0.35	1,000	—	—	850
SPD110		—	20.0DIA	314	−10 ~ +70	1,737	0.35	1,000	—	—	850
SPD111		Acryl resin	—	314	−10 ~ +70	1,600	0.35	1,000	—	—	850
SPD331		ABS (Black)	—	9.0	−10 ~ +70	48	0.35	1,000	—	—	850
SPD500		—	3.0 × 4.5	13.5	−10 ~ +70	75	0.35	1,000	—	—	850
SPD511T		ABS (Black)	—	20.25	−10 ~ +70	112	0.35	1,000	—	—	850
SPD530		—	10.0 × 10.0	100	−10 ~ +70	553	0.35	1,000	—	—	850
SPD540		—	10.0 × 20.0	200	−10 ~ +70	1,105	0.35	1,000	—	—	850
SPD541		Phenol resin (Black)	—	200	−10 ~ +70	995	0.35	1,000	—	—	850
SPD550		—	2.0 × 5.0	10.0	−10 ~ +70	58	0.35	1,000	—	—	850
SPD570		—	4.0 × 10.0	40.0	−10 ~ +70	221	0.35	1,000	—	—	850


GP1U52X series


GP1U52Y


GP1U52Q

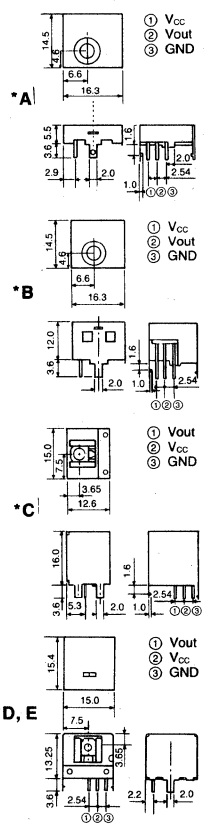

GP1W01
(GP1W02)

GP1W03

Light Detecting Units for Remote Controller

Series			GP1U56 Series	GP1U50X Series	GP1U52X Series	GP1U52Y Series	*1GP1U52Q Series
Viewing direction			Top viewing	Top viewing	Top viewing	Side viewing	
Height			5.5mm	12mm	16mm	13.25mm	
Dimensions			*A	*B	*C	*D	*E
Absolute Maximum Ratings	V_{CC} (V)		6.3				
	T_{opr} (°C)		−10 ~ +60				
	I_{CC} (mA)		5				
Electrical Characteristics	V_{OH} (V)		V_{CC} ~ −0.5				
	V_{OL} (V)		0.45				
	T_1 (μs)	MIN.	400	440	400	400	400
		MAX.	800	770	800	800	800
	T_2 (μs)	MIN.	400	440	400	400	400
		MAX.	800	770	800	800	800
CR filter			—	○	○	○	○
	40kHz		GP1U56	GP1U50X	GP1U52X	GP1U52Y	GP1U52Q
	38kHz		GP1U561	GP1U501X	GP1U521X	GP1U521Y	GP1U521Q
	36.7kHz		GP1U562	GP1U502X	GP1U522X	GP1U522Y	GP1U522Q
	32.75kHz		GP1U563	GP1U503X	GP1U523X	GP1U523Y	GP1U523Q
	41.7kHz		GP1U565	GP1U505X	GP1U525X	GP1U525Y	GP1U525Q
	48kHz		GP1U566	GP1U506X	GP1U526X	GP1U526Y	GP1U526Q
	56.8kHz		GP1U567	GP1U507X	GP1U527X	GP1U527Y	GP1U527Q
	39kHz		GP1U568	GP1U508X	GP1U528X	GP1U528Y	GP1U528Q
	35kHz		GP1U569	GP1U509X	GP1U529X	GP1U529Y	GP1U529Q

*1 With conductive film for eliminating electro-magnetic induction noise



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SILONEX inc

CdS/CdSe PHOTOCONDUCTIVE CELLS • OPTICALLY COUPLED ISOLATORS • SILICON PHOTODIODES AND PHOTODIODE ARRAYS • CUSTOMIZED OPTOELECTRONIC ASSEMBLIES

CdS & CdSe PHOTOCELLS

Cell Type No.	Typical 1.0 Ftc Res. KΩ	Min. Dark Res. MΩ	Max. Peak Volt.	Max. Power mW.	Description
NSL-3120	75	100	70	50	CdSe Photoconductive Cell in Hermetic Glass and Metal TO-18. CdS versions also available.
NSL-3130	30	100	70	50	
NSL-3140	14	100	70	50	
NSL-3150	550	1000	250	50	
NSL-3160	260	1000	250	50	
NSL-3170	110	1000	250	50	
NSL-3180	50	500	120	50	
NSL-3812	43	10	80	100	CdSe Photoconductive cell in TO-5 plastic coated "open pill" package. Also available in CdS material.
NSL-3822	18.6	10	80	100	
NSL-3832	8	10	80	100	
NSL-3842	3.5	10	80	100	
NSL-3852	330	100	320	100	
NSL-3862	155	100	320	100	
NSL-3872	66	100	320	100	
NSL-4440	120	50	1000	1000	1" CdS Photoconductive Cell in Hermetic Glass and Metal case 1.25" diameter.
NSL-4450	26.0	15	1000	1000	
NSL-4460	11.4	5	1000	1000	
NSL-4470	5.5	0.5	1000	1000	
NSL-4442	120	10	1000	500	1" CdS Photocoductive Cell in plastic coated "open pill" package.
NSL-4452	26	1.5	1000	500	
NSL-4462	11.4	0.5	1000	500	
NSL-4472	5.5	0.2	1000	500	
NSL-4610	65	80	80	100	CdS Photoconductive Cell in Hermetic Glass and Metal ¼" dia. case. Hermetic CdSe versions also available.
NSL-4620	28	20	80	100	
NSL-4630	12	2.7	80	100	
NSL-4640	5.2	0.7	80	100	
NSL-4650	550	160	250	100	
NSL-4660	230	20	250	100	
NSL-4670	100	4	250	100	
NSL-2930	1.7	0.5	80	500	TO-8 Hermetic CdS/Se Photoconductive Cell.
NSL-2940	.75	0.1	80	500	
NSL-2970	7.5	5.0	250	500	
NSL-3921	4.0	2	80	200	TO-8 CdSe Photoconductive Cell in Plastic Case. Glass Lens and Plastic Coated "open pill" and CdS versions also available.
NSL-3931	1.7	2	80	200	
NSL-3941	0.75	2	80	200	
NSL-3951	40.0	5	320	200	
NSL-3961	17.0	5	320	200	
NSL-3971	7.5	5	320	200	
NSL-4920	4.0	2.0	80	500	CdS Photoconductive Cell in Hermetic Glass and Metal TO-8. Hermetic CdSe version also available.
NSL-4930	1.7	0.4	80	500	
NSL-4940	0.75	0.05	80	500	
NSL-4950	40	30	320	500	
NSL-4960	17	4.0	320	500	
NSL-4970	7.5	0.5	320	500	
NORP-11	20	2.5	320	250	CdS Photocell in 0.5" lensed Plastic case.
NORP-12	9	1	320	250	
NORP-13	4	0.5	320	250	
NSL-4510	43.0	65	120	100	CdS Photoconductive cell in Hermetic TO-5 package. Two plastic encapsulated versions also available.
NSL-4520	18.6	15	120	100	
NSL-4530	8	1.8	120	100	
NSL-4540	3.5	0.25	120	100	
NSL-4550	330	200	320	100	
NSL-4560	155	130	320	100	
NSL-4570	65	20	320	100	

UV SENSITIVE LDRs

Cell Type No.	Typical 1.0 Ftc Res. KΩ	Min. Dark Res. MΩ	Max. Peak Volt	Max. Power MW	Description
NSL-2129/3	1.7	0.2	80	200	0.5" Plastic Case with Phosphor-Coated Quartz Window
NSL-2129/6	17.0	1	320	200	

PIN PHOTODIODES

NSL Type No.	Light Current* MA	Dark Current nA	Rise Time nS	Fall Time nS	Description
NSL-530	0.3	10	3	6	TO-18 Package
NSL-580	1.5	30	5	8	TO-5

* At 500 Ftc (25 MW/cm²) 2870°K Source

PHOTODETECTOR LAMP/LED ASSEMBLIES

CdSe Photodetector

	Emitter			Detector			
Module Type No.	Volts	Current MA	Max. ON Res. Ω	Min. OFF Res. MΩ	Max. Volts	Max. Power mW	Description
PL-1033-1	10	15	100	10	80	250	Phenolic .75" x .75" x 625" Pin Leads for P.C. Board Mounting, (Matched, Multi-Detector Configurations available.)
PL-1036-1	10	15	400	50	320	250	
PL-2H33-1	200	2	100	10	80	250	
PL-2H36-1	200	2	400	50	320	250	
PL-5S33-1		25	250	10	80	250	
PL-5S36-1		25	2000	100	320	250	
PLT-10384	10	15	250	10	80	100	Standard tube: Axial leads.
PLT-10387	10	15	3000	50	320	100	
PLT-2H384	200	2	500	10	80	100	
PLT-2H387	200	2	10000	50	320	100	
PLS-5S380		25	250	10	80	100	Small tube; Axial leads.
PLS-5S387		25	4000	100	320	100	
PLM-5S310		25	500	10	80	50	Miniature Tube; Axial leads.
PLM-5S317		25	5000	100	320	50	

SILICON PHOTODIODES

Cell Type No.	Min. Short Ct.* Curr. MA	Min. Open Ct.* Volt.	Dark Curr. μA @ IV @ 25°C	Reverse Voltage Recom. Max.	Description
NSL-701-1	0.30	0.35	3	5	.1 " x .2"Chip. Wire Leads
NSL-801-1	0.325	0.275	1.5	10	
NSL-701-9	0.30	0.35	3	5	9 Element Cell, 0.1" Spacing
NSL-702	0.6	0.35	5	5	.2" x .2* Chip. Wire Leads
NSL-802	0.65	0.275	2.5	10	
NSL-703	1.4	0.35	15	5	.2" v .4" Chip. Wire Leads
NSL-803	1.5	0.275	7.5	10	
NSL-705	4.5	0.35	25	5	.76" x .354" Chip. Wire Leads
NSL-805	4.77	0.275	12.5	10	
NSL-706	2.9	0.35	20	5	.4" x .4" Chip. Wire Leads
NSL-806	3.0	0.275	10	10	
NSL-707	3.3	0.35	25	5	.2" x 1" Chip. Wire Leads
NSL-807	3.5	0.275	12.5	10	
NSL-708	1.3	0.35	15	5	.1" x 1" Chip. Wire Leads
NSL-808	1.4	0.275	7.5	10	
NSL-710	0.125	0.4	1	5	TO-18 Package
NSL-810	0.150	0.275	0.5	10	
NSL-751	1.4	0.35	2.0	5	0.5" dia. Epoxy Package
NSL-851	1.5	0.275	10	10	
NSL-781	0.28	0.35	5	5	Hermetic TO-5 Case
NSL-881	0.3	0.275	2.5	10	
NSL-782	0.42	0.35	5	5	
NSL-791	0.60	0.35	5	5	Hermetic TO-8 Case
NSL-792	1.1	0.35	15	5	
NSL-8932	0.65	0.275	0.5	10	0.5" dia. Ceramic
NSL-6136	100.0	.38	3	5	.05" x .125" Chip.
NSL-6122	110.0	.33	2	10	.05" x .125" Chip.
NSL-6134	150.0	.40	3	5	.130" x .150" Dual Chip.

* At 500 Ftc (25 MW/cm²) 2870°K Source

SILICON PLANAR PHOTODETECTORS

Cell Type No.	Min. Short Ct.* Curr. μA	Min. Open Ct.* Volt.	Dark Curr. NA @ 5V @ 25°C	Breakdown Voltage (V)	Description
NSL-811	100	0.4	5	40	TO-18, Flat Window
NSL-812	310	0.4	5	40	TO-18, Low Lens
NSL-813	220	0.4	5	40	TO-18, High Lens
NSL-814	90	0.4	5	40	TO-52, Flat Window
NSL-815	240	0.4	5	40	TO-52, Low Lens
NSL-883	360	0.4	10	20	TO-5, Flat Window
NSL-893	800	0.4	20	10	TO-8, Flat Window

* At 500 Ftc, 2870°K Source

NSL-811 and NSL-883 are available in dual and quad versions in TO-5 and TO-8 packages.

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Designed by Engineers for Engineers

High Speed
Spectrally Enhanced
UV—Visible—IR
Low Noise
Linear
Photoconductive
Photovoltaic
Low Capacitance
High Voltage Breakdown
Reliable and Low Cost

SD — XXX — XX — XX — XXX

ACTIVE AREA SIZE
(Expressed in inches — effective diameter)
ie: 020 = .020 inch diameter
200 = .200 inch diameter
444 = .444 inch diameter

PRODUCT SERIES
11 Single element, Red IR Enhanced
12 Single element, Blue Enhanced
13 Single element, U.V. Enhanced
21 Single Axis Position Sensing (PSC)
22 Dual Axis Position Sensing (PSC)
23 Quadrant Detector
24 Bi-Cell Detector
31 Photopic Detector
32 Red Photopic Detector
41 Opto Hybrid Red/IR Enhanced
42 Opto Hybrid Blue Enhanced
43 Opto Hybrid U.V. Enhanced

DETECTOR APPLICATION
11- Photovoltaic—Ultra Low Noise/Medium Frequency Red I.R. Enhanced
12- Photovoltaic—Ultra Low Noise/Medium Frequency Blue Enhanced
13- Photovoltaic—Ultra Low Noise/Medium Frequency U.V. Enhanced
21- Photoconductive—High Frequency Red I.R. Enhanced
22- Photoconductive—High Frequency Blue I.R. Enhanced
23- Photoconductive—High Frequency U.V. Enhanced

PACKAGE CODE
011-TO-18
211-TO-18 Isolated
021-TO-5
221-TO-5 Isolated
041-TO-8
042-TO-8 UV Window
241-TO-8
242-TO-8 Isolated UV
251-Jumbo TO-8
252-Jumbo TO-8 UV
171-BNC Std. Window
172-BNC UV Window
022-Std. TO-5 Header/UV Window
222-Iso. TO-5 Header/UV Window
042-Std. TO-8 Header/UV Window
242-Iso. TO-8 Header/UV Window
181-1.6" Diameter BNC Pkg.
231-Iso. TO-5 Tall Cap
232-Iso. TO-5 Tall Cap UV Wind
261-Jumbo TO-8 Std. Window
262-Jumbo TO-8 UV Window
391-Plastic Pkg. Exp. Window
040-No Window Cap Ins. Wire Bd
051-Std. Jumbo TO-8 Head Std. Window

Single Element
Bi-Cells
Quadrant
Detector Hybrids
Position Sensors
Filter Detector
Multi-Element Arrays
Custom Hybrids
Calibration
Opto-Assemblies
MIL-STD-883 Screening

SINGLE ELEMENT DETECTORS—PHOTOVOLTAIC GROUP SPECIFICATIONS (23°C)

MODEL NUMBER	SPECTRAL ENHANCEMENT	ACTIVE AREA AREA (mm^2)	RESPONSIVITY AT SPECTRAL PEAK (A/W)	MIN. DYNAMIC RESISTANCE 0 Volts (MΩ)	JUN CAP 5 Volts (pF)	RESP TIME 5 Volts (ns)	TYP DARK CURRENT-I 5 Volts (nA)	TYP. NEP SPECTRAL PEAK 0 Volts 1 kHz ($W/\sqrt{Hz}$)
SD-020-11-11-011 (ISOLATED)-211	RED/IR	0.20	.55	800	25	7	.10	5×10^{-15}
SD-020-12-12-011 (ISOLATED)-211	BLUE/VISIBLE	0.20	.55	800	25	7	.10	5×10^{-15}
SD-041-11-11-011 (ISOLATED)-211	RED/IR	0.85	.55	500	39	4.1	.13	7.3×10^{-15}
SD-041-12-12-011 (ISOLATED)-211	BLUE/VISIBLE	0.85	.55	500	39	8	.13	7.3×10^{-15}
SD-076-11-11-011 (ISOLATED)-211	RED/IR	2.91	.55	200	132	7.3	.45	1.2×10^{-14}
SD-076-12-12-011 (ISOLATED)-211	BLUE/VISIBLE	2.91	.55	200	132	21	.45	1.2×10^{-14}
SD-100-11-11-021 (ISOLATED)-211	RED/IR	5.1	.55	100	232	10	.75	1.7×10^{-14}
SD-100-12-12-021 (ISOLATED)-221	BLUE/VISIBLE	5.1	.55	100	232	34	.75	1.7×10^{-14}
SD-100-13-13-022 (ISOLATED)-222	UV	5.1	.55	100	232	34	.75	1.7×10^{-14}
SD-172-11-11-021 (ISOLATED)-221	RED/IR	15.0	.55	70	682	25	2	1.9×10^{-14}
SD-172-12-12-021 (ISOLATED)-221	BLUE/VISIBLE	15.0	.55	70	682	94	2	1.9×10^{-14}
SD-172-13-13-022 (ISOLATED)-222	UV	15.0	.55	70	682	94	2	1.9×10^{-14}
SD-200-11-11-041 (ISOLATED)-241	RED/IR	20.3	.55	50	923	33	3	2.3×10^{-14}
SD-200-12-12-041 (ISOLATED)-241	BLUE/VISIBLE	20.3	.55	50	923	128	3	2.3×10^{-14}
SD-200-13-13-042 (ISOLATED)-241	UV	20.3	.55	50	923	128	3	2.3×10^{-14}
SD-290-11-11-041 (ISOLATED)-241	RED/IR	42.6	.55	20	1,936	67	7	3.6×10^{-14}
SD-290-12-12-041 (ISOLATED)-241	BLUE/VISIBLE	42.6	.55	20	1,936	216	3 @ 1 V	3.6×10^{-14}
SD-290-13-13-042 (ISOLATED)-242	UV	42.6	.55	20	1,936	216	3 @ 1 V	3.6×10^{-14}
SD-444-11-11-171 (ISOLATED)-251	RED/IR	100	.55	10	4,545	153	15	5.1×10^{-14}
SD-444-12-12-171 (ISOLATED)-251	BLUE/VISIBLE	100	.55	10	4,545	510	7 @ 1 V	5.1×10^{-14}
SD-444-13-13-172 (ISOLATED)-252	UV	100	.55	10	4,545	510	7 @ 1 V	5.1×10^{-14}

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SILICON DETECTOR CORP.

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CUSTOM SILICON PHOTODETECTORS

Designed by Engineers for Engineers

SINGLE ELEMENT DETECTORS—PHOTOCONDUCTIVE GROUP SPECIFICATIONS (23°C)

MODEL NUMBER	SPECTRAL ENHANCEMENT	ACTIVE AREA Area (mm^2)	RESPONSIVITY AT SPECTRAL PEAK (A/W)	MAX DARK CURRENT-Id 50 Volts (nA)	DYNAMIC RESISTANCE-Rp 0 Volts (MΩ)	JUN CAP 50 Volts (pF)	RESP TIME 50 Volts (ns)	TYP. NEP Spectral Peak 50 Volts 1 kHz (W/√Hz)
SD-020-11-21-011 (ISOLATED)-211	RED/IR	0.20	.55	2	600	1	3.5	4.0×10^{-14}
SD-020-12-22-011 (ISOLATED)-211	BLUE/VISIBLE	0.20	.55	2	600	1	3.5	4.0×10^{-14}
SD-041-11-21-011 (ISOLATED)-211	RED/IR	0.85	.55	6	300	2	3.7	5.7×10^{-14}
SD-041-12-22-011 (ISOLATED)-211	BLUE/VISIBLE	0.85	.55	6	300	2	4.5	5.7×10^{-14}
SD-076-11-21-011 (ISOLATED)-211	RED/IR	2.91	.55	20	130	6	3.8	1.0×10^{-13}
SD-076-12-22-011 (ISOLATED)-211	BLUE/VISIBLE	2.91	.55	20	130	6	6.3	1.0×10^{-13}
SD-100-11-21-021 (ISOLATED)-221	RED/IR	5.1	.55	35	70	11	4.6	1.4×10^{-13}
SD-100-12-22-021 (ISOLATED)-221	BLUE/VISIBLE	5.1	.55	35	70	11	8.6	1.4×10^{-13}
SD-100-13-23-022 (ISOLATED)-222	UV	5.1	.55	35	70	11	8.6	1.4×10^{-13}
SD-172-11-21-021 (ISOLATED)-221	RED/IR	15.0	.55	105	50	33	4.9	2.4×10^{-13}
SD-172-12-22-021 (ISOLATED)-221	BLUE/VISIBLE	15.0	.55	105	50	33	18	2.4×10^{-13}
SD-172-13-23-022 (ISOLATED)-222	UV	15.0	.55	105	50	33	18	2.4×10^{-13}
SD-200-11-21-041 (ISOLATED)-241	RED/IR	20.3	.55	140	30	44	5.3	2.7×10^{-13}
SD-200-12-22-041 (ISOLATED)-241	BLUE/VISIBLE	20.3	.55	140	30	44	23	2.7×10^{-13}
SD-200-13-23-042 (ISOLATED)-241	UV	20.3	.55	140	30	44	23	2.7×10^{-13}
SD-290-11-21-041 (ISOLATED)-241	RED/IR	42.6	.55	300	13	91	6.8	4.0×10^{-13}
SD-290-12-22-041 (ISOLATED)-241	BLUE/VISIBLE	42.6	.55	200 @ 10 V	13	212 @ 10 V	103 @ 10 V	3.2×10^{-13} @ 10 V
SD-290-13-23-042 (ISOLATED)-251	UV	42.6	.55	200 @ 10 V	13	212 @ 10 V	103 @ 10 V	3.2×10^{-13} @ 10 V
SD-444-11-21-171 (ISOLATED)-251	RED/IR	100	.55	700	7	214	11	6.2×10^{-13}
SD-444-12-22-171 (ISOLATED)-251	BLUE/VISIBLE	100	.55	500 @ 10 V	7	500 @ 10 V	230	5.3×10^{-13} @ 10 V
SD-444-13-23-172 (ISOLATED)-252	UV	100	.55	500 @ 10 V	7	500 @ 10 V	230	5.3×10^{-13} @ 10 V
SD-1100-11-21-181	RED/IR	613	.55	6000 @ 10 V	1	3040	300 @ 10 V	1.0×10^{-12}
SD-1100-12-22-181	BLUE/VISIBLE	613	.55	6000 @ 10 V	1	3040	300 @ 10 V	1.0×10^{-12}

BI-CELL AND QUADRANT SILICON DETECTORS (23°C)

Detector Model Number	Photosensitive Surface/Element Size (mm)	Photosensitive Surface/Element Effective Area (mm^2)	GAP (mm)	Dark Current I_D @ V_R = 10V (nA)	Shunt Resistance = 10mV) Typ (MΩ)	Junction Capacitance C_j @ V_R = 10V (pF)	Spectral Range (nm)	Radiant Sensitivity (A/W) He-Ne Laser (633nm)	Radiant Sensitivity (A/W) GaAs LED (930nm)	Radiant Sensitivity (A/W) YAG Laser (1060nm)	NEP (W/Hz$^{1/2}$) @ 633nm	Response Time (@ 655nm) t_r @ V_R = 10v (ns)
Bi-Cell (Two Element Detectors)												
SD 066-24-21-011	1.19 x 0.58	0.7	0.02	0.4	2000	5	400-1100	0.35	0.50	0.20	8×10^{-15}	40
SD 113-24-21-021	2.54 x 1.22	3.1	0.10	2.0	500	20	400-1100	0.35	0.50	0.20	1.6×10^{-14}	40
SD 160-24-21-021	4.57 x 0.51	2.3	0.02	1.5	500	10	400-1100	0.35	0.50	0.20	1.6×10^{-14}	40
SD 385-24-21-041	4.83 x 4.23	20.4	0.13	25.0	300	70	400-1100	0.35	0.50	0.20	2.1×10^{-14}	40
Quadrant (Four Element Detectors)												
SD 055-23-21-011	0.50 x 0.50	0.25	0.015	0.15	2000	8	400-1100	0.35	0.50	0.20	8×10^{-15}	40
SD 085-23-21-021	1.50 x 1.50	2.25	0.01	1.5	500	10	400-1100	0.35	0.50	0.20	1.6×10^{-14}	40
SD 118-23-21-021	1.27 x 1.27	1.6	0.13	1.0	500	12	400-1100	0.35	0.50	0.20	1.6×10^{-14}	40
SD 197-23-21-041	5.00 dia	4.8	0.03	2.5	500	20	400-1100	0.35	0.50	0.20	1.6×10^{-14}	40
SD 225-23-21-040	5.72 dia	5.4	0.13	2.8	500	25	400-1100	0.35	0.50	0.20	1.6×10^{-14}	40
SD 380-23-21-051	9.65 dia	17.8	0.10	10.0	250	90	400-1100	0.35	0.50	0.20	2.3×10^{-14}	80
SD 380-23-21-251	9.65 dia	17.8	0.10	10.0	250	90	400-1100	0.35	0.50	0.20	2.3×10^{-14}	80

OPTO HYBRIDS (DETECTOR AMPLIFIER HYBRID) SPECIFICATIONS (23°C)

MODEL NUMBER	Active Area (mm^2)	Spectral Enhancement	Responsivity PEAK	Dynamic Resistance (0 Volts)	Junction Capacitance at 0V / at 5V	Dark Current (nA) 1V 5V	Typical NEP (w√Hz) Spectral Peak, 1KHz at 0V
SD100-41-11-231	5.1	Red/IR	.55	100	510 / 232	.75 @ 5V	1.7×10^{-14}
SD100-42-12-231	5.1	Blue/Vis	.55	100	510 / 232	.75 @ 5V	1.7×10^{-14}
SD100-43-13-232	5.1	UV	.55	100	510 / 232	.75 @ 5V	1.7×10^{-14}
SD444-41-11-261	100	Red/IR	.55	10	10K / 4.545	15 @ 5V	5.1×10^{-14}
SD444-42-12-261	100	Blue/Vis	.55	10	10K / 4.545	7 @ 5V	5.1×10^{-14}
SD444-43-13-262	100	UV	.55	10	10K / 4.545	7 @ 1V	5.1×10^{-14}
SD100-41-21-231	5.1	Red/IR	.55	70	75 / 11 @ 50V	35 @ 10V	1.4×10^{-13} @ 50V
SD100-42-22-231	5.1	Blue/Vis	.55	70	75 / 11 @ 50V	35 @ 10V	1.4×10^{-13} @ 50V
SD100-42-22-232	5.1	Blue/Vis	.55	70	75 / 11 @ 50V	35 @ 10V	1.4×10^{-13} @ 50V
SD444-41-21-261	100	Red/IR	.55	7	1,500 / 215 @ 50V	700 @ 50V	6.2×10^{-13} @ 10V
SD444-42-22-261	100	Blue/Vis	.55	7	1,500 / 215 @ 50V	500 @ 10V	5.3×10^{-13} @ 10V
SD444-43-23-262	100	UV	.55	7	1,500 / 215 @ 50V	500 @ 10V	5.3×10^{-13} @ 10V

Amplifier Specifications (23°)

- Input Offset Voltage-------- 3.0 mV (max)
- Input Offset Current-------- 3.0 mV (typ)
- Input Bias Current---------- 15.0 pz (typ)
- Slew Rate 60 V/US
- Gain Bandwidth Prodnt 26 mHz
- Power Supply ± 5 to 15 Volts.

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- 20ma loops
- Video lines
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See EEM Pages B•1394-1400.

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See EEM Pages B•1388-1393.

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CIRCUIT BREAKERS, LIMITERS, SUPPRESSORS

Manufacturer	Starting EEM Page No.	Circuit Breakers	Limiters/ Protectors, Surge	Sup- pressors, Transient Voltage	Data Line Protectors	Conformance			
						UL	CSA	Semko	MIL
Airpax/Cambridge Div.	B•1352	√				√	√		√
Amber Ind. Inc.	B•1353			√		√			
Carlingswitch Inc.	B•1359	√				√	√		
ETA Circuit Breakers	B•1363	√	√	√		√	√		
FIC Corp.	B•1367					√	√		√
Globtek Inc.	B•1369	√	√	√	√	√	√	√	√
Heinemann Electric Co.	B•1370	√				√	√		√
K-Tronics	B•1375		√						
MCG Electronics	B•1387	√	√	√	√				
Mechanical Products	B•1401	√				√	√		√
Perma Power Electronics	B•1404		√	√		√			
Polyphaser Corp.	B•1405		√	√	√				
Potter & Brumfield	B•1406	√				√	√		
Raychem Corp.	B•1407		√	√					
Shurter Inc.	B•1408	√				√	√	√	

FUSES

Manufacturer	Starting EEM Page No.	Normal Action	Slow Blowing	Fast Action	Failure Indicat- ing	Rectifier	Mini- ature & Submin.	Clips & Holders	Conformance			
									UL	CSA	SEMKO	MIL
Atlee	B•1354							√				
Bel Fuse Inc.	B•1355	√	√	√			√	√	√	√	√	
FIC Corp.	B•1367	√			√			√				
Globtek Inc.	B•1369	√	√	√			√	√	√	√	√	√
Littelfuse Electronic Div.	B•1376	√	√	√	√		√	√	√	√	√	
Microdevices Prods.	B•1402	√					√					
Panel Components	B•1403		√	√				√	√	√	√	
Shurter Inc.	B•1408	√	√	√			√	√	√	√	√	

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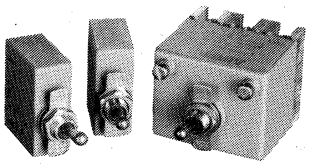
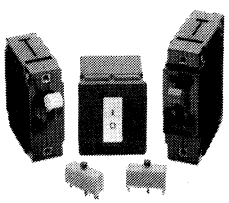


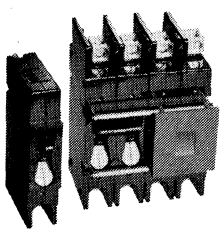
Models AP and UP**

Hermetically sealed. DC, 50/60 Hz or 400 Hz versions. Various delays to meet your needs. UP version has wide glass terminals.
Specifications: 1 to 3 poles. Ratings: 0.05-20A, 240 VAC, 50 VDC. Interrupting capacity: AP MIL 500A @ 120 VAC, 50 VDC; 300A @ 240 VAC. UP 1000A @ 32 VDC, 240 VAC.
Approval: QPL: MIL-C-39019 Lloyds
**(UP, single pole, series only)



Models SNAPAK®, CARDGARD®, IEG and IEL

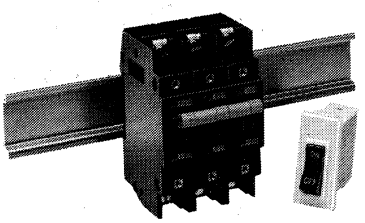
All conform to VDE and IEC spacing requirements. CARDGARD is PC board mountable.
Specifications: SNAPAK: 1 or 2 pole ratings. 7.6 to 15A at 32 VDC/125 VAC, 0.10 to 7.5A at 50 VDC/250 VAC.
2-pole only (2-pole breaking) and ratings: 7.6 to 15A at 125/250 VAC, 32/50 VDC. Interrupting capacity: 1000A at 125 VAC, 250 VAC, 32 VDC and 65 VDC.
Approval: IEC VDE* Lloyds
CARDGARD: 1 pole. Ratings: 1.0-6.0A, 32 VDC, 250 VAC. Interrupting capacity: 10 times rated current, at rated voltage.
Approval:
IEG and IEL Ratings: 0.05-30A, 277 VAC, 65 VDC (Model IEG). 0.05-50A, 277 VAC, 65 VDC (Model IEL). Interrupting capacity: 3500A, 277 VAC max., 2000A, 65 VDC (Model IEG). 5000A, 277 VAC max., 2000A, 65 VDC (Model IEL).
Approval: VDE*



Model 209

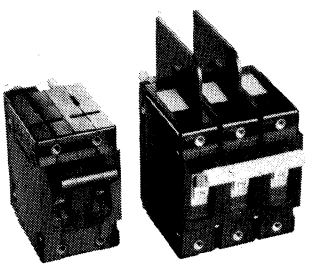
Ideal for branch circuits. Mounts in switch boards, panel enclosures, panel boards, junction boxes. Series includes 219 manual motor controller, 229 appliance controller, 249, 259 and 269 marine power selectors.
Specifications: 1 to 6 poles. Ratings: 0.10-100A, 125 VDC; 0.10-77A, 600 VAC; 0.10-100A, 120, 240, 277 and 480 VAC. Interrupting capacity: 5000A.
Approval: Lloyds

*Limited approvals; consult factory.



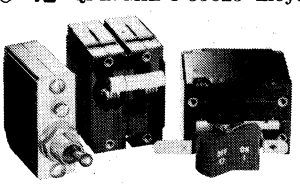
Models 203 and IELHR

203 is a front panel mounting device which combines over-current protection, ON-OFF switching and pilot light. Series, shunt or relay trip.
Specifications: 1 to 3 poles. Ratings: 0.05-10A, 250 VAC, 50 VDC, 10.1-20A, 120 VAC, 32 VDC. Interrupting capacity: 1000A.
Approval: Lloyds
IELHR designed for 35 mm symmetrical DIN rail; quick mounting, easy removal. Handle assembly available in 7 colors.
Specifications: Ratings: 0.05-50A, 65 VDC and 250 VAC. Operating temperature: −40°C to +85°C.



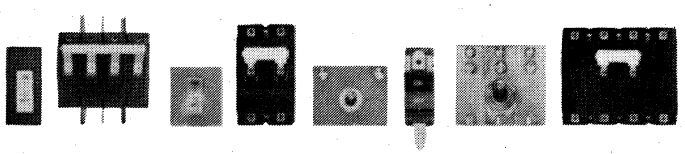
Models APL/UPL and 205

These breakers offer precision operation for critical service. Series, shunt and relay configuration options. Choice of delays, ratings. 205 is dust-sealed for harsh environments.
Specifications: 1 to 9 poles. Model APL/UPL Ratings: 0.05-20A, 277 VAC; 0.05-50A, 250 VAC; 0.05-100A, 65 VDC. Interrupting capacity: 5000A, 120 VAC; 2000A, 65 VDC. Model 205 Ratings: 0.05-20A, 277/480 VAC; 0.05-50A, 250 VAC; 0.05-100A, 32 VDC. Interrupting capacity: 5000A, 277/480 VAC; 5000A, 250 VAC; 2000A, 32 VDC.
Approval: QPL: MIL-C-55629 Lloyds



Models APG/UPG/IPG

Low-cost, precision operation. Multi-pole assemblies, single or multi-handle. For data processing, broadcast equipment, vending machines, controllers, etc.
Specifications: 1 to 4 poles. Ratings: 0.02-30A, 277 VAC, (Model IPG, 250 VAC), 65 VDC, 31-50A, 50 VDC. Interrupting capacity: 1000A, 277 VAC, (Model IPG, 250 VAC), 2000A, 65 VDC, and at 5000A, max. ratings of 30A at 120 VAC, 20A at 250 VAC, 10A at 277 VAC, (Model IPG, 250 VAC).
Approval: QPL: Mil-C-55629 Lloyds Model IPG-VDE*

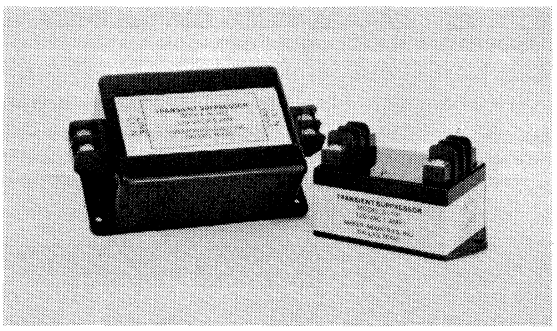


AIRPAX®
CAMBRIDGE DIVISION

AII

AMBER INDUSTRIES, INC.

AC POWERLINE TRANSIENT SUPPRESSORS



OEM Series

Our Most Popular Series

OEM Series

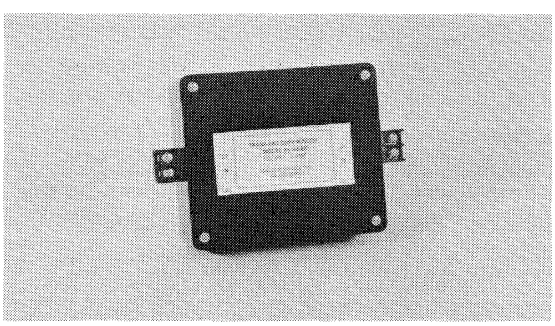
Attenuates spikes and fills notches throughout the full 360 degrees of the AC sinewave. Unlike other suppressors which merely "clamp" a transient above the AC voltage, Amber starts to operate within 1 volt variation both above and below the sinewave. Meets IEEE-587 A & B and is UL 1449 recognized.

CM Series

Add Common Mode Protection

CM Series

All the features of the OEM series plus adds common mode protection as well. Protects for transients between hot and neutral, hot and ground, and neutral and ground. Like the OEM series, the CM series meets IEEE-587 A & B and is UL recognized.

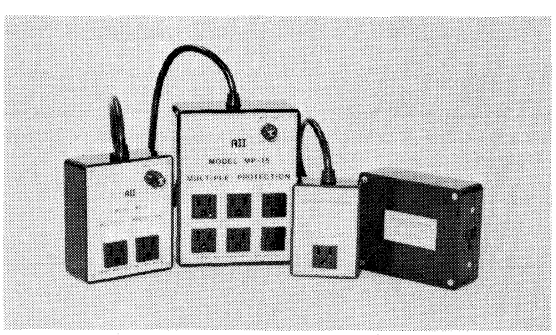


BD Series

Bi-Directional For 2-Way Protection

BD Series

The BD series operates in both directions. It not only keeps transients out of equipment, but also keeps equipment from sourcing transients back onto the AC line. Useful in applications where equipment has motors, solenoids, relays, switches, controllers, SCR's, triacs, etc.



LR and MP Series

Convenience Plus Best Protection

LR and MR Series

For those applications where there is not room in the equipment or control panel being protected. Identical protection as our CM series, plus adds a UL listed line cord and one to six NEMA 5-15 receptacles.

AMBER INDUSTRIES, INC.

14902 Preston Road, #212 • Dallas, Texas 75240 • P.O. Box 790712 • Dallas, Texas 75379 • (214) 490-9801

ATLEE COMPONENT HOLDERS

Atlee component clips are made of spring steel and beryllium copper because they afford the most generally desirable combination of properties. Specific selection of material will depend on conditions of the application. In addition clips can be manufactured to your specification for a variety of uses. Please contact the factory with your questions and special requirements.

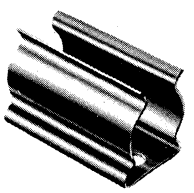
Atlee offers a complete line of MS and NAS component clips.

M24066 **M17160**

MS28136 **MS28137** **NAS1464**

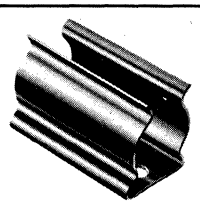
FEATURES

- The design of our component holders, from raw material through the finished product, ensures maximum performance and reliability under extreme usage, insertion, withdrawal force, and shock and vibration.
- Holding power increases as shock and vibration increase, measured by force required to remove component.
- Special contour design acquires closer set to component during shock and vibration, increasing security without localized pressure.
- Slotted design assures firm retention for fragile components without risk of injury.
- As an indication of the spring characteristics of Atlee's component holders, all of which are heat treated after forming, the following data is supplied; beryllium copper will withstand over 500 and spring steel 100 insertion-withdrawals of a slug 1/32" larger than nominal diameter, without metal fatigue.



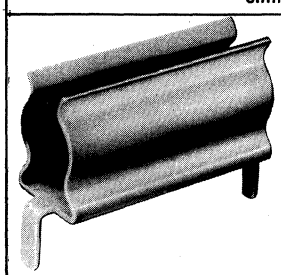
Beryllium Copper, QQ-C-533a

PLATING: cadmium CQ-P-416a; silver, QQ-S-365a; zinc, QQ-Z-325; tin, QQ-T-425; nickel, QQ-U-290; black matte, MIL-F-495A.
Various finishes available.
Designed to hold resistors, capacitors and small cylindrical devices. Fastened by means of rivets, eyelets, screws or similar fasteners.



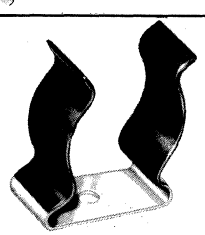
Spring Steel, QQ-S-777a

PLATING: cadmium CQ-P-416a; silver, QQ-S-365a; zinc, QQ-Z-325; tin, QQ-T-425; nickel, QQ-N-290; black matte, MIL-F-495A.
Various finishes available.
Designed to hold resistors, capacitors and small cylindrical devices. Fastened by means of rivets, eyelets, screws or similar fasteners.



Tab Mounted Clips

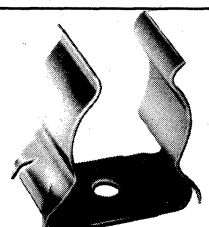
MATERIAL: beryllium copper, QQ-C-533a.
PLATING: cadmium, QQ-P-416a; silver, QQ-S-365a; zinc, QQ-Z-325; tin, QQ-M-151; nickel, QQ-N-290; black matte, MIL-F-495A.
Various finishes available.
Designed to hold resistors, capacitors, relays and similar cylindrical components. Fastened to a circuit board by tabs.



Industrial Component Holders

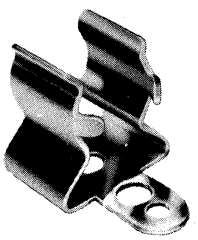
MATERIAL: spring steel S.A.E. 1065, .020 thick.

PLATING: commercial nickel, commercial nickel and vinyl coating
Designed for use in industrial and commercial applications.



No-Twist Clips

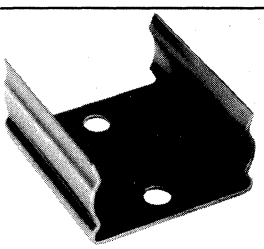
MATERIAL: spring steel, QQ-S-777a.
PLATING: cadmium, QQ-P-416a; silver, QQ-S-365a; zinc, QQ-Z-325; tin, QQ-M-151; nickel, QQ-N-290; black matte, MIL-F-495A.
Various finishes available.
Designed for holding capacitors and similar cylindrical components, without twisting.



Fuse and Resistor Holders

MATERIAL: phosphor bronze, QQ-B-750; beryllium copper, QQ-C-533a.

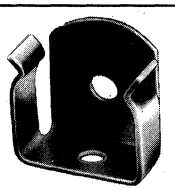
PLATING: silver, QQ-S-365a.
Finishes available silver plate.
Designed to hold fuses and ferrule-type resistors plus reduce heating by providing high contact pressure.



Crystal Clips

MATERIAL: spring steel, QQ-S-777a, spring steel S.A.E. 1065.

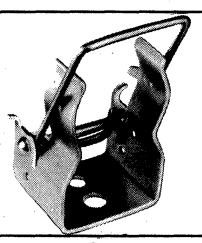
PLATING: cadmium, QQ-P-416a; silver, QQ-S-365a; zinc QQ-Z-325; tin, QQ-M-151; nickel, QQ-N-290; black matte, MIL-F-495A.
Various finishes available.
Designed to provide secure mounting for flattened elliptical components.



Transistor Clips

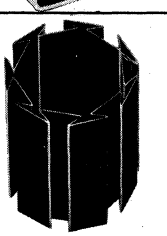
MATERIAL: beryllium copper, QQ-C-533a.

PLATING: cadmium, QQ-P-416a; silver, QQ-S-365a; tin, QQ-M-151; nickel, QQ-N-290; black matte, MIL-F-495A.
Various finishes available.
Designed to hold transistors without depending on soldered leads and at the same time act as a heat sink.



Locking Clips

MATERIAL: spring temper phosphor bronze, QQ-B-750.
PLATING: silver, QQ-S-365a; cadmium, QQ-P-416a; nickel, QQ-N-290; Class II, Type VI.
Various finishes available.
Designed to hold a fuse, ferrule-type resistor or similar component against the most severe shock and vibration.



Heat Dissipating Liners

MATERIAL: beryllium copper, .002 thick per QQ-C-533a, heat treated.

FINISH: black matte
Designed to cool many types of components combined with different types of cooling methods.

ATLEE 10 BAYFIELD DRIVE, NORTH ANDOVER BUSINESS PARK, NORTH ANDOVER, MA 01845
(508) 681-1003 • TELEX #928252 • **FAX: (508) 686-2934**

Atlee manufactures a full line of Bus Bars Card Guides and Component Holders. For additional information, please contact the factory.

FUSES/UL, CSA & SEMKO 1-1/4" x 1/4" & 1" x 1/4"

TYPE 3AG/3AP NORMAL BLOW GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, maximum

MECHANICAL DIMENSIONS

	3AG		3AP		Pigtail Leads	
Dimensions	Inches	(mm)	Inches	(mm)	Inches	(mm)
Diameter	0.250	(6.35)	0.270	(6.9)	0.032	(0.813)
Length	1.25	(31.8)	1.28	(32.5)	1.5	(38.1)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
3AG010	1/100	250	3AG1	1	250
3AG031	1/32	250	3AG1.25	1-1/4	250
3AG062	1/16	250	3AG1.5	1-1/2	250
3AG100	1/10	250	3AG1.6	1-6/10	250
3AG125	1/8	250	3AG1.75	1-3/4	250
3AG150	15/100	250	3AG2	2	250
3AG175	.175	250	3AG2.3	2-3/10	250
3AG187	3/16	250	3AG2.5	2-1/2	250
3AG200	2/10	250	3AG3	3	250
3AG250	1/4	250	3AG3.5	3-1/2	250
3AG300	3/10	250	3AG4	4	250
3AG375	3/8	250	3AG4.5	4-1/2	250
3AG400	4/10	250	3AG5	5	250
3AG500	1/2	250	3AG6	6	125
3AG600	6/10	250	3AG7	7	125
3AG750	3/4	250	3AG8	8	125
3AG800	8/10	250	3AG10	10	125

Listed by Underwriters Laboratories and certified by Canadian Standards Association through 10 Amperes.

Type 3AG fuses, described as normal blow, are medium to quick acting protectors for use in general circuit applications. Suitable for most circuits where high surges or transients are not anticipated. Pigtail leads (Type 3AP) are available when direct soldering into circuits is desirable.

TYPE 3SB/3SBP SLOW BLOW GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, minimum

MECHANICAL DIMENSIONS

	3SB		3SBP		Pigtail Leads	
Dimensions	Inches	(mm)	Inches	(mm)	Inches	(mm)
Diameter	0.250	(6.35)	0.270	(6.9)	0.032	(0.813)
Length	1.25	(31.8)	1.28	(32.5)	1.5	(38.1)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
3SB010	1/100	250	3SB1	1	250
3SB031	1/32	250	3SB1.2	1-2/10	250
3SB040	4/100	250	3SB1.25	1-1/4	250
3SB062	1/16	250	3SB1.5	1-1/2	250
3SB100	1/10	250	3SB1.6	1-6/10	250
3SB125	1/8	250	3SB1.8	1-8/10	250
3SB150	15/100	250	3SB2	2	250
3SB175	.175	250	3SB2.25	2-1/4	250
3SB187	3/16	250	3SB2.5	2-1/2	250
3SB200	2/10	250	3SB2.8	2-8/10	250
3SB250	1/4	250	3SB3	3	250
3SB300	3/10	250	3SB3.2	3-2/10	250
3SB375	3/8	250	3SB3.5	3-1/2	250
3SB400	4/10	250	3SB4	4	250
3SB500	1/2	250	3SB4.5	4-1/2	250
3SB600	6/10	250	3SB5	5	250
3SB700	7/10	250	3SB6	6	250
3SB750	3/4	250	3SB7	7	250
3SB800	8/10	250	3SB8	8	250

Listed by Underwriters' Laboratories through 8 amperes. Certified by Canadian Standards Association through 8 amperes.

Type 3SB fuses, described as slow blow, are designed to prevent unnecessary blowing in circuits where transient surges are anticipated. Protection against short circuit or continued overload is still maintained. Pigtail leads (Type 3SBP) are available when direct soldering into circuits is desired.

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
3SF050	.05	250	3SF800	.800	250
3SF063	.063	250	3SF1	1	250
3SF080	.080	250	3SF1.25	1.250	250
3SF100	.100	250	3SF1.6	1.600	250
3SF125	.125	250	3SF2	2	250
3SF160	.160	250	3SF2.5	2.500	150
3SF200	.200	250	3SF3.15	3.15	150
3SF250	.250	250	3SF4	4	150
3SF315	.315	250	3SF5	5	60
3SF400	.400	250	3SF6.3	6.3	60
3SF500	.500	250	3SF8	8	60
3SF630	.630	250	3SF10	10	60

Approved by SEMKO from 315 mA through 10 A.

Type 3SF fuses are designed to meet the electrical and mechanical requirements of IEC 127, CEE 4, Standard Sheet IV. They carry the SEMKO mark in the values specified as SEMKO approved. They are mechanically interchangeable with Type 3AG, the 1/4 x 1-1/4 normal blow fuse. However, since the fusing characteristics specified in IEC 127 and UL 198G are different, it is important that the designer carefully compare the blowing curves of the two types before substituting one for the other. They permit manufacturers of equipment built to United States/Canadian standards to substitute a fuse acceptable and available in the European market without changing board layouts or fuse mountings. Pigtail leads (3SFP) are available when direct soldering into circuits is desired.

TYPE 3WO/3WOP SLOW BLOW GLASS TUBE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, minimum

MECHANICAL DIMENSIONS

	3WO		3WOP		Pigtail Leads	
Dimensions	Inches	(mm)	Inches	(mm)	Inches	(mm)
Diameter	0.250	(6.35)	0.270	(6.9)	0.039	(1.0)
Length	1.25	(31.8)	1.28	(32.5)	1.5	(38.1)

Catalog Number	Ampere Rating	Voltage Rating
3WO6	6	125
3WO7	7	125
3WO8	8	125
3WO10	10	125
3WO12	12	125
3WO15	15	125

Listed by Underwriters Laboratories and Certified by Canadian Standards Association from 6 to 15 Amperes.

The 3WO fuses, described as slow blow, are suitable for use in microwave ovens and in general circuit applications. Pigtail leads (Type 3WOP) are available when direct soldering into circuits is desired.

TYPE 3SF/3SFP QUICK ACTING GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rated Current	$2I_n$ Max.	$2.75I_n$ Min.	$2.75I_n$ Max	$4I_n$ Min.	$4I_n$ Max	$10I_n$ Max.
50 to 100 mA inclusive	20 s	2 ms	200 ms	1 ms	30 ms	5 ms
Above 100 mA to 10 A	20 s	20 ms	1500 ms	8 ms	400 ms	80 ms

MECHANICAL DIMENSIONS

	3SF		3SFP		Pigtail Leads	
Dimensions	Inches	(mm)	Inches	(mm)	Inches	(mm)
Diameter	0.250	(6.35)	0.270	(6.9)	0.032	(0.813)
Length	1.25	(31.8)	1.28	(32.5)	1.5	(38.1)

TYPE 8AG/8AP NORMAL BLOW GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, maximum

MECHANICAL DIMENSIONS

Dimensions	8AG Inches (mm)	8AP Inches (mm)	Pigtail Leads Inches (mm)
Diameter	.250 (6.35)	.270 (6.9)	.032 (.813)
Length	1.00 (25.4)	1..03. (26.2)	1.5 (38.1)

Catalog Number		Ampere Rating	Voltage Rating
8AG100	8AP100*	1/10	250
8AG125	8AP125	1/8	250
8AG250	8AP250	1/4	250
8AG375	8AP375	3/8	250
8AG500	8AP500	1/2	250
8AG750	8AP750	3/4	250
8AG1	8AP1	1	250
8AG1.5	8AP1.5	1-1/2	250
8AG2	8AP2	2	250
8AG2.5	8AP2.5	2-1/2	125
8AG3	8AP3	3	125
8AG4	8AP4	4	125
8AG5	8AP5	5	125
8AG6	A8P6	6	125
8AG7	8AP7	7	125

*Pigtail (AP)

Listed by Underwriters' Laboratories through 7 amperes. Certified by Canadian Standards Association through 5 amperes.

Type 8AG is designated as a normal blow fuse for use in general circuit protection. Their smaller size permits use where space limitations prevent use of Type 3AG. Pigtail leads (Type 8AP) are available when direct soldering into circuits is desired.

bel BEL FUSE INC. 198 Van Vorst Street/Jersey City, NJ 07302/(201) 432-0463/TWX 710-730-5301/FAX (201) 432-9542

FUSES/UL, CSA & SEMKO 5mm x 20mm

TYPE 5MF FAST ACTING GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, maximum

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5.1 (0.200)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5MF100	1/10	250	5MF1	1	250
5MF125	1/8	250	5MF1.25	1-1/4	250
5MF200	2/10	250	5MF1.6	1-6/10	250
5MF250	1/4	250	5MF2	2	250
5MF300	3/10	250	5MF2.5	2-1/2	250
5MF400	4/10	250	5MF3	3	250
5MF500	1/2	250	5MF4	4	125
5MF600	6/10	250	5MF5	5	125
5MF700	7/10	250	5MF6	6	125
5MF800	8/10	250	5MF7	7	125
			5MF8	8	125

Listed by Underwriters' Laboratory from 50 mA to 8 amperes. Certified by Canadian Standards Association through 8 amperes.

Type 5MF fuses, described as fast acting are manufactured to meet the requirements of UL 198G and CSA 22.2. They permit European manufacturers of original equipment to substitute a fuse listed or certified by UL/CSA when exporting their equipment to the United States or Canada without making costly changes in mountings and printed circuit board layouts. Since fusing characteristics are different than those specified by IEC 127 for specific ratings, a careful analysis of the blowing curves should be made before determining the proper substitution. The small size of these fuses also offer the American/Canadian designer a protective device where space limitations are an important consideration. Pigtail leads (5MFP) are available when direct soldering into circuits is desired.

TYPE 5MT TIME LAG GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	2 minutes, maximum
1000%	10 milliseconds, minimum

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5 (0.197)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5MT100	1/10	250	5MT1	1	125
5MT125	1/8	250	5MT1.25	1-1/4	125
5MT200	2/10	250	5MT1.6	1-6/10	125
5MT250	1/4	250	5MT2	2	125
5MT300	3/10	250	5MT2.5	2-1/2	125
5MT400	4/10	250	5MT3	3	125
5MT500	1/2	250	5MT4	4	125
5MT600	6/10	250	5MT5	5	125
5MT700	7/10	250	5MT6	6	125
5MT800	8/10	250	5MT7	7	125

Listed by Underwriters' Laboratories from 50 mA to 5 amperes. Certified by Canadian Standards Association through 5 amperes.

Type 5MT fuses, described as time lag offer additional surge protection for circuits where momentary transients are anticipated. They are built to meet the specifications of UL 198G and CSA 22.2. They permit the European manufacturers of original equipment to substitute a fuse listed or certified by UL/CSA when exporting their equipment to the United States or Canada without making costly changes in mountings and printed circuit board layouts. Since fusing characteristics are different than those specified by IEC 127 for specific ratings, a careful analysis of the blowing curves should be made before determining the proper substitution. The small size of these fuses also offer the American/Canadian designer a protective device where space limitations are an important consideration. Pigtail leads (5MTP) are available when direct soldering into circuits is desired.

TYPE 5SF QUICK ACTING GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rated Current	2.1 I_n Max.	2.75 I_n Min.	2.75 I_n Max.	4 I_n Min.	4 I_n Max.	10 I_n Max.
32 to 100 mA inclusive	30 min	10 ms	500 ms	3 ms	100 ms	20 ms
Above 100 mA to 6.3A	30 min	50 ms	2 s	10 ms	300 ms	20 ms

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5.1 (0.200)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5SF032	.032	250	5SF500	1/2	250
5SF040	.040	250	5SF630	.630	250
5SF050	1/20	250	5SF800	8/10	250
5SF063	1/16	250	5SF1	1	250
5SF080	.080	250	5SF1.25	1-1/4	250
5SF100	1/10	250	5SF1.6	1-6/10	250
5SF125	1/8	250	5SF2	2	250
5SF160	.160	250	5SF2.5	2-1/2	250
5SF200	2/10	250	5SF3.15	3.15	250
5SF250	1/4	250	5SF4	4	250
5SF315	.315	250	5SF5	5	250
5SF400	4/10	250	5SF6.3	6-3/10	250

Approved by SEMKO for 80 mA, 125 mA, and from 250 mA through 6.3A.

Type 5SF fuses, described as quick acting, low breaking capacity, are manufactured to the specifications of IEC 127, CEE 4, Standard Sheet II (Type F). Used throughout Europe, they carry the SEMKO mark in the ratings indicated. They are used for general circuit protection in electrical and electronic equipment where momentary transients are not anticipated. Pigtail leads (5SFP) are available when direct soldering into circuits is desired.

TYPE 5ST TIME LAG GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rated Current	2.1 I_n Max.	2.75 I_n Min.	2.75 I_n Max.	4 I_n Min.	4 I_n Max.	10 I_n Min.	10 I_n Max.
32 to 100 mA inclusive	2 min	200 ms	10 s	40 ms	3 s	10 ms	300 ms
Above 100 mA to 6.3A	2 min	600 ms	10 s	150 ms	3 s	20 ms	300 ms

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5.1 (0.200)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5ST032	.032	250	5ST500	1/2	250
5ST040	.040	250	5ST630	.630	250
5ST050	1/20	250	5ST800	8/10	250
5ST063	1/16	250	5ST1	1	250
5ST080	.080	250	5ST1.25	1-1/4	250
5ST100	1/10	250	5ST1.6	1-6/10	250
5ST125	1/8	250	5ST2	2	250
5ST160	.160	250	5ST2.5	2-1/2	250
5ST200	2/10	250	5ST3.15	3.15	250
5ST250	1/4	250	5ST4	4	250
5ST315	.315	250	5ST5	5	250
5ST400	4/10	250	5ST6.3	6-3/10	250

Approved by SEMKO from 63 mA through 6.3A.

Type 5ST fuses, described as time lag, low breaking capacity, are manufactured to the specifications of IEC 127, CEE 4, Standard Sheet III (Type T). They carry the SEMKO mark in the ratings indicated. They are used for general circuit protection in electrical and electronic equipment where momentary transients are anticipated. Pigtail leads (5STP) are available when direct soldering into circuits is desired.

TYPE 5TT SLOW BLOW GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, minimum (3 seconds minimum for fuses with rating over 3 amp)

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5.1 (0.200)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5TT100	1/10	250	5TT1	1	250
5TT125	1/8	250	5TT1.25	1-1/4	250
5TT200	2/10	250	5TT1.6	1-5/10	250
5TT250	1/4	250	5TT2	2	250
5TT300	3/10	250	5TT2.5	2-1/2	250
5TT400	4/10	250	5TT3	3	250
5TT500	1/2	250	5TT4	4	125
5TT600	6/10	250	5TT5	5	125
5TT700	7/10	250	5TT6	6	125
5TT800	8/10	250	5TT7	7	125

Listed by Underwriters' Laboratories from 50mA to 5 amperes and certified by CSA through 5 amperes.

Type 5TT fuses, described as slow blow, are designed to withstand higher surge currents occurring at switching during the normal life of equipment than the 5MT series. They are built to meet the specifications of UL 198G and CSA 22.2. They permit the European manufacturers of original equipment to substitute a fuse listed or certified by UL/CSA when exporting their equipment to the United States or Canada without making costly changes in mountings and printed circuit board layouts. Since fusing characteristics are different than those specified by IEC 127 for specific ratings, a careful analysis of the blowing curves should be made before determining the proper substitution. The small size of these fuses also offer the American/Canadian designer a protective device where space limitations are an important consideration.

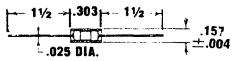
Pigtail leads (5TTP) are available when direct soldering into circuits is required.

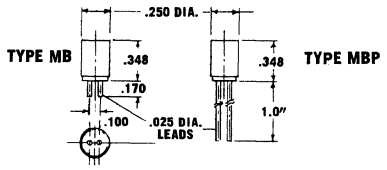
bel BEL FUSE INC. 198 Van Vorst Street/Jersey City, NJ 07302/(201) 432-0463/TWX 710-730-5301/FAX (201) 432-9542

Fuse Clips
Reel And Rail Packaging

TYPE MB/MBP/MFA MICROBEL MICRO FUSE SERIES

TYPE MFA





ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
*150%	10 minutes, maximum
200%	5 sec. max.

*Not applicable to MFS

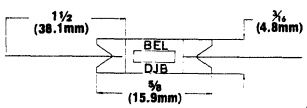
Catalog Number			Ampere Rating	Voltage Rating
MB125	MBP125	MFA125	1/8	125
MB250	MBP250	MFA250	1/4	125
MB375	MBP375	MFA375	3/8	125
MB500	MBP500	MFA500	1/2	125
MB750	MBP750	MFA750	3/4	125
MB1	MBP1	MFA1	1	125
MB1.5	MBP1.5	MFA1.5	1-1/2	125
MB2	MBP2	MFA2	2	125
MB2.5	MBP2.5	MFA2.5	2-1/2	125
MB3	MBP3	MFA3	3	125
MB3.5	MBP3.5	MFA3.5	3-1/2	125
MB4	MBP4	MFA4	4	125
MB5	MBP5	MFA5	5	125
MB7	MBP7	MFA7	7	125

MFA is UL listed through 7A while MB/MBP are UL listed and CSA certified through 7A.

MFA type fuses are subminiature and are color coded for current rating identification.

MB/MBP are designed for applications where space is a critical factor.

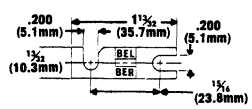
TYPE DJB FLAT PACK FUSE



ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
160%	25 seconds, maximum

TYPE BER FLAT PACK FUSE

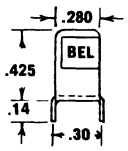


ELECTRICAL CHARACTERISTICS

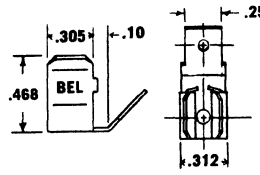
Rating	Blow Time
100%	4 hours, minimum
135%	1 hour, maximum
200%	1 minute, maximum

Catalog Number		Ampere Rating	Catalog Number		Ampere Rating
DJB250	BER250	1/4	DJB2	BER2	2
DJB300	BER300	3/10	DJB2.25	BER2.25	2-1/4
DJB400	BER400	4/10	DJB2.5	BER2.5	2-1/2
DJB500	BER500	1/2	DJB2.75	BER2.75	2-3/4
DJB600	BER600	6/10	DJB3	BER3	3
DJB750	BER750	3/4	DJB3.5	BER3.5	3-1/2
DJB875	BER875	7/8	DJB4	BER4	4
DJB1	BER1	1	DJB5	BER5	5
DJB1.25	BER1.25	1-1/4	DJB8	BER8	8
DJB1.5	BER1.5	1-1/2	DJB10	BER10	10

CLIPS

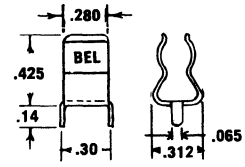


TYPE FC-101
3AG Clip
PC Board Mount
(Ear Stops)

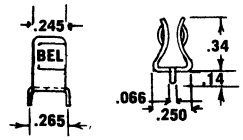


TYPE FC-107
3AG Clip
Hole Mount
(.250 Quick Connect)

TYPE FC-102
3AG Clip
PC Board Mount
(Earless)

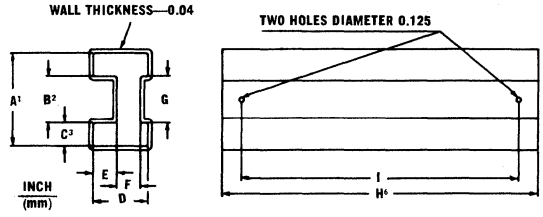


TYPE FC-201
5mm Clip
PC Board Mount
(Ear Stops)



All Bel Fuse clips are manufactured from .020 phosphor bronze stock and specially hardened to assure long life and minimum contact resistance. They are bright tin plated to facilitate soldering and prevent oxidation. In addition to the stock designs illustrated, clips can be quickly tooled to meet customer specifications.

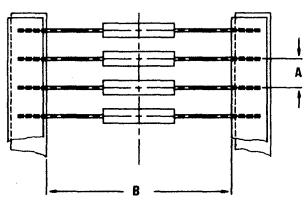
RAIL PACKAGING



Fuse Type	A	B	C	D	E	F	G	H	I
5mm x 20mm	1.00 +.02 −.00	.34 ±.01	.330	.55 +.02 −.00	.280	.20 +.02 −.00	.300 ±.010	13.2	12.60
	(25.4 +0.5 −.0)	(8.6 ±0.3)	(8.4)	(14.0 +0.5 −.0)	(7.1)	(5.1 +0.5 −.0)	(7.6 ±0.3)	(335.2)	(320.0)
¼ inch x 1¼ inch	1.45 +.03 −.00	.64 ±.01	.405	.73 +.025 −.000	.365	.26 +.025 −.000	.600 ±.010	15.75	15.08
	(36.8 +0.8 −.0)	(16.3 ±0.3)	(10.3)	(18.5 +0.6 −.0)	(9.3)	(6.6 +0.6 −.0)	(15.2 ±0.3)	(400.1)	(383)

To minimize assembly costs cartridge fuses can be supplied with clips attached. They are shipped in rails. Rail sizes are given above.

REEL PACKAGING



Leaded fuses can be supplied taped and reeled to assist in automatic assembly. Reeled fuses are supplied in quantity increments of 2500 pieces for microfuses and 1000 pieces for 1¼×¼ inch, 1500 pieces for 5×20mm fuses.

Fuse Type	A	B
Micro fuses (MF, MFS, MFA)	5.0 mm	52.4 mm
5×20 mm fuses	10.0 mm	85.0 mm
¼×1¼ inch fuses	10.0 mm	97.0 mm

Specifications Subject To Change Without Notice.

bel BEL FUSE INC. 198 Van Vorst Street Jersey City, NJ 07302 (201) 432-0463 TWX 710-730-5301 FAX (201) 432-9542

MICRO FUSES

MQ QUICK ACTING

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
200%	5 seconds, maximum

MQ is recognized under the components program of the UL and certified by the CSA through 15 Amperes.

Catalog Number	Ampere Rating	Voltage Rating
MQ125	1/8	125
MQ250	1/4	125
MQ375	3/8	125
MQ500	1/2	125
MQ750	3/4	125
MQ1	1	125
MQ1.5	1.5	125
MQ2	2	125
MQ2.5	2.5	125
MQ3	3	125
MQ3.5	3.5	125
MQ4	4	125
MQ5	5	125
MQ7	7	125
MQ10	10	125
MQ12	12	125
MQ15	15	125

Marking

Current rating, voltage rating, MQ designation and Bel Fuse logo are printed on each fuse in white ink.

Lead diameter 0.025" except for 10, 12 and 15 Ampere fuses which have a lead diameter of 0.032".

MM MEDIUM ACTING

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
200%	1 minute, maximum
400%	20 millisecond, minimum

MM is recognized under the components program of the UL and certified by the CSA through 15 Amperes.

Catalog Number	Ampere Rating	Voltage Rating
MM2	2	125
MM2.5	2.5	125
MM3	3	125
MM3.5	3.5	125
MM4	4	125
MM5	5	125
MM7	7	125
MM10	10	125
MM12	12	125
MM15	15	125

Marking

Current rating, voltage rating, MM designation and Bel Fuse logo are printed on each fuse in orange ink.

Lead diameter 0.025" except for 10, 12 and 15 Ampere fuses which have a lead diameter of 0.032".

MS SLOW ACTING

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
200%	1 minute, maximum
800%	20 millisecond, minimum

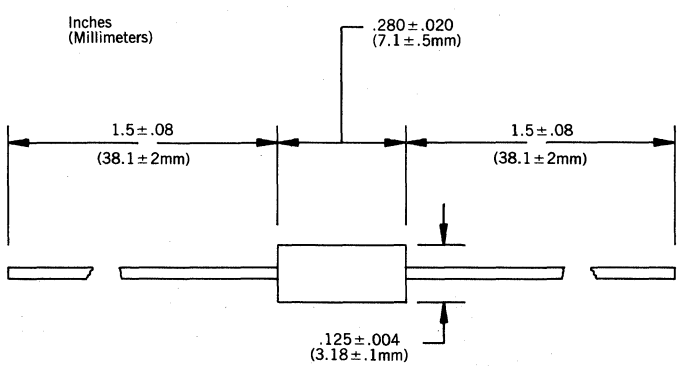
MS is recognized under the components program of the UL and certified by the CSA through 7 Amperes.

Catalog Number	Ampere Rating	Voltage Rating
MS125	1/8	125
MS250	1/4	125
MS375	3/8	125
MS500	1/2	125
MS750	3/4	125
MS1	1	125
MS1.5	1.5	125
MS2	2	125
MS2.5	2.5	125
MS3	3	125
MS3.5	3.5	125
MS4	4	125
MS5	5	125
MS7	7	125

Marking

Current rating, voltage rating, MS designation and Bel Fuse logo are printed on each fuse in green ink.

Lead diameter 0.032".



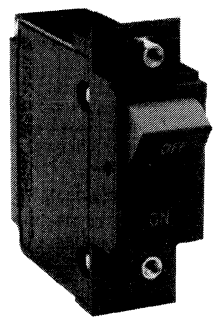
Specifications Subject To Change Without Notice

bel BEL FUSE INC. 198 Van Vorst Street/Jersey City, NJ 07302/(201) 432-0463/TWX 710-730-5301/FAX (201) 432-9542

CARLINGSWITCH CIRCUIT BREAKERS

VISI-ROCKER® CIRCUIT PROTECTION

Unique molded-in two-color rocker actuator indicates "tripped" mode when breaker is on or off (per illustrations) or series trip. 6-32 threaded mtg. inserts, push on .250 tab terminals. Rated @ 250 VAC/65 VDC. Series trip curve-34 (AC-DC type) trip point is 135%. UL listed and CSA certified.



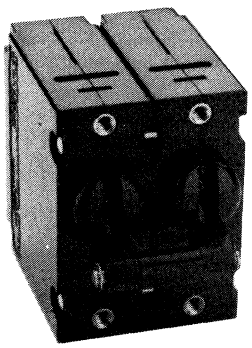
Visi-Rocker Circuit Breaker

Type	Amps
(INDICATE ON)	
AC1-BO-34-450-1G1-C	5
AC1-BO-34-610-1G1-C	10
AC1-BO-34-615-1G1-C	15
AC1-BO-34-620-1G1-C	20
AC1-BO-34-625-1G1-C	25
AC1-BO-34-630-1G1-C	30
(INDICATE OFF)	
AF1-BO-34-450-1G1-C	5
AF1-BO-34-610-1G1-C	10
AF1-BO-34-615-1G1-C	15
AF1-BO-34-620-1G1-C	20
AF1-BO-34-625-1G1-C	25
AF1-BO-34-630-1G1-C	30

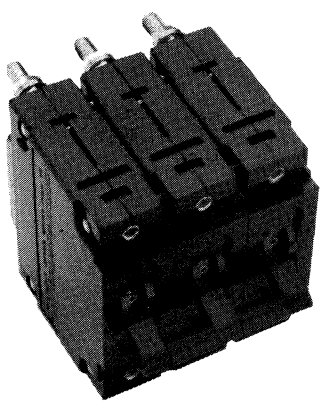
All "B" and "C" series magnetic circuit breakers are UL listed and CSA certified. "B" series products are also certified by VDE under VDE registration number 2495 when the "product type" part ends in "D". "C" series products are designed in accordance with IEC and VDE requirements and are pending international approvals.

All products are of "A" series trip construction, with 6-32 threaded mounting inserts, dual "I-O/ON-OFF" markings on a black toggle actuator, and come with .250" tab (Q.C.) terminals on the "B" series, and 10-32 threaded stud terminals on the "C" series. All units are supplied with an all purpose medium, AC-DC delay curve #34, rated at 277 VAC/65 VDC with trip times as shown below.

Percentage of Rated Current	135%	200%	400%	600%	800%	1000%
Trip Time (Seconds)	1.8-100	.60-20	.15-3	.03-1.3	.004-.60	.004-.1



B Series Circuit Breaker



C Series Circuit Breaker

Type	Amps
"BA1-SERIES" (1-POLE)	
BA1-BO-34-425-121-D	2.5
BA1-BO-34-450-121-D	5
BA1-BO-34-610-121-D	10
BA1-BO-34-620-121-D	20
BA1-BO-34-630-121-C*	30
"BA2-SERIES" (2-POLE)	
BA2-BO-34-450-121-D	5
BA2-BO-34-610-121-D	10
BA2-BO-34-615-121-D	15
BA2-BO-34-620-121-D	20
BA2-BO-34-630-121-C*	30
"BA3-SERIES" (3-POLE)	
BA3-BO-34-610-121-C*	10
BA3-BO-34-620-121-C*	20
BA3-BO-34-630-121-C*	30
"CA1-SERIES" (1-POLE)	
CA1-BO-34-450-121-C	10
CA1-BO-34-610-121-C	15
CA1-BO-34-615-121-C	20
CA1-BO-34-620-121-C	30
CA1-BO-34-630-121-C	40
CA1-BO-34-640-121-C	50
CA1-BO-34-650-121-C	
"CA2-SERIES" (2-POLE)	
CA2-BO-34-450-121-C	5
CA2-BO-34-610-121-C	10
CA2-BO-34-615-121-C	15
CA2-BO-34-620-121-C	20
CA2-BO-34-630-121-C	30
CA2-BO-34-640-121-C	40
CA2-BO-34-650-121-C	50
"CA3-SERIES" (3-POLE)	
CA3-BO-34-450-121-C	5
CA3-BO-34-610-121-C	10
CA3-BO-34-615-121-C	15
CA3-BO-34-620-121-C	20
CA3-BO-34-630-121-C	30
CA3-BO-34-640-121-C	40
CA3-BO-34-650-121-C	50

UL listed & CSA certified only.

The information listed above is for standard Carlingswitch products. Consult Carlingswitch for additional product information.

CARLINGSWITCH, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156
(203) 793-9281 • FAX: (203) 793-9231 • 1-800-243-8556

CARLINGSWITCH CIRCUIT BREAKERS

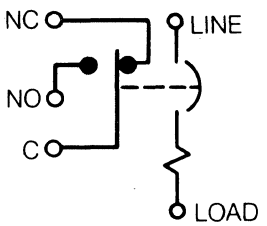
Circuit Options

Series Trip

A basic two (2) terminal device usually used as a combination power switch and overload protector. The contacts and current sensing coil are connected in series with the line and load terminals.

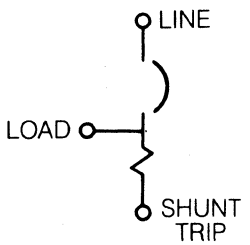
Series Trip with Auxiliary Switch

Same as "Series Trip" except with the addition of a SPDT snap-action switch which is *electrically isolated,* but *mechanically* linked to the movement of the main breaker contacts. Commonly used to remotely signal the status of the breaker (on or off/tripped).



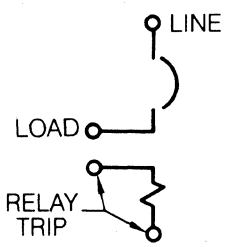
Shunt Trip

A three (3) terminal device similar to a "Series Trip" with the addition of a third terminal between the contacts and coil. This circuit is usually used to control two separate loads from the same power source, while sensing overload current in only one load.



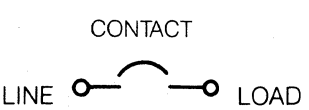
Relay Trip

A four (4) terminal device in which the contact and coil circuits are *electrically isolated* but are still *mechanically* linked to each other. An overload in the coil circuit will cause the contact circuit to open. Both circuits may be of opposite polarity to each other. Commonly used in "dump" circuit or "remote shut down" applications. (Note: World Approval Agencies may require an extra "Series Trip" pole for this function.)



Switch Only

Same as a "Series Trip" device without a sensing coil. Provides low cost, heavy duty switch capability when overload protection is not needed.



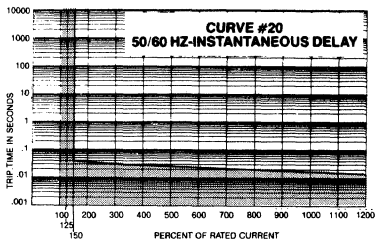
Note: The preceding circuits may be mixed on multi-pole units for special application requirements—(consult factory).

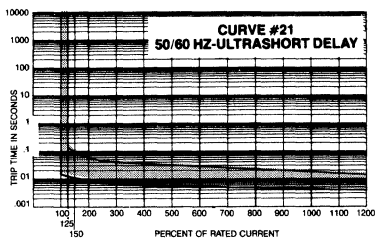
CARLINGSWITCH, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156
(203) 793-9281 • FAX: (203) 793-9231 • 1-800-243-8556

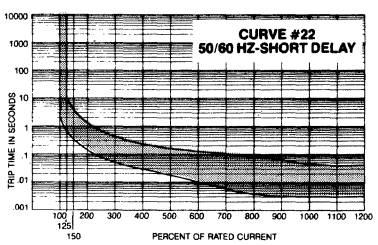
CARLINGSWITCH CIRCUIT BREAKERS

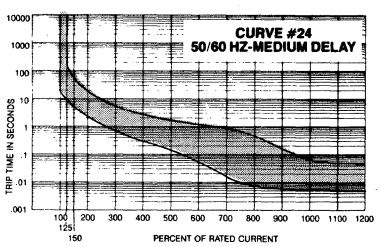
Time Delay Options

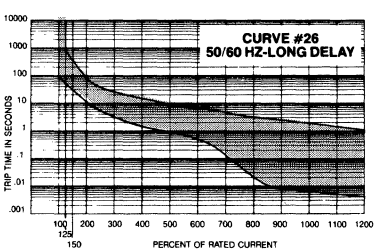
AC











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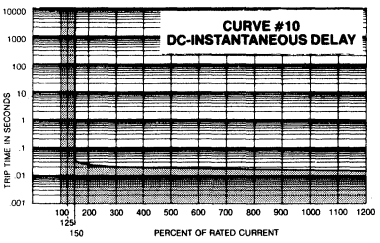

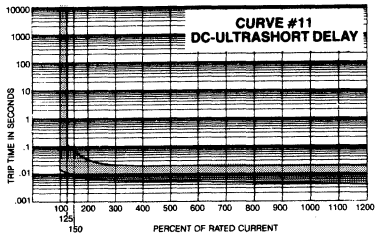

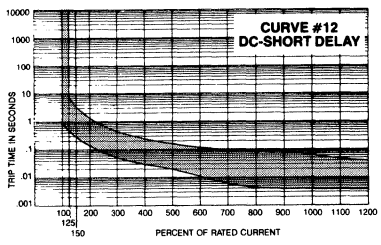

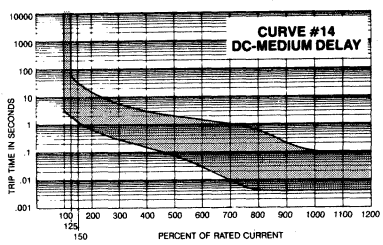

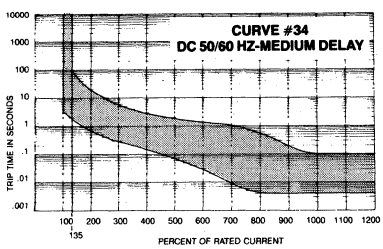

Curve #34 is a combination AC/DC Time Delay Curve.

Notes:

High Inrush Time Delay Curves #42, 44, 46 are also available

Time Delay Curves (#11, 12, 14, 21, 22, 24 & 26):

Breakers must hold 100%, may trip between 101% to 125%, must trip at 125% of rated current and above within time limits shown in curves.

Time Delay Curve (#34):

Breaker must hold 100%, may trip between 101% to 135%, must trip at 135% of rated current and above within time limits shown in curve.

Instantaneous Curves (#10 & 20):

Breakers must hold 100%, may trip between 101% to 150%, must trip at 150% of rated current and above within maximum times shown in curves.

All Curves:

Curve data shown represents breaker response at ambient temperature of 77°F (25°C) with no preloading. Breakers are mounted in standard wall-mount position.

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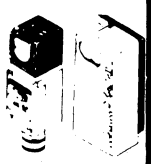
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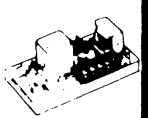
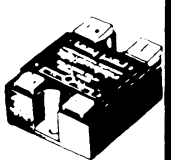

LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

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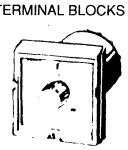
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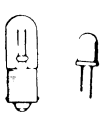
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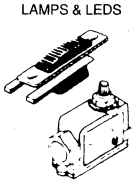
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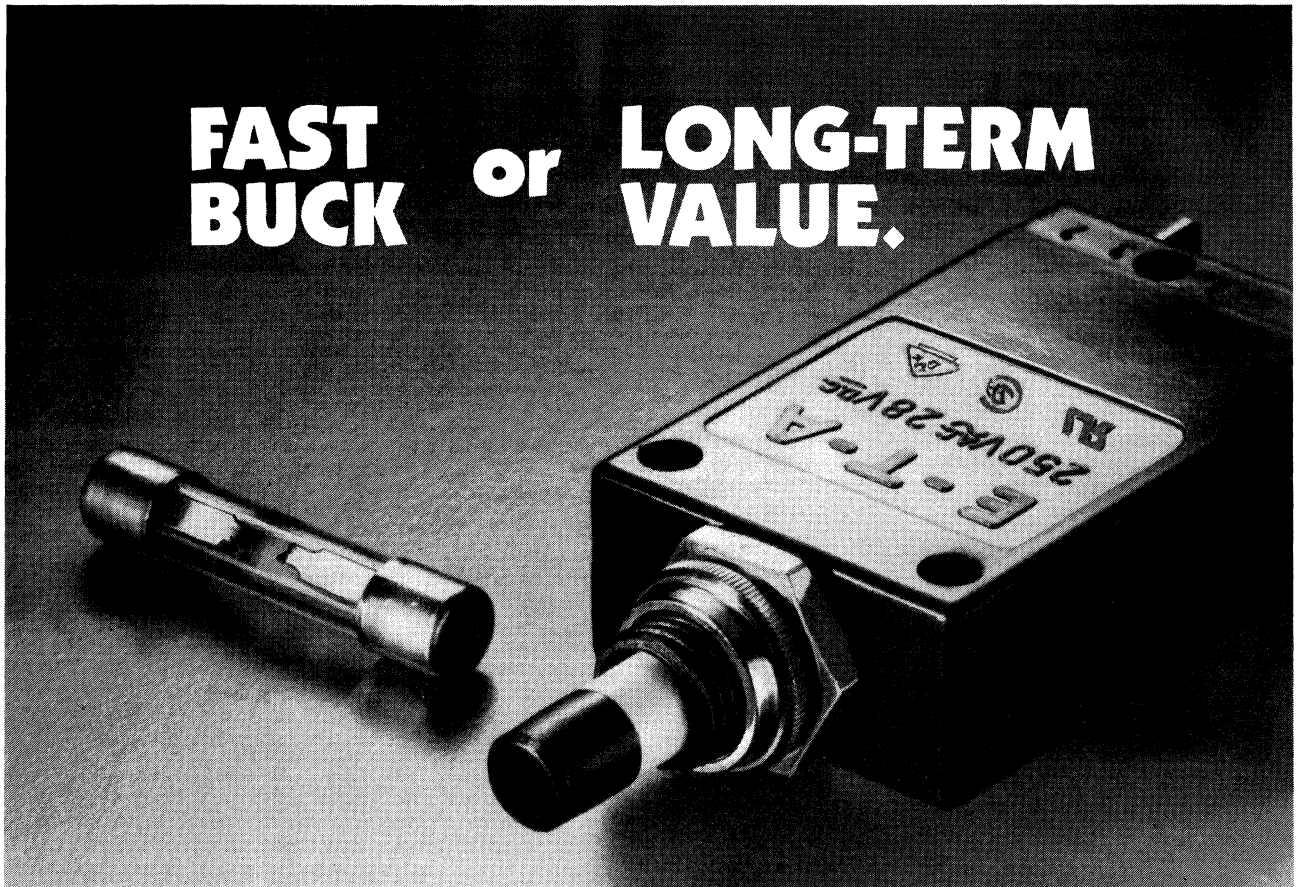

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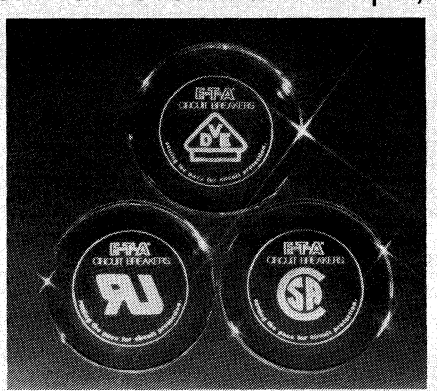

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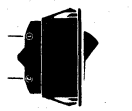
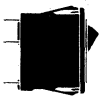


-F30/31

-G10

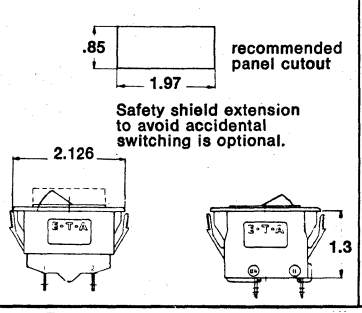
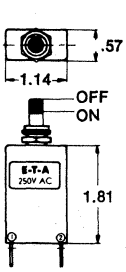
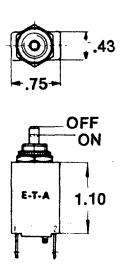
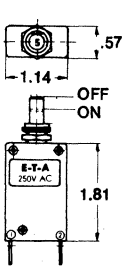
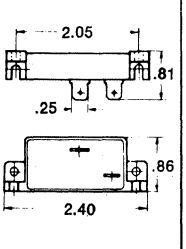


3120-F621 fits panel cutout Heinemann TX2 and AIRPAX 203-11 2 pole.

41-04

41-05

41-06

Series	**41-10-P10/41-11-P10**	**3120-F321**	**45-700-IG1-P10-DD**	**41-04-PR 41-05-P30 41-06-P30**	**45-700-IG1-P10**	**46-500-P10**
Description	Single pole, series trip Rocker, Toggle or Baton handles in many colors. (Illumination Optional)	Double pole, identical Snap-in mounting of single pole 41-10/41-11 series (Illumination Optional)	Single pole, series trip B/W button trip indicator Push ON/Push OFF Switching	Series trip, miniature. 41-04-PR: PC Board Mount 41-05-P30: Snap-in Mount 41-06-P30: Panel Mount	Series trip	Series trip automatic reset
Current ratings	0.1 thru 16A	0.1 thru 16A	0.05 thru 25A	0.05 thru 10A	0.05 thru 25A	0.1 thru 15A
Maximum voltage ratings	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc
Maximum interrupting capacity depending on current rating, UL 1077 approved breakers have been tested to 2000A.	10 times rated current normal use. UL up to 2000A.	10 times rated current 0.1-2A. 300A for ratings 2.5-16A. UL tested to 2000A.	10 times rated current normal use. UL up to 2000A.	6 times rated current. UL up to 1000A. 5 times for ratings 3.5 thru 5A, 4 times for ratings 6 thru 10A.	10 times rated current of circuit breaker, normal use. UL up to 2000A.	6 times rated current of circuit breaker, 60A maximum
Current capacity of auxiliary contacts, NO, NC.	NA	5A resistive 3, .110″ quick connect NO-NC-COM	NA	NA	NA	NA
Life	6000 cycles (UL 1077) 25,000 mechanical	6000 cycles (UL 1077) 25,000 mechanical	6000 cycles (UL 1077) 10,000 mechanical	2000 cycles at rated current	6000 cycles at rated current	10,000 cycles at 200% rated current
Terminals	.250 quick connect	.250 quick connect	.250 quick connect	.110 quick connect	.250 quick connect	.250 quick connect
Shunt circuit— A3, optional	Optional; specify—A3	Optional	Optional; specify—A3	Optional; specify—A3	Optional; specify—A3	Optional; specify—A3
Approvals E-T-A also has European approvals, such as VDE etc. Additional info upon request	UL 1077; E67320 CSA: 16186 VDE	UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 up to 16A CSA: 16186 up to 15A VDE	UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 up to 16A CSA: 16186 up to 15A VDE	UL: E29255 CSA: 16186 VDE
Design notes See technical data sheets for data	41-10 is unlighted 41-11 is illuminated	Options: • handle colors • handle marking • Illumination • Amp ratings • Dust/water seal	Aircraft styling B/W reset button. Ideal for marine control panels. Screw terminals, (—S10) optional.	Smallest full feature circuit breaker. .250 quick-connect avail. non-standard (—P10)	Screw terminals available, non-standard. Version for Class 2 transformers available: Specify 45-700-P10-CL2 3.2 or 5A.	Screw terminals 1, 2 available (—S20), non-standard
Technical Data Sheet	Catalog Sheet 40129 Catalog Sheet 40130	Catalog Sheet 40136	Catalog Sheet 40132	Catalog Sheet 40127	Catalog Sheet 40119	Catalog Sheet 40701
Physical Dimensions in inches All dimensions without tolerances are for reference only. In the interest of improved design and performance, E-T-A reserves the right to make changes in these specifications.				 Shown: 41-06-P30		

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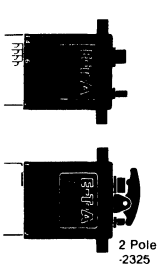
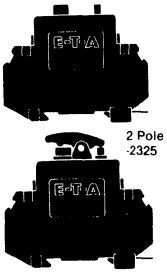
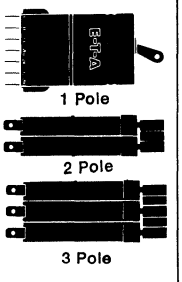
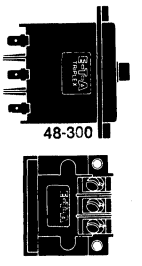
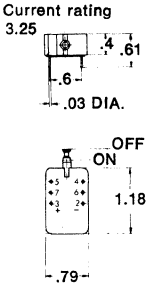
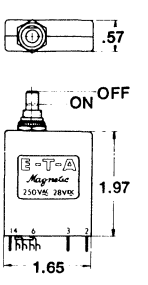
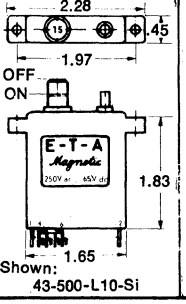
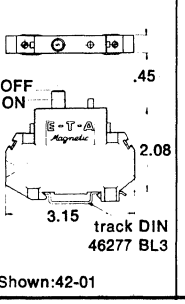
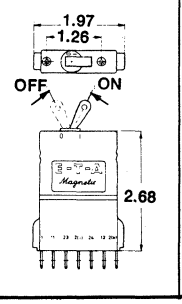
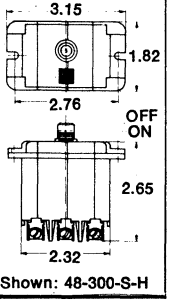
						
Series	**48-08**	**43-400-L10**	**43-500-L10 43-500-L10-2325**	**42-01 42-01-2325**	**2210**	**48-300-S 48-800-S**
Description	Magnetic, undelayed trip, PC board mount, NO and NC contacts. ON-OFF switching.	Series trip, two auxiliary contacts NO, NC optional (-Si). Fast Acting: specify series 43-300	Series trip, UL approved for primary ON-OFF switching. Two pole version: order -2325, has rocker handle.	Series trip, ON-OFF switching. DIN track 3 mounting. Adapter for DIN track 1 available.	Series trip, ON-OFF switching. Aux. contacts std. 1, 2 or 3 pole configuration.	Series trip, ON-OFF switch (-H) optional, auxiliary contacts NO, NC (suffix-Si) optional. Auto-reset version 0.1-5A: 48-800.
Current ratings	0.01 thru 3.25A	0.05 thru 15A	0.05 thru 15A	0.1 thru 15A	0.1 thru 16A	0.5 thru 15A
Maximum voltage ratings	115V ac or 60V dc	250V ac or 65V dc	250V ac or 65V dc	250V ac or 65V dc	250V ac or 65V dc	0.5—5A: 500V ac 5.5—15A: 380V ac
Maximum interrupting capacity depending on current rating, UL 1077 approved breakers have been tested to 2000A.	40A at 115Vac/ 60V dc 60A at 48V ac/dc 100A at 24V ac/dc	200A normal use. UL up to 1000A. 1500A/250V ac version, current ratings 8-15A. E-T-A series 43-4-P10 not-Si)	200A normal use. UL up to 1000A. 1500A/250V ac version, current ratings 8-15A. E-T-A series 42-1-P10 (not-Si)	200A normal use. UL tested to 1000A.	500A normal use, not to exceed 100 times rated current	6 times rated current of circuit breaker
Current capacity of auxillary contacts, NO, NC.	NO contacts: 5A continuous at 24V	1A resistive 4 solder terminals optional	1A resistive 4 solder terminals optional (single pole only)	NA	1A resistive, 4 quick connects, standard	3A resistive at 250V ac, 4 solder terminals, optional
Life	10,000 cycles at rated current	4000 cycles at 200% rated current	6000 cycles (UL 1077) at rated current	6000 cycles (UL 1077) at rated current	10,000 cycles at rated current	5000 cycles at rated current
Terminals	PC board pins	Solder terminals	Solder terminals	Screw clamp terminals	.250 quick connect(7x)	Screw terminals
Shunt circuit—A3, optional	Can be arranged	Optional; specify—A3	Optional; specify—A3	NA	Standard	NA
Approvals E-T-A also has European approvals, such as VDE etc. Additional info upon request		UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 CSA: 16186 VDE	UL, CSA: upon request VDE	CSA: 16186 up to 3.5A VDE: up to 10A
Design notes See technical data sheets for data	Series 48-08 has extra low impedance.	Quick-connect or screw terminals avail., non-standard DUAL CONTROL available.	Quick-connect or screw terminals avail., non-standard. DUAL CONTROL available. UL approved for primary ON-OFF switching.	Half inch spacing makes this device especially attractive for modern control systems design.	Shunt and auxiliary contacts are standard. DIN track mountable via terminal block #17-P10-Si	ON/OFF version available (suffix—H). Quick-connect terminals (—P10) avail. non-std. For tech. data 48-800-S see Cat. sheet 40806
Technical Data Sheet	Catalog Sheet 42433	Catalog Sheet 40223	Catalog Sheet 40228	Catalog Sheet 40237	——	Catalog Sheet 40308 (48-800: Cat. Sheet 40806)
Physical Dimensions in Inches All dimensions without tolerances are for reference only. In the interest of improved design and performance, E-T-A reserves the right to make changes in these specifications.	Current rating 					

E-T-A® CIRCUIT BREAKERS

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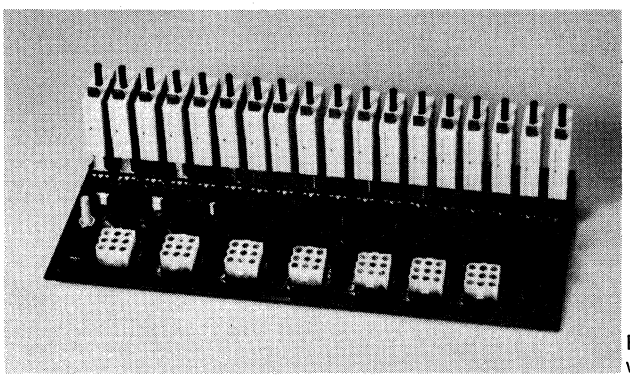
ELECTRICAL DISTRIBUTION CENTERS

E-T-A CIRCUIT BREAKERS and BERIFORS ELECTRONICS AB introduce state-of-the-art Electrical Distribution Centers for use in trucks, buses and construction equipment.

Advantages Offered:

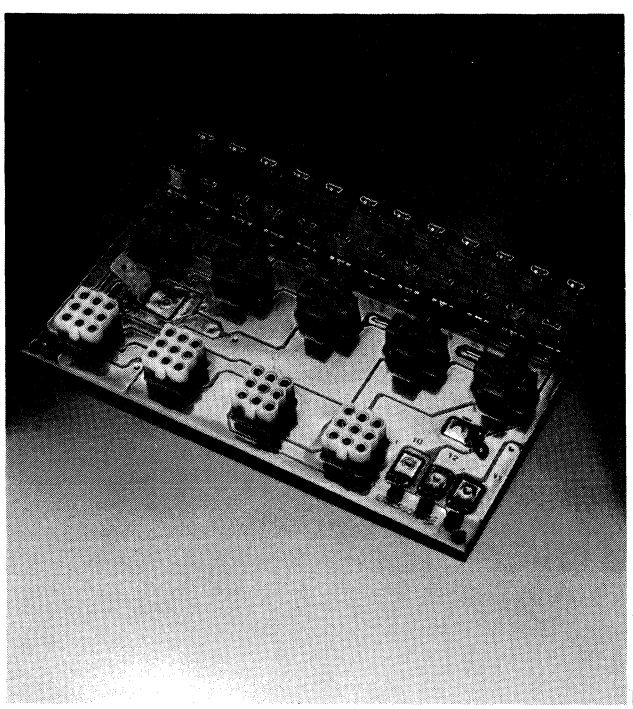
- Simple plug in installation
- ON-OFF switching for maintenance purposes
- 100% Tested
- Manual reset
- Standard versions (fits majority automotive applications)
- CUSTOM design (according to your specifications)
- Space savings
- Easy maintenance
- Proven reliability by design
- Fewer electrical connections
- Low weight
- Considerable cost savings



E-T-A GELC I has the following design specifications:
- 18 E-T-A full feature circuit breakers
- 8 Relays
- 7 9-contact connectors, AMP Mate-N-Lok

Dimensions: 290 mm x 140 mm (11.4 in x 5.5 in)
Weight of PC board: 390 grams (14 oz.)

E-T-A GELC I Distribution Center with E-T-A Circuit Breakers.



E-T-A GELC II has the following design specifications:
- 12 E-T-A full feature circuit breakers
- 5 Relays
- 4 9-contact connectors, AMP Mate-N-Lok

Dimensions: 200 mm x 140 mm (7.9 in. x 5.5 in.)
Weight: 250 grams (9 oz.)

Technical Data: The printed circuit boards are 1.6 mm of reinforced epoxy laminate, both sides of the board having a layer of copper 135μ thick including tin plating. Four-layer boards are used in cases where numerous control functions must be accommodated on relatively small surface areas, thus making the PC board even smaller. Plating extends fully through all drill holes in the boards. Fully automated production methods are in place for quantity runs. All PC boards are fully computer tested before the protective coating is applied. Modern production processes guarantee long-term reliability in most rigorous automotive environments.

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BERIFORS
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fic ·Fuseholders ·Fuse Clips ·Blown Fuse Indicators

Commercial & Military Approved Panel Mount Fuseholders

- Superior Clip Design for Solid Fuse Contact
- UL Recognized & C.S.A. Certified
- Most Commercial Models are recognized under the Marine Electrical and Fuel System (PEQZ2) as "Ignition Protected Devices"
- Blown Fuse Indicating & Non-Indicating
- High Impact Plastic for Superior Strength
- Dead-Front, Watertight
- Military Versions Meet MIL-F-19207

Commercial Fuseholders

All Recognized by Underwriters Laboratories

Model	Fuse Size	Qty	Indicating (I) or Non-Indicating (N)	Voltage AC/DC	UL Recognized Amps	UL Recognized Voltage
5000+	¼x1¼"	1	N	250	0-30	250 max
5100+	¼x1¼"	3	N	250	0-30	250 max
5200+	¼x1¼"	1	N or I	250	0-30	250 max
*5300+	¼x1¼"	2	N or I	250	0-30	250 max
*5400+	13/32x1½"	1	N	600	0-30	600 max
*5500+	13/32x1½"	3	N	600	0-30	600 max
*5600+	13/32x1½"	1	N or I	600	0-30	600 max
*5700+	13/32x1½"	2	N or I	600	0-30	600 max
*5800	9/16x2"	1	N or I	600	0-30	250 max
*5900	13/16x3"	1	N or I	600	31-60	250 max

*CSA Certified
+Ignition Protected Devices

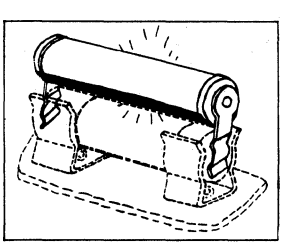
Indicating models can be modified for use in low voltage applications.

Military Fuseholders

MIL-SPEC	Type	Fuse Size	Qty	Indicating (I) or Non-Indicating (N)	Amps	Volts	Moisture Protection
19207/1	FHL10U	¼x1¼"	2	I	0-30	90-250	Unsealed
19207/2	FHL11U	¼x1¼"	1	I	0-30	90-250	Unsealed
19207/3	FHL12U	13/32x1½"	1	I	0-30	90-500	Unsealed
19207/4	FHL13G	9/16x2"	1	I	0-30	90-500	Dripproof
19207/5	FHL14G	13/16x3"	1	I	31-60	90-500	Dripproof
19207/6	FHL15G	1 5/16x5 7/8"	1	I	61-100	90-500	Dripproof
19207/7	FHL16G	1 5/8x7 1/8"	1	I	101-200	90-500	Dripproof
19207/17	FHN28WB	¼x1¼"	1	N	0-30	250 Max	Watertight Body Sealed
19207/18	FHL29G	¼x1¼"	2	I	0-30	12-90	Dripproof
19207/19	FHL30G	¼x1¼"	1	I	0-30	12-90	Dripproof
19207/21	FHL32W	¼x1¼"	1	I	0-30	90-250	Watertight
19207/22	FHL33W	¼x1¼"	2	I	0-30	90-250	Watertight
19207/23	FHL34W	13/32x1½"	2	I	0-30	90-500	Watertight
19207/24	FHL35W	13/32x1½"	1	I	0-30	90-500	Watertight
19207/25	FHN41WB	13/32x1½"	1	N	0-30	500 Max	Watertight Body Sealed
19207/30	FHN46WB	¼x1¼"	3	N	0-30	250 Max	Watertight Body Sealed
19207/31	FHN47WB	13/32x1½"	3	N	0-30	500 Max	Watertight Body Sealed

Blown Fuse Indicators

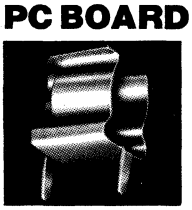
When A Fuse Blows, A Light Glows!®



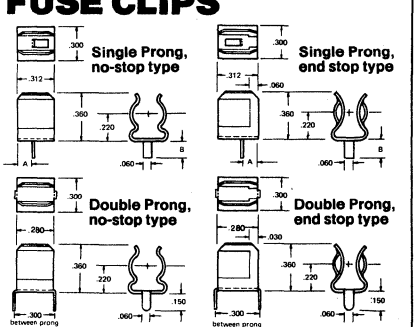
Several Models To Choose From

- Bolt Down for Rectifier Fuses
- Snap On for Ferrule Fuses
- Top Mounting for Knife Blade Fuses

PC BOARD FUSE CLIPS



Low profile clips (.360" high) are soldered to printed circuit boards eliminating eyeletting or riveting. Available in Spring brass, beryllium copper or spring bronze with various platings.



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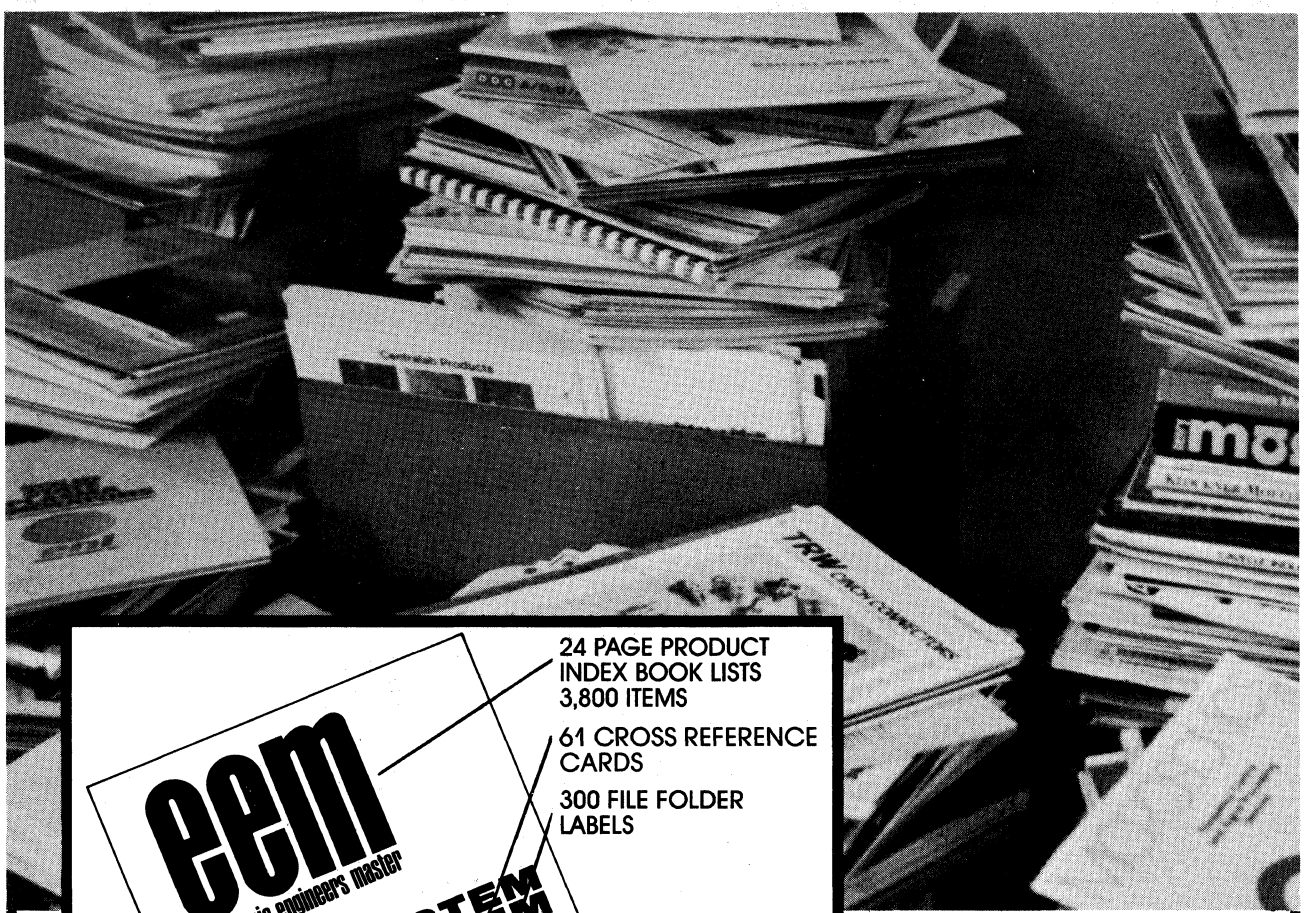

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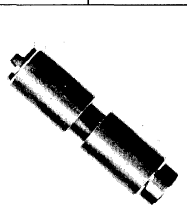
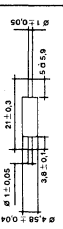
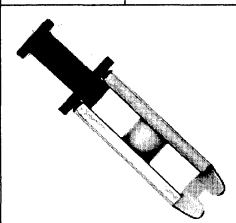
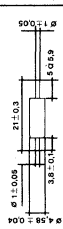
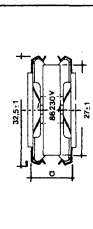
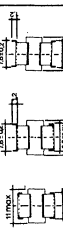
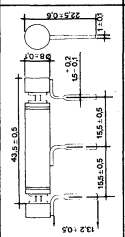
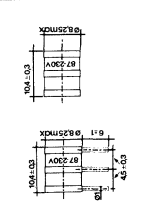
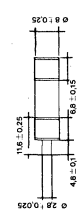
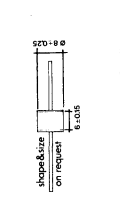
SURGE PROTECTION

GASTUBES SURGE ARRESTERS

For Protection of: Telecommunications & Transmission Lines; Power Lines; Power Supplies; Safety Applications

PRESENTATION	TYPE	DIMENSIONS	ELECTRICAL CHARACTERISTICS										APPLICATIONS
			D.C. Spark-over voltage		Impulse sparkover voltage (wave form 1 kV/µs)	Insulation resistance at 100 V.D.C.	Capacitance: 1 kHz (pF)	Minimum sustaining voltage (V)	Arc voltage (V)	Impulse current	50 Hz current	End of life (short circuit)	
			Nominal (V)	Tolerance (%)						Wave-shape 8 × 20 µs	Wave-shape 10 × 1000 µs	R.M.S. value (root mean square)	Cycle	Nominal current (I)	Period of time(s)	
	CA 5[1]		275	±30%	≤1000 V	≥ 10^8	<5	U=75 V < 150 ms	<20 (I<1,5 A	10 times interval 2 mn 2,5 kA	200 times 100 A interval 30 s	5 A	1 s interval 5 mn 10 times	2 à 20 A		Terminal block
	CA 5 RA[1]		150 250 350	±12% ±12% ±12%	≤750 V	≥ 10^9	<5	U=75 V < 150 ms	<20 (>1,5 A	20 times interval 15 s 5 kA	200 times 100 A interval 30 s	10 A	2 × 0,6 s interval 5 mn 10 times	2 à 20 A	approx. 50 1	Terminal block Printed circuit board
	CA 8 BB[1]		250 400	±15% ±25%	≤750 V	≥ 10^9	<5	U=52 V < 150 ms	<20 (≥1,5 A	20 times interval 15 s 10 kA	200 times 200 A interval 30 s	20 A	2 × 1 s interval 5 mn 10 times	10 à 30 A	approx. 50 1	Junction box Subscriber box
	3 blade shapes available[2]		400	±25%	≤750 V	≥ 10^9	<5	U=150 V < 150 ms	<25 (≥1,5 A)	1 time 10 kA	600 times 500 A interval 90 s	65 A	1 s interval 3 mn 5 times			Junction box Subscriber box
	CA 8[1]		250	±12%	≤750 V	≥ 10^9	<5	U=60 V < 150 ms	<20 (i≥750 mA)	10 times interval 30 s 10 kA		20 A	2 × 1 s interval 5 mn 10 times	5 à 50 A	approx. 200 1	Junction box Subscriber box
	CA 8 T 11[2]		90 185 230 350	±15% ±15% ±15% ±15%	≤750 V	≥ 10^9	<5	U=150 V < 300 ms	<35 (i=1 A)	10 times interval 30 S 5 kA	600 times 100 A interval 90 s	5 A	1 s interval 3 mn 5 times			Terminal box M.D.F.
	CA 8 B WITH OR WITHOUT POST[2]		400	±25%	≤750 V	≥ 10^9	<10	U=150 V < 300 ms		once 10 kA	600 times 500 A					Subscriber box Terminal block N.I.D.
	CA 8 B6 WITH OR WITHOUT LEADS[2]		90 185 230 350	±20% ±20% −15% ±15% ±15%	≤750 V	≥ 10^9	<5	U=150 V < 300 sm	<35 (i=1 A)	once 10 kA	600 times 500 A	65 A	1 s interval 3 mn 5 times			Subscriber box Terminal block N.I.D.

* Wave form 100 V/µs

1 TESTED IN ACCORDANCE WITH COTT 2 MEETS PEG 1 & REA PE 80

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HEINEMANN® Circuit Breakers First in Features, First in Quality

Heinemann offers the widest choice of styles and current ratings in high-quality, reliable circuit protectors. Ratings range from 0.01A to as high as 700A. Their applications are as diverse as medical equipment, computers, industrial air conditioners, electric locomotives and telecommunications equipment.

Heinemann can also supply circuit breakers that provide auxiliary functions. For example, a heavy-duty relay, an on/off switch and a hydraulic-magnetic circuit breaker, all in one economical and compact unit.

Use this condensed guide to locate the type of circuit breaker that best meets your requirements. Then write or call us for a copy of the appropriate product bulletin containing detailed specifications and ordering information. Or call one of our technical assistance engineers to dicuss your particular application.

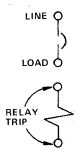
Technical assistance, important features and quality products...three reasons why it pays to look to Heinemann "When your reputation's on the line."

SPECIAL-FUNCTION CIRCUITS

Heinemann circuit breakers (except for PS1, KD, TX and Hector) can be furnished with a number of special-function internal circuits. They permit a single protector to perform the protection and control functions of several components.

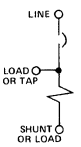
RELAY-TRIP

Permits remote actuation using a separate control circuit. Electrical isolation allows use of a different current or voltage from contact circuit. Both time delay and non-time delay constructions are available.



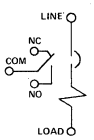
SHUNT/TAP

Use of third terminal permits remote tripping by utilizing line voltage with or without a time delay response. On breakers rated up up to 1A, the trip point may be raised by shunting with an external resistor on the shunt/tap terminal.



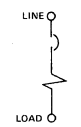
AUXILIARY SWITCH

Used for logic functions, alarms, lights and other circuits. Miniature snap-action SPDT or DPDT switch is mounted on the back of the breaker, mechanically connected to the switching mechanism. Contact capacity: 10A at 125/250 V, 50/60 Hz; 4A resistive at 30 Vdc; 2.5A inductive at 30 Vdc. Minimum operating voltage 6 Vdc or ac, at 3 VA dc or ac.



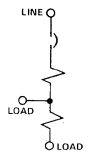
SERIES TRIP (Standard internal circuit)

Ideal for use as both power switch and overload protector. Usually installed in series with line and load terminals to provide circuit interruption in the protected circuit.



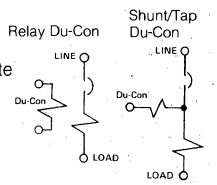
DUAL RATING

Two concentrically-wound sensing coils provide two discrete current ratings in the same breaker. Protects equipment designed to operate at two different current levels or supply voltages within certain limitations.



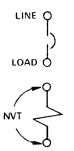
DU-CON™ (DUAL-CONTROL)

Provides sensing of both overcurrent and separate voltage signals in the same pole through a small, non-continuous-duty voltage sensing coil. DU-CON overload and voltage coils must be specified separately.



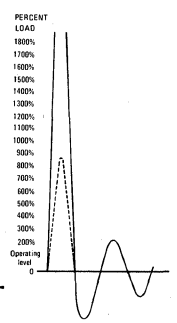
NO-VOLTAGE TRIP

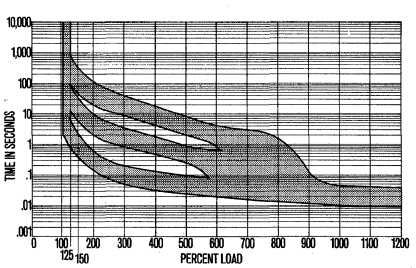
Prevents uncontrolled re-start of equipment after power outage. Used in ground-fault interrupters and other safety applications. Not intended for overload protection without one pole connected in series-trip configuration.



HIGH-INRUSH

Economical protection of high-reactance loads, which draw starting surges often as high as 30 times normal load current in a 50/60 Hz 1/2-cycle pulse, such as ferro-resonant power supplies and distribution transformers. Eliminates nuisance tripping without derating or special circuitry.





Typical Time Delay Curves

Circuit breakers are available in a variety of time-delay curves for applications such as high-inrush, 50/60 Hz and dc as well as with no intentional delay.

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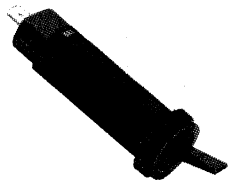
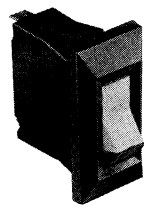
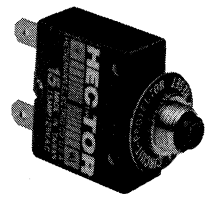
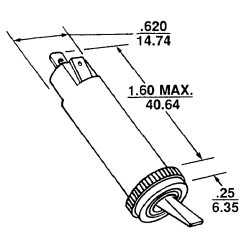
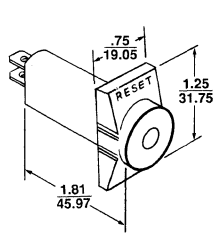
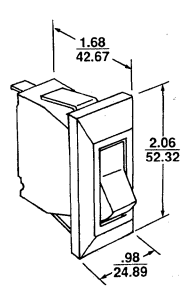
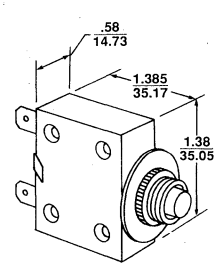
	PS1 FUSE-SWITCH	RE-CIRK-IT® SERIES KD1	TYPE TX	HECTOR
				
	Fuse-Switch provides ON/OFF control and fuse protection in a single low-cost component. Its use eliminates a hole and interconnecting wiring and makes it easy to re-fuse from the front panel. It accepts standard 1/4-inch diameter by 1¼-inch fuses. An adapter is available for 5 mm x 20 mm fuses. Can be supplied for normally open or normally closed operation.	A low-cost, pushbutton supplementary protector for electrical equipment, designed to fit in a standard 5/8-inch round or "D" fuseholder panel cutout. Resettable at up to 1000% of its rated current from 2.5A through 15A, 500% from 0.25A through 2A. Slide-on retaining ring included.	The attractively designed Type TX circuit protector doubles as an economical ON/OFF switch and with an optional lamp as a power indicator. Rocker arms available in a variety of colors; in one and two pole models. Its trip free design cannot be held closed against a fault. Features quick-connect terminals and snap-in mounting.	A low-cost fuse eliminator for the protection of electronic equipment and high-inrush circuitry from 4A to 20A. Its trip-free design prevents the contacts from being held closed manually during an overload condition. Supplied with mounting nut and faceplate reading "PRESS TO RESET." It has 1/4-inch quick-connect terminals that are also solderable.
APPLICATIONS	Consumer and industrial products that would otherwise use a separate ON/OFF switch and fuse holder.	Consumer and industrial products, office machines, appliances, power supplies, convenience outlets, electronic games.	Commercial and consumer products, power supplies, medical electronic equipment, office and reproduction equipment, data processing equipment.	Consumer and commerical electronic equipment, appliances and high-inrush circuitry.
NO. OF POLES	1	1	1 and 2	1
CURRENT RATINGS	Determined by choice of fuse. To 20A	0.25-15A	2,3,5,7,10,15 and 20A	4,5,6,7,7.5,9,10,12,15, 18 and 20A
MAX. VOLTAGE	120 Vac @ 20A 250 Vac @ 15A 32 Vdc @ 20A	250 V, 50/60 Hz 50 Vac up to 10A 32 Vdc @ 15A 50 Vdc @ 10A	250 Vac (10A max.) 125 Vac (20A max.) 32 Vdc (20A max.)	125 Vac (20A max.) 12/24 Vdc (20A max.)
INTERRUPTING CAPACITY		1000A @ 250 V, 50/60 Hz 200A @ 32 Vdc and 50 Vdc per UL Std 1077 testing procedures	3500A (ac) with backup fusing 1000A (dc) with backup fusing	1000A (ac) with backup fuse 200A (dc) with backup fuse
AGENCY RECOGNITION OR APPROVAL	UL recognized CSA certified SEV approved	UL recognized (Std 1077) CSA certified VDE approved SEV approved	UL recognized, Component Recognition Program CSA certified Suitable for VDE 0730 Equipment	UL recognized (Std 1077) CSA certified
DIMENSIONS				

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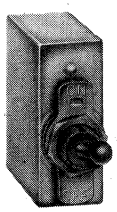
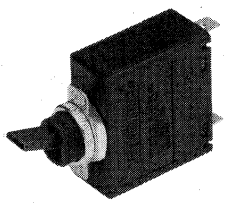
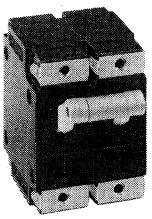
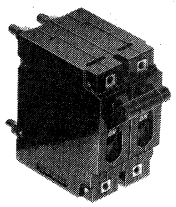
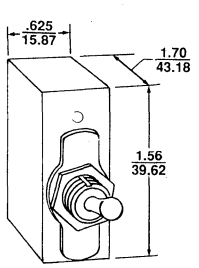
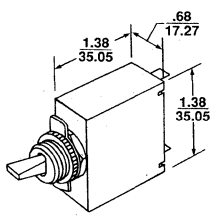
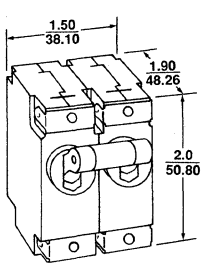
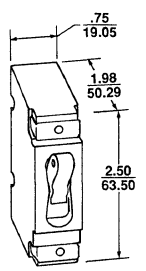
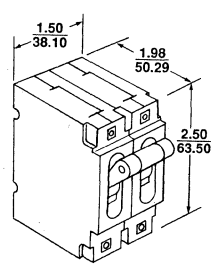
SERIES HM	SERIES L	SERIES J/S	SERIES AM	SERIES AM-MIL
				
Lightweight, subminiature, multi-frequency circuit breaker designed to withstand severe environmental extremes such as shock, vibration and high humidity. Housed in a corrosion-resistant brass case, nickel plated. Meets MIL-C-39019, is explosion- and fungus-resistant, operates in any position. Silver contacts provide good conductivity with low power loss.	This compact hydraulic-magnetic circuit protector provides the same quality, precision and choice of time delays found in larger Heinemann magnetic circuit breaker. Over-the-center, non-teasable mechanism provides snap-action operation that prolongs contact life by reducing arcing. Handles available in seven different colors for decorative or circuit-identification purposes.	Compact, lightweight, moderately-priced circuit breaker for single or multi-pole OEM applications. Also available with snap-in mounting or rocker handles. Sealed mount models are also available, single pole only. Series J/S breakers are suitable for domestic or world-market applications. Models also available for marine applications.	A low-cost, lightweight breaker available in single or multi-pole configurations, the Series AM features rear-connection studs, a high level of moisture resistance, and a current range up to 100A dc or 60A ac. Qualified under MIL-C-55629 to 50A dc and ac.	Heinemann Series AM-MIL breakers are specifically built and tested in accordance with the requirements of MIL-C-55629. Fungus- and moisture-resistance is provided by treating all ferrous parts with a special finish, and by using special springs and inherently fungus-resistant phenolic cases, covers and handles.
Military programs and commercial products, power supplies, mining and medical applications where hermetically-sealed circuit protection is required.	OEM (power supplies, medical-electronic equipment, control systems, office and EDP equipment).	OEM (power supplies, medical-electronic equipment, control systems, office and EDP equipment), control panels, marine equipment, field instrumentation.	OEM (data-processing equipment, mobile applications, humid environments).	OEM (data processing equipment, mobile applications, military equipment subject to humid, tropical environments).
1 and 2	1 and 2	1 to 4	1 to 4	1 to 3
0.050-20A	0.1 to 20A	0.02-50A	0.020-60A (ac) 0.020-100A (dc)	0.020-50A (ac and dc)
240 Vac, 60 or 400 Hz; 50 Vdc	250 Vac (7.5A max.) 125 Vac (15A max.) 32 Vdc (20A max.)	250 Vac (30A max.) 65 Vdc (50A max.) 80 Vdc (15A max.)	250 V, 50/60 or 400 Hz 277 V, 50/60 Hz, 1-phase 480 V, 50/60 Hz, 3-phase "Y" 65 Vdc AC/DC	240 V 50/60 Hz 240 V 400 Hz 50 Vdc
1000A @ 240 V, 60 Hz or 400 Hz and 50 Vdc per UL Std 1077 testing procedures	1000A 5000A with backup fusing	1000A 5000A with backup fusing	1000A 5000A with backup fusing	2000A @ 50 Vdc and 120 Vac 60 Hz 1500A @ 120 Vac, 400 Hz 1000A @ 240 Vac, 60 and 400 Hz
Not UL/CSA recognized or listed. Available as MIL-C-39019 QPL item.	UL recognized (Std 1077) CSA certified SEV approved IEC approved Designed to meet VDE	UL recognized (Std 1077) CSA certified SEV approved IEC approved VDE approved	UL recognized CSA certified	Not required for QPL items
				

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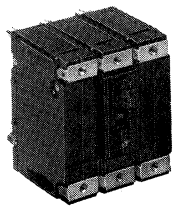
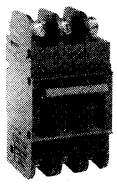
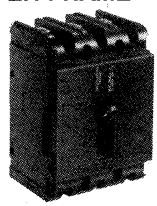
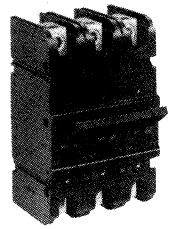
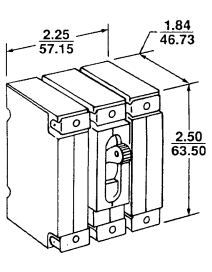
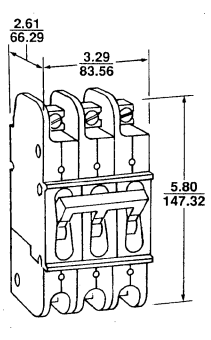
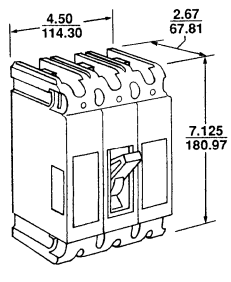
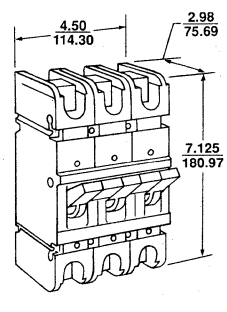
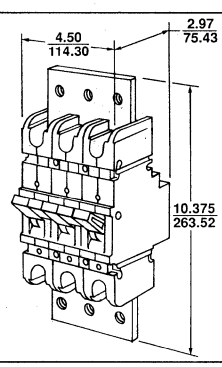
SERIES AM/S	SERIES CF E-FRAME	SERIES GH EH-FRAME	SERIES GJ	SERIES GJ1P
				
Series AM/S "world class" circuit breakers meet International Standard IEC 380 and German Standard VDE 0730. The 8-mm spacing requirement and dielectric-withstand specification are incorporated into the standard AM breaker housing without changes in size, thereby eliminating mounting procedure modifications or the need for adapter plates.	Priced considerably lower than competitive E-frame breakers, the Series CF is the most compact and versatile circuit breaker available for equipment and branch-circuit protection. Single- and multi-pole models are stocked in a wide range of standard ratings for fast, off-the-shelf delivery.	This rugged new EH-frame breaker offers all the advantages of a completely magnetic, three-pole breaker with 14,000A interrupting capacity for less than most thermal units. Compact, environmentally stable and to 100A at 480 Vac and 250 Vdc.	Where space is at a premium and current capacity up to 250A is called for, the Series GJ is the answer. Available in one-, two-, or three-pole models, it is especially suitable for panelboards, service entrances, and electric vehicles.	GJ1P parrallel-pole breakers incorporate Precision Current Equalization (PCE) to automatically distribute current equally through the current-sensing elements. PCE thereby minimizes nuisance tripping which can occur with conventional parallel-pole breakers. An optional shunt permits metering of current. Since shunt output is only 25 mv, light-gauge wiring can be used between shunt and meter.
OEM (data processing equipment, mobile applications, humid environments).	Panelboards, switchboards, branch circuits, EDP equipment, machine tools, environmental systems, single- and three-phase applications.	Motor controls, air conditioning, electric heating, computer main frames, transportation, indoor or outdoor installations.	Commercial, industrial, and residential service — entrance or panelboard applications; lighting, appliance, transformer, electric vehicles, EDP power supplies, heating, air conditioning, and electronic circuit protection.	Telecommunications, transportation, air conditioning, other outdoor "heat-loaded" equipment.
1 to 4	1 to 6	1 to 3	1 to 3	1
0.020-60A (ac) 0.020-100A (dc)	0.01-100A (ac) 1.0-100A (dc)	.5-100A (ac) .5-100A (dc)	100-250A	100-700A (dc)
250 V 50/60 Hz or 400 Hz 277 V 50/60 Hz 1-phase 65 Vdc 480 V 50/60 Hz 3-phase "Y"	240 V, 50/60 or 400 Hz 480 V, 1- and 3-phase 125 Vdc 600 V, 3-phase 125 Vdc	480 V, 50/60 Hz 250 Vdc	240 V, 50/60 Hz 125/250 Vdc	160 Vdc
1000A 5000A with backup fusing	10,000 @ 120 Vac 7500A @ 120/240 Vac 50/60 Hz; 240 Vac 50/60 Hz 5000A @ 120/240 Vac 400 Hz; 240 Vac 400 Hz 125 Vdc	14,000A (ac) 10,000A (dc)	18,000A @ 240 V, 50/60 Hz 10,000A @ 125/250 Vdc 14,000A @ 160 Vdc 25,000A @ 65 Vdc	10,000A @ 160 Vdc 25,000A @ 65 Vdc
UL recognized (Std 1077) CSA certified SEV approved IEC approved VDE approved	240 V, 50/60 Hz and 125 Vdc: UL listed Others: Recognized CSA certified	UL listed (ac) (3-pole) 480 Vac 15-100A	240 V, 50/60 Hz and 125/250 Vdc: UL listed	160 Vdc: UL listed
				

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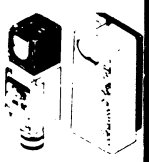
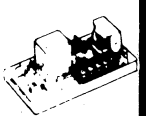
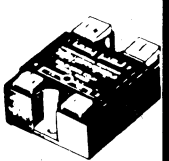
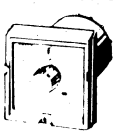

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS


TEMPERATURE CONTROLS

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Master Specialties
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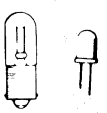
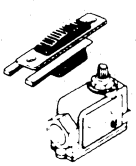
CIRCUIT BREAKERS FUSES & FUSEHOLDERS

KNOBS


LAMPS & LEDS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The Lightning Arrester

Special features
- High reliability and maintenance-free
- Fast surge voltage response speed
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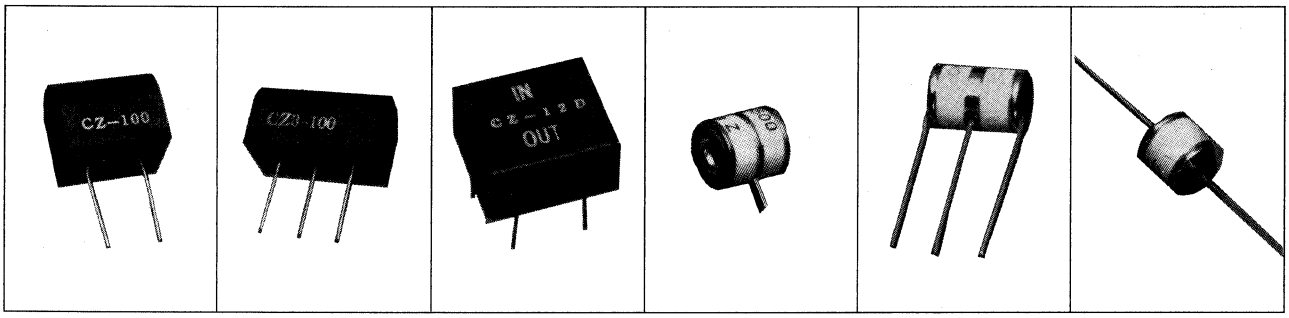

Electronic Characteristics

	Types	Max. Line Voltage Limit (V)	Voltage Limit (V) Between the line and the ground.	Between the lines	Current Limit (KA)	Current limit resistances
DC TYPES	CZ-12D	DC.15	108	16.5	5	10Ω/2W×1 pc
	CZ3-12D					10Ω/2W×2 pcs
	CZ-24D	DC.28	108	36.3	5	10Ω/2W×1 pc
	CZ3-24D					10Ω/2W×2 pcs
	CZ-48D	DC.54	108	74.8	5	10Ω/2W×1 pc
	CZ3-48D					10Ω/2W×2 pcs

	Types	Max. Line Voltage	Max. Voltage Limit (V), Between the line and the ground ✳1	Maximum ✳2 Current Limit (KA)	✳3 Isolation Resistance (MΩ)
AC TYPES	CZ-100	AC.110	500	1.25	more than 100
	CZ3-100				
	CZ-200	AC.220	700	1.25	more than 100
	CZ3-200				

Ceramic Tube (REA equivalent or better)

Series	Items	(3) DC Discharge Starting Time Series	Impulse Discharge Starting Time	Max. Impulse Current	Max. AC Discharge Current	Impulse Discharge Life	DC Dynamic Current Cut-off Characteristic	Insulation Resistance	Stray Capacitance	Dimensions A mm Tube diameter	B mm Tube length MAX	C mm Lead length MIN	D mm Terminal length
	Test conditions / Product Name	500V/s Average range	5KV/μs Upper value	8/20μs Peak Value	Applied 9 Cycle at 50Hz	10/1000μs Average Life Frequency at peak 500A applied	Voltage Vs 10/1000μs, Peak Value 500A applied	Resistance value after one minute MIN	1KHz~1MHz MAX				
CM	CM-90(L)	90V±20%	1000V	10KA	90A	600 times	50V	10^4MΩ	1.5PF	8	6.8	20	···
	CM-145(L)	145V±20%	1000V				70V						
	CM-230(L)	230V±15%	1000V				140V						
	CM-350(L)	350V±15%	1100V				150V				7.3		
	CM-470(L)	470V±15%	1500V				150V		1.0PF				
	CM-600(L)	600V±15%	1800V				150V				7.8		
	CM-800(L)	800V±15%	2000V				150V						
CL3	CL3-230(L)	230V±20%	1000V	10KA	65A	400 times	100V	10^4MΩ	1.5PF	8.6	8.9	20	4
	CL3-350(L)	350V±20%	1000V				150V						
	CL3-500(L)	500V±20%	1500V				150V						
CM3	CM3-90(L)	90V±20%	1000V	10KA	90A	600 times	50V	10^4MΩ	1.5PF	8	11.9	18	···
	CM3-230(L)	230V±15%	1000V				150V						
	CM3-400(L)	400V±15%	1200V				150V						

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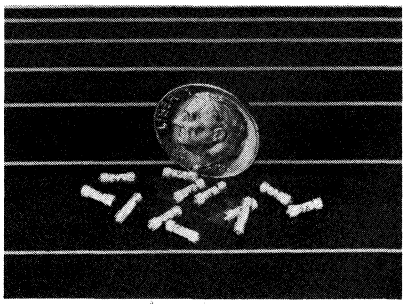
Littelfuse®

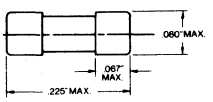
CIRCUIT PROTECTION DEVICES

SUBMINIATURE SURFACE MOUNT NANOFUSE™



- Design compatibility for surface mount applications.
- Reduced subminiature size for compact board layouts.
- Supplied on 12mm tape and reel for use with automatic placement equipment per EIA Standard 481.
- Designed to meet a wide variety of electrical and environmental MIL specifications for more demanding applications.

Opening Time: 100%, 4 hrs. min. 200%, 1 sec. max. (1/16-5A), 5 sec. max. (7-10A), 20 sec. max. (12-15).
Interrupting Rating: 300A D.C. and 50A A.C. at rated voltage.
Approvals: U.L. Recognized and Certified by C.S.A.



Catalog Number	Ampere Rating	Voltage Rating
R271.062	1/16	125V
R271.125	1/8	125V
R271.250	1/4	125V
R271.375	3/8	125V
R271.500	1/2	125V
R271.750	3/4	60V
R271001	1	60V
R27101.5	1-1/2	60V
R271002	2	60V
R27102.5	2-1/2	60V
R271003	3	60V
R27103.5	3-1/2	60V
R271004	4	60V
R271005	5	32V
R271007	7	32V
R271010	10	32V
R271012	12	32V
R271015	15	32V

PICO II™ SUBMINIATURE FUSES

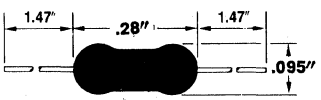
- World's smallest axial lead fuse for use in micro electronic circuits including computer and aerospace applications.
- Available on tape and reel.
- Low resistance values.
- Hi-speed action.
- Epoxy coated body for protection against environmental conditions.
- Withstand axial pull of 7 lbs.
- Available with or without color-coding per I.E.C. standards.
- Interrupting rating of 300A D.C. and 50A A.C. at rated voltage.

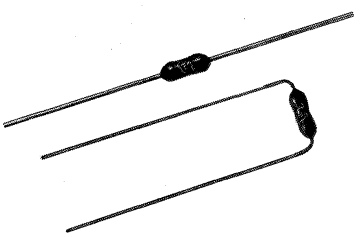
ENVIRONMENTAL CHARACTERISTICS

- Operating ambient temperature range:
  −55°C to 125°C
- Current carrying capacity:
  −55°C = 110% of rating
  25°C = 100% of rating
  125°C = 80% of rating
- Withstand vibrations of 10-55 Hz per method 201 of MIL-STD-202 and vibrations of 55-2000 Hz at 10 G's per method 204 test condition C of MIL-STD-202.
- Withstand shock of 100 G's for 6 milliseconds per method 213 test condition I of MIL-STD-202.

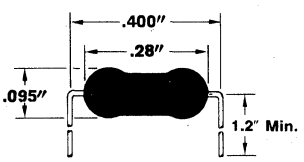
Opening Time: 100%, 4 hrs. min.; 200%, 1 sec. max. (1/16-7A) 3 sec. max. (10A) 10 sec. max. (12-15A).
U.L. Recognized and Certified by C.S.A. through 15 amperes.

251 Series - Axial Leads





252 Series - Radial Leads



Note: Leads are solder-coated copper, .025" diameter for 1/16-10A, .032" diameter for 12-15A.

L.F. Number		Amp Rating	Voltage Rating
Axial Leads	Radial Leads		
251.062	252.062	1/16	125
251.125	252.125	1/8	125
251.250	252.250	1/4	125
251.375	252.375	3/8	125
251.500	252.500	1/2	125
251.750	252.750	3/4	125
251001	252001	1	125
25101.5	25201.5	1-1/2	125
251002	252002	2	125
25102.5	25202.5	2-1/2	125
251003	252003	3	125
25103.5	25203.5	3-1/2	125
251004	252004	4	125
251005	252005	5	125
251007	252007	7	125
251010	252010	10	125
251012	252012	12	32
251015	252015	15	32

Note: To order color-coded PICO II™ fuses, contact factory.

Littelfuse®

CIRCUIT PROTECTION DEVICES

3AG FUSES (32V) ¼" x 1¼"

Fast-acting fuses for use in cars, radios, amplifiers, etc.

For 20 ampere rating, use 307020.

Opening Time: 110%, 4 hour min.; 135%, 1 hour max.; 200%, 10 sec. max. (4-30A), 20 sec. max. (35A)

U.L. Listed under U.L. STD 275 through 30 amps. CSA Certified through 30 amps.

L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
311004	4	31107.5	7-1/2	311015	15
311005	5	311008	8	311025	25
311006	6	311010	10	311030	30
311007	7	311012	12	311035	35

3AG FUSES (250V) ¼" x 1¼"

Fast-acting fuses for general circuit protection.

L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
312.010	1/100	312.300	3/10	312002	2
312.031	1/32	312.375	3/8	3122.25	2-1/4
312.062	1/16	312.500	1/2	31202.5	2-1/2
312.100	1/10	312.600	6/10	312003	3
312.125	1/8	312.750	3/4	312004	4
312.150	15/100	312001	1	312005	5
312.175	.175	3121.25	1-1/4	312006	6
312.187	3/16	31201.5	1-1/2	312007	7
312.200	2/10	31201.6	1-6/10	312008	8
312.250	1/4	3121.75	1-3/4	312010	10

3AG AXIAL LEAD FUSES

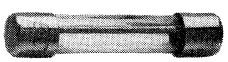
Same as above but with Axial leads for direct wiring into chassis. Leads are 1-1/2" long, copper wire.

Opening Time: 110%, 4 hour min.; 135%, 1 hour max.; 200%, 5 sec. max.

U.L. Listed and Certified by CSA

Note: To order fuses with axial leads, change **312** series number to **318.**

3AG SLO BLO® FUSES (250V or less) ¼" x 1¼"



Designed to withstand momentary high-current surges but still blow quickly on shorts. Provide protection for equipment with high reactive current surges or heavy starting currents such as solenoids, motors and lamp circuits.

3AG SLO BLO®AXIAL LEAD FUSES

Same as above but with Axial leads for direct wiring into chassis. Leads are 1-1/2" long, copper wire.

Opening Time: 100%, 4 hour min.; 135%, 1 hour max., 200%, 5 sec. min.

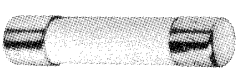
U.L. Listed and certified by CSA through 7 amps.
U.L. Recognized from 8-30 amps.

Patents: U.S. patents 4,409,729 and 4,445,106.

L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
313.010	1/100	313.700	7/10	313005	5
313.031	1/32	313.750	3/4	3136.25	6-1/4
313.040	4/100	313.800	8/10	313007	7
313.062	1/16	313001	1	313008	8*
313.100	1/10	31301.2	1-2/10	313010	10*
313.125	1/8	3131.25	1-1/4	313012	12*
313.150	15/100	31301.5	1-1/2	313015	15*
313.175	.175	31301.6	1-6/10	313020	20*
313.187	3/16	31301.8	1-8/10	313025	25*
313.200	2/10	313002	2	313030	30*
313.250	1/4	3132.25	2-1/4		
313.300	3/10	31302.5	2-1/2		
313.375	3/8	31302.8	2-8/10		
313.400	4/10	313003	3		
313.500	1/2	31303.2	3-2/10		
313.600	6/10	313004	4		

*32 volt. Note: For axial leads, change **313** to **315.**

3AB CERAMIC SLO BLO® FUSES (250V or less) ¼" x 1¼"



Similar to 313(000) series above, but have higher interrupting rating.

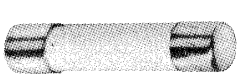
Opening Time: 110%, 4 hour min.; 135%, 1 hour max.; 200%, 5 sec. min.; 30 sec. max.

U.L. Listed 1/100 - 10 amps.
U.L. Recognized 12-30 amps.
CSA Certified 1/4-10 amps.
Patents: U.S. Patents 4,409,729 and 4,445,106.

L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
326.010	1/100	326.600	6/10	326004	4
326.031	1/32	326.700	7/10	326005	5
326.062	1/16	326.750	3/4	3266.25	6-1/4
326.100	1/10	326.800	8/10	326007	7
326.125	1/8	326001	1	326008	8
326.150	15/100	32601.2	1-2/10	326010	10
326.175	.175	3261.25	1-1/4	326012	12
326.187	3/16	32601.5	1-1/2	326015	15
326.200	2/10	32601.6	1-6/10	326020	20
326.250	1/4	326002	2	326025	25*
326.300	3/10	32602.5	2-1/2	326030	30*
326.375	3/8	32602.8	2-8/10		
326.400	4/10	326003	3		
326.500	1/2	32603.2	3-2/10		

* 125 volt.

3AB CERAMIC BODY FAST-ACTING FUSES (250V or less) ¼" x 1¼"



Ceramic body and arc-quenching filler in higher amperages provide high interrupting rating.

Opening Time: 1/8-30 amps: 110%, 4 hrs. min.; 135%, 1 hr. max.; **1/8-12 amps:** 200%, 15 sec. max.; **15-30 amps:** 200%, 30 sec. max.

U.L. Listed through 15 amps.

Certified by CSA through 15 amps. U.L. Recognized 20-30 A.

L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
314.125	1/8	314003	3	314012	12
314.250	1/4	314004	4	314015	15
314.375	3/8	314005	5	314020	20
314.500	1/2	314006	6	314025	25*
314.750	3/4	314007	7	314030	30*
314001	1	314008	8		
314002	2	314010	10		

* 125 volt.

3AB CERAMIC BODY RECTIFIER FUSES (250V or less) ¼" x 1¼"

Extremely fast-acting fuses for protection of silicon controlled rectifiers and similar solid state devices.

Opening Time: 1-30 amps: 100%, 4 hour min.; **1-10 amps:** 250%, .2 sec. max. (pre-arcing); **12-30 amps:** 250%, 1 sec. max. (pre-arcing).

U.L. Recognized.

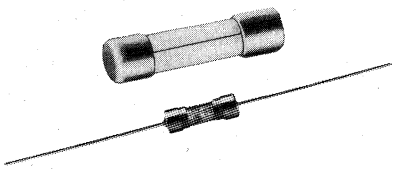
L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
322001	1	322006	6	322012	12*
3221.25	1-1/4	322007	7	322015	15*
322002	2	322008	8	322020	20*
322003	3	322009	9	322025	25*
322004	4	322010	10	322030	30*
322005	5				

* 65V. All others 250V.

Littelfuse®

CIRCUIT PROTECTION DEVICES

2AG SUBMINIATURE FUSES



Size .177" dia. × .58".

FAST ACTING TYPE

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max.; 200%, 1 sec. max.

Interrupting Rating: 1/10-1 amp — 10,000A (125V); 35A (250V). **1.5-3.5 amp** — 10,000A (125V); 100A (250V). **4-10 amps** — 10,000A (125V).

Approvals: U.L. Listed and Certified by C.S.A.

PATENTS: U.S. Patent 4,636,765

SLO-BLO® TYPE

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max.; 200%, 3 sec. min./20 sec. max.

Interrupting Rating: 1/4-1 amp — 10,000A (125V); 35A (250V). **1.5-3.5 amps** — 10,000A (125V); 100A (250V). **4-7 amps** — 400A (125V).

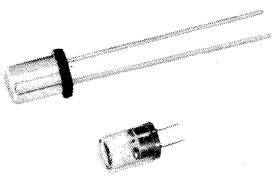
Approvals: U.L. Listed and Certified by C.S.A. thru 3.5 amps. U.L. Recognized 4-7 amps.

PATENTS: U.S. Patent 4,409,729 and 4,445,106.

Littelfuse Number		Ampere Rating	Voltage Rating
Fast-Acting	Slo-Blo		
225.100	—	1/10	250V
225.125	—	1/8	250V
225.250	229.250	1/4	250V
225.375	229.375	3/8	250V
225.500	229.500	1/2	250V
—	229.600	6/10	250V
225.750	229.750	3/4	250V
225001	229001	1	250V
22501.5	22901.5	1-1/2	250V
225002	229002	2	250V
—	2292.25	2-1/4	250V
22502.5	22902.5	2-1/2	250V
225003	229003	3	250V
22503.5	22903.5	3-1/2	250V
225004	229004	4	125V
225005	229005	5	125V
225006	229006	6	125V
225007	229007	7	125V
225008	—	8	125V
225010	—	10	125V

Note: To order fast-acting fuses with axial leads, change **225** to **224**; to order Slo-Blo® fuses with axial leads, change **229** to **230.**

MICROFUSE SUBMINIATURE FUSES (125V)



Designed for applications where space is a critical factor. Ideal for installation on printed circuit boards. Interrupting rating — 125 volts at 10,000 amperes A.C. and D.C.

Opening Time: 100%, 4 hour min.; 200%, 5 sec. max. (1/500-3/10A). 2 sec. max. (4/10-5A).

Size: 1/4" dia. × 11/32" (fuse body).

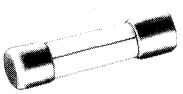
U.L. Recognized and Certified by C.S.A.

Plug-in, transparent cap type listed. Use prefix **272** for plug-in, metal cap; prefix **279** for radial leaded, transparent cap; prefix **278** for radial leaded, metal cap.

PATENTS: U.S. Patent 3,110,787.

L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
273.002	1/500	273.125	1/8	273.750	3/4
273.005	1/200	273.200	2/10	273.800	8/10
273.010	1/100	273.250	1/4	273001	1
273.015	1/64	273.300	3/10	27301.5	1-1/2
273.031	1/32	273.400	4/10	273002	2
273.050	1/20	273.500	1/2	273003	3
273.062	1/16	273.600	6/10	273004	4
273.100	1/10	273.700	7/10	273005	5

SUBMINIATURE FUSES (250V) 5 × 20mm DESIGNED TO IEC STANDARD



For original installations and replacements in foreign-made equipment, such as home and car radios, amplifiers, tape recorders, etc. and in other applications where space is a factor. Available in fast-acting, high interrupting; fast-acting; and slo-blo types.

FAST-ACTING HIGH-INTERRUPTING (250V) TYPE F

Opening Time: .050-3.15 amp — 150%, 60 minutes min.; 210%, 30 minutes max.; 275%, .01-2 seconds; 400%, .003-0.3 seconds; 1000%, .02 seconds max. **4-10 amp** — 150%, 60 minutes min.; 210%, 30 minutes max.; 275%, .01-3 seconds; 400%, .003-0.3 seconds; 1000%, .02 seconds max.

Cat. No.	Amp. Rtg.	Cat. No.	Amp. Rtg.	Cat. No.	Amp. Rtg.
216.050	.050	216.315	.315	216002	2
216.063	.063	216.400	.400	21602.5	2.5
216.080	.080	216.500	.500	2163.15	3.15
216.100	.100	216.630	.630	216004	4
216.125	.125	216.800	.800	216005	5
216.160	.160	216001	1	21606.3	6.3
216.200	.200	2161.25	1.25	216008	8*
216.250	.250	21601.6	1.6	216010	10*

SEMKO approved through 6.3 amps.
U.L. Recognized.

FAST-ACTING (250V) TYPE F

Opening Time: .032-.100 amp — 150%, 60 minutes min.; 210%, 30 minutes max.; 275%, .01-5 seconds; 400%, .003-.1 second; 1000%, .02 seconds max. **125-10 amp** — 150%, 60 minutes min.; 210% 30 minutes max.; 275%, .05-2 seconds; 400%, .01-.3 seconds; 1000%, .02 seconds max.

Cat. No.	Amp. Rtg.	Cat. No.	Amp. Rtg.	Cat. No.	Amp. Rtg.
217.032	.032	217.250	.250	217002	2
217.040	.040	217.315	.315	21702.5	2.5
217.050	.050	217.400	.400	2173.15	3.15
217.063	.063	217.500	.500	217004	4
217.080	.080	217.630	.630	217005	5
217.100	.100	217.800	.800	21706.3	6.3
217.125	.125	217001	1	217008	8*
217.160	.160	21701.25	1.25	217010	10*
217.200	.200	21701.6	1.6		

SEMKO approved through 6.3 amperes. BSI approved from .050-6.3 amperes.

SLO-BLO® (250V) TYPE T

Opening Time: .032-.100 amp — 150%, 60 minutes min.; 210%, 2 minutes max.; 275%, 0.2-10 seconds; 400%, .04-3 seconds; 1000%, .01-3 seconds. **.125-10 amp** — 150%, 60 minutes min.; 210%, 2 minutes max.; 275%, 0.6-10 seconds; 400%, .15-3 seconds; 1000%, .02-3 seconds.

Catalog Number	Ampere Rating	Catalog Number	Ampere Rating
218.032	.032	218.630	.630
218.040	.040	218.800	.800
218.050	.050	218001	1
218.063	.063	2181.25	1.25
218.080	.080	21801.6	1.6
218.100	.100	218002	2
218.125	.125	21802.5	2.5
218.160	.160	2183.15	3.15
218.200	.200	218004	4
218.250	.250	218005	5
218.315	.315	21806.3	6.3
218.400	.400	218008	8*
218.500	.500	218010	10*

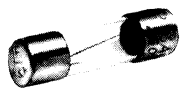
SEMKO and BSI approved through 6.3 amperes.
U.L. Recognized.

*** Standards for 5 x 20mm fuses do not include ratings above 6.3 amperes.**

Littelfuse®

CIRCUIT PROTECTION DEVICES

8AG INSTRUMENT FUSES (250V or less) 1/4" x 1"



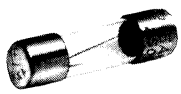
Very fast-acting fuses for protection of delicate equipment such as microammeters, galvanometers, voltmeters and other instruments.

Opening Time: 100%, 4 hour min.; 200%, 5 sec. max.

L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
361.002	1/500	361.125	1/8	361.750	3/4
361.005	1/200	361.187	3/16	361001	1
361.010	1/100	361.200	2/10	36101.5	1-1/2
361.015	1/64	361.250	1/4	361002	2
361.031	1/32	361.375	3/8	361003	3*
361.062	1/16	361.400	4/10	361004	4*
361.100	1/10	361.500	1/2	361005	5*
		361.600	6/10		

*125 volt.

8AG FAST-ACTING FUSES (250V or less) 1/4" x 1"



Fast-acting fuses designed to standard N.E.C. specs. Used when space limitations prevent use of 3AG fuses.

Opening Time: 110%, 4 hour min.; 135%, 1 hour max; 200%, 10 sec. max.

U.L. Listed through 6 amps. Certified by CSA 1/4-6 amps.

L.F No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
362.125	1/8	362002	2	362010	10†
362.250	1/4	36202.5	2-1/2*	362012	12†
362.375	3/8	362003	3*	362015	15†
362.500	1/2	362004	4*	362020	20†
362.750	3/4	362005	5*	362025	25†
362001	1	362006	6*	362030	30†
36201.5	1-1/2	362007	7*		
		362008	8†		

*125V. † 32V.

BLF FUSES (250V/125V or less) 13/32" x 1 1/2"

For low-cost, non-time delay use in control circuits.

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max., 200%, 30 sec. max.
Interrupting Rating: 10,000 Amperes AC.
U.L. Listed.
Certified by CSA.

L.F. No.	L.F. No.	L.F. No.	L.F. No.
BLF 1/2	BLF 3	BLF 7	BLF 15
BLF 1	BLF 4	BLF 8	BLF 20*
BLF 1-1/2	BLF 5	BLF 9	BLF 25*
BLF 2	BLF 6	BLF 10	BLF 30*
BLF 2-1/2	BLF 6-1/4	BLF 12	

Note: Numerals indicate amperage ratings.

* 125V. All others 250V.

BLN FUSES (250V or less) 13/32" x 1 1/2"

For low-cost, non-time delay use in control circuits and military applications.
Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max., 200%, 30 sec. max.
Interrupting Rating: 10,000 Amperes AC.
U.L. Listed. Certified by CSA.

L.F. No.	L.F. No.	L.F. No.	L.F. No.
BLN 1	BLN 5	BLN 10	BLN 20
BLN 2	BLN 6	BLN 12	BLN 25
BLN 3	BLN 8	BLN 15	BLN 30
BLN 4			

Note: Numerals indicate amperage ratings.

FLA FUSES (125V) 13/32" x 1 1/2"

Indicating Fuse

Time delay fuses for use in circuits with high in-rush currents.

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max.
Interrupting Rating: 10,000 Amperes AC.
U.L. Listed 1/10 - 15 amperes.
C.S.A. Certified 1/10 - 10 amperes.
12-30 ampere fuses have dual tube construction
Note: Numerals indicate amperage ratings.

L.F. No.	L.F. No.	L.F. No.	L.F. No.
FLA 1/10	FLA 1	FLA 2-8/10	FLA 6-1/4
FLA 15/100	FLA 1-1/8	FLA 3	FLA 7
FLA 2/10	FLA 1-1/4	FLA 3-2/10	FLA 8
FLA 1/4	FLA 1-4/10	FLA 3-1/2	FLA 10
FLA 3/10	FLA 1-1/2	FLA 4	FLA 12
FLA 4/10	FLA 1-6/10	FLA 4-1/2	FLA 15
FLA 1/2	FLA 1-8/10	FLA 5	FLA 20
FLA 6/10	FLA 2	FLA 5-6/10	FLA 25
FLA 8/10	FLA 2-1/4	FLA 6	FLA 30
	FLA 2-1/2		

FLM FUSES (250V or less) 13/32" x 1 1/2"

Dual element, time delay fuses for use in circuits with high in-rush currents.

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max., 200%, 12 sec. min.
Interrupting Rating: 10,000 Amperes AC.
U.L. Listed.
C.S.A. Certified.
PATENTS: U.S. Patents 4,409,729 and 4,445,106.
Note: Numerals indicate amperage ratings.

L.F. No.	L.F. No.	L.F. No.	L.F. No.
FLM 1/10	FLM 1-1/8	FLM 3	FLM 8
FLM 15/100	FLM 1-1/4	FLM 3-2/10	FLM 9
FLM 2/10	FLM 1-4/10	FLM 3-1/2	FLM 10
FLM 1/4	FLM 1-1/2	FLM 4	FLM 12
FLM 3/10	FLM 1-6/10	FLM 4-1/2	FLM 15
FLM 4/10	FLM 1-8/10	FLM 5	FLM 20
FLM 1/2	FLM 2	FLM 5-6/10	FLM 25
FLM 6/10	FLM 2-1/4	FLM 6	FLM 30
FLM 8/10	FLM 2-1/2	FLM 6-1/4	
FLM 1	FLM 2-8/10	FLM 7	

FLQ FUSES (500V) 13/32" x 1 1/2"

Time delay fuses for circuits with high in-rush currents.

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max., 200%, 12 sec. min.
Interrupting Rating: 10,000 Amperes AC.
U.L. Listed. C.S.A. Certified.
PATENTS: U.S. Patents 4,409,729 and 4,445,106.
Note: Numerals indicate amperage ratings.

L.F. No.	L.F. No.	L.F. No.	L.F. No.
FLQ 1/10	FLQ 8/10	FLQ 3-2/10	FLQ 9
FLQ 1/8	FLQ 1	FLQ 3-1/2	FLQ 10
FLQ 15/100	FLQ 1-1/8	FLQ 4	FLQ 12
FLQ 3/16	FLQ 1-1/4	FLQ 4-1/2	FLQ 14
FLQ 2/10	FLQ 1-1/2	FLQ 5	FLQ 15
FLQ 1/4	FLQ 1-6/10	FLQ 5-6/10	FLQ 20
FLQ 3/10	FLQ 2	FLQ 6	FLQ 25
FLQ 4/10	FLQ 2-1/4	FLQ 6-1/4	FLQ 30
FLQ 1/2	FLQ 2-1/2	FLQ 7	
FLQ 6/10	FLQ 3	FLQ 8	

BLS FUSES (600V or less) 13/32" x 1 3/8"

Fast clearing, space-saving fuses for street lighting, control and electronic circuits.
Opening Time: 110%, 4 hrs. min., 135%, 1 hr. max. 200%, 5 sec. max. (2/10-5A), 10 sec. max. (6-10A).
Interrupting Rating: 10,000 amperes AC.
U.L. Listed 1/2 - 5 amperes.
C.S.A. Certified 1/2 - 5 amperes.
PATENTS: U.S. Patents 4,563,809 and 4,656,453.

L.F. No.	L.F. No.	L.F. No.	L.F. No.
BLS 2/10	BLS 1	BLS 2	BLS 6
BLS 4/10	BLS 1-1/2	BLS 3	BLS 7
BLS 1/2	BLS 1-6/10	BLS 4	BLS 8
BLS 3/4	BLS 1-8/10	BLS 5	BLS 10
BLS 8/10			

Note: Numerals indicate amperage ratings.

LITTELFUSE, Inc. • Dept. EM, 800 E. Northwest Highway • Des Plaines, IL 60016 • (312) 824-0400* • *Effective November 11, 1989, the area code is 708

Littelfuse®

CIRCUIT PROTECTION DEVICES

KLK FUSES (600 VAC) 13/32" × 1 1/2"

Fast-acting, current limiting fuses for use in control electronic and other circuits with high fault current capacity. DC version available.

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max. 200%, 2 sec. max. (1/10-4A) 15 sec. max. (5-12A) 2 min. max. (15-30A).
Interrupting Rating: 100,000 amperes AC. Capable of 200,000 amperes A.C.
U.L. Listed 3/10 - 30 amperes.
C.S.A. Certified 3/10 - 30 amperes.
PATENTS: U.S. Patents 4,563,809 and 4,656,453.

L.F. No.	L.F. No.	L.F. No.	L.F. No.
KLK 1/10	KLK 3/4	KLK 4	KLK 10
KLK 1/8	KLK 1	KLK 5	KLK 12
KLK 2/10	KLK 1-1/2	KLK 6	KLK 15
KLK 1/4	KLK 2	KLK 7	KLK 20
KLK 3/10	KLK 3	KLK 8	KLK 25
KLK 1/2	KLK 3-1/2	KLK 9	KLK 30

Note: Numerals indicate amperage ratings.

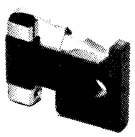
BLADE TYPE TERMINAL FUSES (32V) (ATO®)

Low voltage plug-in fuses. Color coded for amperage identification.

Opening Time: 110%, 100 hours min.; 135%, 1800 sec. max.; 200%, 5 sec. max. 350%, .02 sec. min. (1-2A), .08 sec. min. (3-30A) min. **Size:** .75" wide × .75" high × .207" deep.
U.L. Listed 3 - 30 amps.
PATENTS: Sixteen worldwide. U.S. Patent 3,909,767.

L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
257001	1	257005	5	257020	20
257002	2	257007.5	7.5	257025	25
257003	3	257010	10	257030	30
257004	4	257015	15		

ALARM INDICATING FUSES (125 VAC, 60 VDC)



Plug-in fuses for telecommunications and similar applications. Blown fuse indicating flag can also activate alarm circuit. Flag is color-coded by ampere rating.

Opening Time: 100%, 10 minutes min.; 150%, 5 minutes max.
U.L. Recognized at 60 VDC, 125 VAC

L.F. No.	Amp Rtg.	Color Code	L.F. No.	Amp Rtg.	Color Code
401.180	18/100	Yellow	401002	2	Orange
401.250	1/4	Violet	401003	3	Blue
401.500	1/2	Red	401005	5	Green
401.650	65/100	Black	40107.5	7-1/2	Black
401.750	3/4	Brown			White
401001	1	Gray	401010	10	Red
4011.33	1-1/3	White			White
40101.5	1-1/2	Yellow/ White			

SCREW TERMINAL FUSE BLOCKS

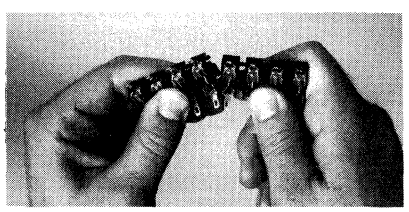
Open type blocks available for 3AG and Midget (13/32" × 1-1/2") fuse sizes from one to twelve poles. Bases are of grade X black laminate with 1/32" insulator sheet cemented to underside. Screw terminal clips.

Mounting Hole: 3AG — .142"/.147" dia. with .295"/.302" by 82°CS. **Midget** — .171"/.176" dia. with .342"/.349" × 82°CS.
Clip Material: 356 Series — Nickel Plated Spring Brass. **359** and **556** Series — Silver plated Beryllium Copper.
Size: Width: 2-3/8" (3AG), 2-3/4" (Midget). See chart for length dimensions. **356 Series and 556 Series are Recognized under the Components Program of Underwriters Laboratories.**

No. of Poles	For 3AG Fuses		For Midget Fuses	
	Length (In.)	Part No.	Length (In.)	Part No.
1	25/32	356001	27/32	556001
2	1-11/16	356002	1-13/16	556002
3	2-19/32	356003	2-25/32	556003
4	3-1/2	356004	3-3/4	556004
5	4-13/32	356005	4-23/32	556005
6	5-5/16	356006	5-11/16	556006
7	6-7/32	356007	6-21/32	556007
8	7-1/8	356008	7-5/8	556008
9	8-1/32	356009	8-19/32	556009
10	8-15/16	356010	9-9/16	556010
11	9-27/32	356011	10-17/32	556011
12	10-3/4	356012	11-1/2	556012

For 3AG block with silver plated beryllium copper, change series number to **359.**

2AG OMNI FUSE BLOCK

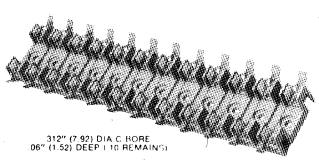


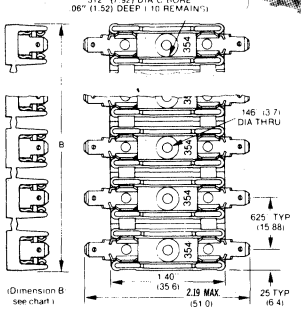
ELECTRICAL SPECIFICATIONS:
- 10 amps at 300 volts.
- Minimum dielectric - 1,500 volts RMS

MATERIALS:
Clip Terminals: Solder or Quick-connect, tin-plated, spring brass.
Base: Thermoplastic, glass reinforced. (Black standard) UL94V0 flammability rated.
Approvals: UL Recognized and Certified by CSA.

Catalog Number			
Solder Type Terminals	0.110" Q.C. Terminals	Number of Poles	Overall Width (B)
254001	254201	1	0.35"
254002	254202	2	0.80"
254003	254203	3	1.25"
254004	254204	4	1.70"
254005	254205	5	2.15"
254006	254206	6	2.60"
254007	254207	7	3.05"
254008	254208	8	3.50"

3AG OMNI-BLOK® FUSE BLOCKS





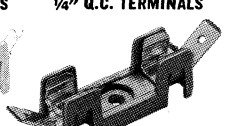
For 3AG fuses. New, low profile fuse blocks with "break-away" pole feature.

Approvals: U.L. Recognized and Certified by CSA up to 300V and at current ratings shown below.

Series	Current Rating	
	U.L.	CSA
354000	30A	30A
354600	20A	20A
354800	20A	20A
354900	30A	25A
354101-GY	15A	15A

354000 SERIES SOLDER TERMINALS

354800, 354900 SERIES 1/4" Q.C. TERMINALS



354600 SERIES 3/16" Q.C. TEMINALS

354101-GY P.C. BOARD TERMINALS

Specifications: 354 (000) Series (Solder type terminals); 30 amps, 300V. 354 (600) Series (3/16" Q.C. terminals); 20 amps, 300V. 354 (800) Series (1/4" Q.C. terminals); 20 amps, 300V. 354 (900) Series (1/4" Q.C. terminals): 30 amps, 300V. 354101-GY (PC Board): 15A, 300V.

Materials: Clip/terminal; High tensile spring brass, electro-tin plated. Base; Grey Polyester, glass reinforced. UL-94V0 flammability rating.

Special Options: Standard color is gray. Contact factory for special colors. Single pole units can be supplied with anti-rotation boss. Contact factory.

Patented.

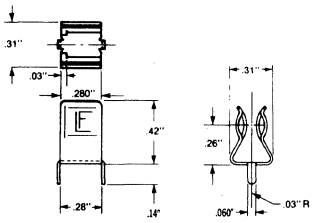
Catalog Number						
Solder Type Terminals	NEMA STYLE 3/16" Q.C. Terminals	1/4" Q.C. Terminals	NEMA STYLE 1/4" Q.C. Terminals	No. of Poles	Dimension "B"
354001-GY	354601-GY	354801-GY	354901-GY	1	.50"
354002-GY	354602-GY	354802-GY	354902-GY	2	1.12"
354003-GY	354603-GY	354803-GY	354903-GY	3	1.75"
354004-GY	354604-GY	354804-GY	354904-GY	4	2.38"
354005-GY	354605-GY	354805-GY	354905-GY	5	3.00"
354006-GY	354606-GY	354806-GY	354906-GY	6	3.63"
354007-GY	354607-GY	354807-GY	354907-GY	7	4.25"
354008-GY	354608-GY	354808-GY	354908-GY	8	4.88"
354009-GY	354609-GY	354809-GY	354909-GY	9	5.50"
354010-GY	354610-GY	354810-GY	354910-GY	10	6.13"
354011-GY	354611-GY	354811-GY	354911-GY	11	6.75"
354012-GY	354612-GY	354812-GY	354912-GY	12	7.38"

FOR INFORMATION ON OTHER STYLES OF FUSE BLOCKS, CONTACT FACTORY.

LITTELFUSE, Inc. • Dept. EM, 800 E. Northwest Highway • Des Plaines, IL 60016 • (312) 824-0400* • *Effective November 11, 1989, the area code is 708

Littelfuse® CIRCUIT PROTECTION DEVICES

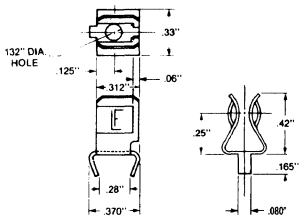
P.C. BOARD FUSE CLIPS
FOR 1/4" DIAMETER FUSES



Cat. No.	Clip Material	Finish	Style
102071	Spring Brass	Tin Plated	Ear
102074	Spring Brass	Tin Plated	Earless
102076	Spring Brass	Hot Tin	Ear
122083	Beryllium Copper	Silver Plated	Ear
122088	Beryllium Copper	Tin Plated	Ear
122087	Beryllium Copper	Silver Plated	Earless
122093	Beryllium Copper	Tin Plated	Earless

Note: Spring brass clips are suitable for current levels up to 15 amperes; beryllium copper clips up to 30 amps.

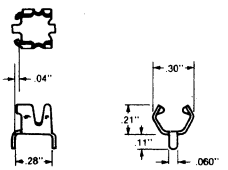
P.C. BOARD FUSE CLIPS
BOWED TAB TYPE FOR 1/4" DIAMETER FUSES



Cat No.	Clip Material	Finish	Style
102078	Spring Brass	Tin Plated	Earless
102079	Spring Brass	Tin Plated	Ear
102082	Spring Brass	Hot Tin	Ear

Note: Spring brass clips are suitable for current levels up to 15 amperes.

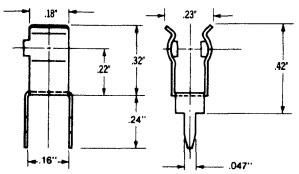
P.C. BOARD FUSE CLIPS
LOW PROFILE TYPE FOR 1/4" DIAMETER FUSES



Cat. No.	Clip Material	Finish	Style
122090	Beryllium Copper	Silver Plated	Ear
102080	Spring Brass	Tin Plated	Ear

Note: Spring brass clips are suitable for current levels up to 15 amperes; beryllium copper clips up to 30 amperes.

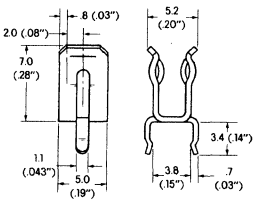
P.C. BOARD FUSE CLIPS
FOR 5mm DIAMETER FUSES



Cat. No.	Clip Material	Finish	Style
100054	Spring Brass	Silver Plated	Ear
100056	Spring Brass	Tin Plated	Ear

Note: Spring brass clips are suitable for current levels up to 10 amperes.

P.C. BOARD FUSE CLIPS
FOR 2AG OR 5mm DIAMETER FUSES



Cat No.	Clip Material	Finish	Style
111501	Spring Brass	Tin Plated	Ear
111505	Beryllium Copper	Tin Plated	Surface Mnt.
111506	Beryllium Copper	Tin Plated	Ear

Note: Suitable for current levels up to 10 amperes.

Note: Metric dimensions are shown. Inch dimensions are in parentheses.

RIVET MOUNT FUSE CLIPS

EAR TYPE

EARLESS TYPE

LUG TYPE

Be Cu*	Spring Brass†	Style	Fuse Dia.
121001	101001	Ear	1/4"
125001	105001		13/32"
127001	107001		9/16"
129001	109001		13/16"
121002	101002	Earless	1/4"

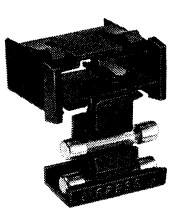
* Silver Plated. † Nickel Plated.

Be Cu*	Spring Brass†	Style	Fuse Dia.
125002	105002	Earless	13/32"
127002	107002		9/16"
129002	109002		13/16"
121004	101003‡	Lug-45°	1/4"
—	102064‡	Lug-Straight	1/4"

‡ Tin Plated.

FLIP TOP SHOCK-SAFE PANEL MOUNT FUSEHOLDER #346877 FOR 3AG. (#286377 FOR 2AG, #286677 FOR 5x20mm)

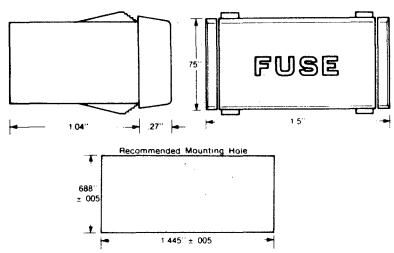
FUSE CARRIER HOLDS SPARE FUSE



Shock-Safe design eliminates any possibility of electrical shock, per IEC Standards 257 and 65. Fuse carrier holds spare fuse for fast, easy fuse replacement and convenient servicing. Low profile design complements modern panels.
APPROVALS: Recognized under the Components Program of Underwriters Laboratories and Certified by CSA.

SPECIFICATIONS:
Electrical Rating: See Approvals.
Insulation Resistance: 10,000 megohm minimum at 500 VDC.
Contact Resistance: Less than .01 ohm.
Dielectric Strength: 1,500 volts minimum.
Mounting: Snap-in mounting. No hardware required. Panel thickness = .032"/.125".
Molded Parts: Thermoplastic, 94V0 black standard (other colors available as special).
Fuse Carrier: Springloaded. Unlocks with a press of the finger. Locks into place to prevent accidental circuit interruption. Permanently attached to fuseholder body to prevent loss. Extracts fuse from live terminals.
Terminals: Copper alloy, tin plate. Accept .250" x .032" quick-connect or solder. .072" dia. hole.
Ambient Temperature: −40°C to +85°C.

Vibration: 10-55-10 Hz at .06 double amplitude (Method 201, MIL-STD-202).
PATENTS: U.S. Patent 4,543,557.



Note: Dimensions differ for 2AG and 5x20 styles.

LITTELFUSE, Inc. • Dept. EM, 800 E. Northwest Highway • Des Plaines, IL 60016 • (312) 824-0400* • *Effective Nov. 11, 1989, the area code is 708

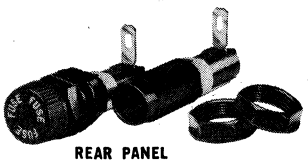
Littelfuse® CIRCUIT PROTECTION DEVICES

SHOCK-SAFE FUSEHOLDERS FOR 3AG OR 5 x 20mm FUSES

FRONT PANEL, LOW PROFILE

FRONT PANEL, HIGH PROFILE

FRONT PANEL


REAR PANEL

LOW PROFILE, QUICK MOUNT

- Designed to meet IEC (International Electrotechnical Commission) specifications 65 and 257.
- Eliminate possibility of electrical shock.
- Bodies accept ¼" x 1¼" or 5 x 20mm fuses with use of appropriate knob.
- **U.L. Recognized. Certified by CSA (20A, 300V). SEMKO approved (6.3A, 250 V). VDE approved (10A, 250V).**

SPECIFICATIONS

MOLDED PARTS
Body material: black glass-filled thermoplastic
Knob material: grey or black glass-filled thermoplastic
Hex nut material: glass filled thermoplastic

LOW PROFILE BODY
(with screwdriver slot knob)

L.F. No.		Bottom Terminal	
1/4" x 1-1/4" Fuses	5mm x 20mm Fuses	Right Angle	Straight
345601	345621	X	
345611	345631		X

Body and Nut only: #345601-010 (Rt. Angle) #345611-010 (Straight)
Knob only: #345601-020 (¼" x 1¼") #345621-020 (5 x 20mm)

HIGH PROFILE BODY
(with screwdriver slot knob)

L.F. No.		Bottom Terminal	
1/4" x 1-1/4" Fuses	5mm x 20mm Fuses	Right Angle	Straight
345602	345622	X	
345612	345632		X

Body and Nut only: #345602-010 (Rt. Angle) #345612-010 (Straight)
Knob only: #345601-020 (¼" x 1¼") #345621-020 (5 x 20mm)

KNOB
Finger grip or screwdriver slot types
Spring loaded, bayonet style
Fuse extractor
Nickel plated copper alloy insert

TERMINALS
Electro tin plated brass
Accept solder or 3/16" female connector. See below.

MOUNTING
Withstands 15 pound/inch mounting torque
Maximum panel thickness: 5/16"

ELECTRICAL CHARACTERISTICS
300 volt rating 20 amperes max.
Insulation resistance: 10,000 megohm minimum at 500 VDC

FINGER GRIP BODY
(with finger grip knob)

L.F. No.		Bottom Terminal	
1/4" x 1-1/4" Fuses	5mm x 20mm Fuses	Right Angle	Straight
345603	345623	X	
345613	345633		X

Body and Nut only: #345603-010 (Rt. Angle) #345613-010 (Straight)
Knob only: #345603-020 (¼" x 1¼") #345623-020 (5 x 20mm)

REAR PANEL-FINGER GRIP

L.F. No.		Bottom Terminal	
1/4" x 1-1/4" Fuses	5mm x 20mm Fuses	Right Angle	Straight
345903	345923	X	
345913	345933		X

Body and Nuts (2) only: #345903-010 (Rt. Angle) #345913-010 (Straight)
Knob only: #345603-020 (¼" x 1¼") #345623-020 (5 x 20mm)

Contact Resistance: Less than .005 ohms average at currents up to 1 ampere.
Dielectric strength: 4000 volts minimum

ENVIRONMENTAL
Ambient temperature: −40°C to +85°C
Vibration: 10-500 Hz, .03" constant amplitude or 10 G's constant acceleration

Patents: Pending

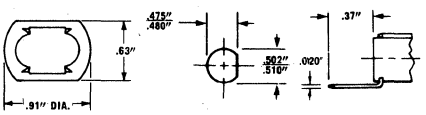
LOW PROFILE-FAST MOUNT

L.F. No.		Bottom Terminal	
1/4" x 1-1/4" Fuses	5mm x 20mm Fuses	Right Angle	Straight
345701	345721	X	
345711	345731		X

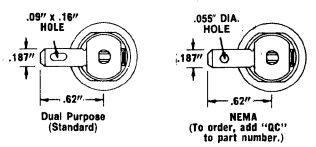
Body and Retaining Nut only: #345701-010 (Rt. Angle) #345711-010 (Straight)
Knob only: #345601-020 (¼" x 1¼") #345621-020 (5 x 20mm)

NOTE: Knobs are color-coded. On screwdriver slot type, knobs are grey for 1/4" × 1-1/4" fuses, black for 5 × 20mm fuses. On finger grip type, the lettering on knobs for 1/4" × 1-1/4" fuses are filled with white paint.

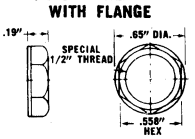
"PUSH-ON" TYPE RETAINING NUT | **SUGGESTED MOUNTING HOLE** | **STRAIGHT BOTTOM TERMINAL**



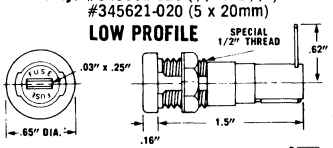
QC Terminal Styles



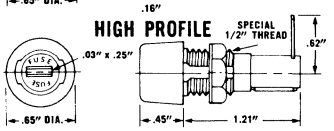
PLASTIC HEX NUT WITH FLANGE



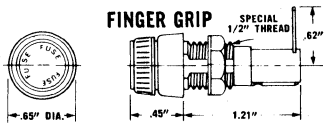
LOW PROFILE



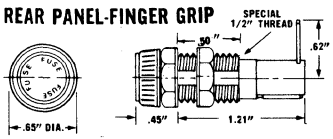
HIGH PROFILE



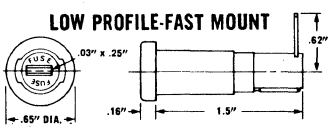
FINGER GRIP



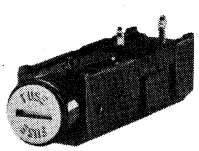
REAR PANEL-FINGER GRIP



LOW PROFILE-FAST MOUNT



P.C. BOARD SHOCK-SAFE FUSEHOLDERS FOR 3AG OR 5x20MM FUSES



Similar to shock-safe fuseholders shown above but designed for p.c. board mounting. Shock-safe design per IEC Standards 257 and 65. Two different knob styles available for use with ¼" x 1¼" or 5 x 20mm fuses.

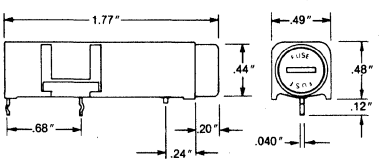
SPECIFICATIONS:
Electrical: Rating See APPROVALS.
Insulation Resistance: 10,000 megohm minimum at 500 VDC.
Contact Resistance: Less than .005 ohms average at a current of one ampere.
Dielectric Strength: 4000 volts minimum.

Mounting: Intended for soldering to printed circuit boards.
Molded Parts: Body Material: Black glass-filled thermoplastic. Knob Material: Grey or black glass-filled thermoplastic.
Knob: Screwdriver slot, fuse extractor type with nickel-plated copper alloy insert. Spring-loaded, bayonet style.
Terminals: Brass. Tin-plated.
Ambient Temperature: −40°C to +85°C.

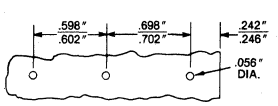
APPROVALS: Recognized under the Components Program of Underwriters Laboratories (16A, 250V)
Certified by CSA (15A, 250V).
SEMKO approved (6.3A, 250V). VDE approved (10A,250V).

L.F. No.	
1/4" x 1-1/4 FUSES	5mm x 20mm FUSES
345101	345121

Body only: #345101-010
Knob only: #345101-020 (¼" x 1¼") #345121-020 (5 x 20mm)



Recommended Hole Pattern



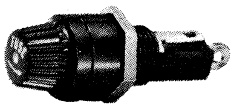
NOTE: Knobs are color-coded; grey for 1/4" x 1-1/4" fuses, black for 5 x 20mm fuses.

Littelfuse® CIRCUIT PROTECTION DEVICES

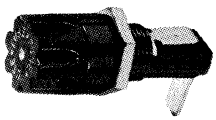
3AG FUSEHOLDERS WITH SOLDER TYPE, 3/16" OR 1/4" QUICK-CONNECT TERMINALS

Extend only 1" behind panel. **UL Recognized and Certified by CSA.**

KNURLED KNOB



FLUTED KNOB



SPECIFICATIONS

Electrical: Rated at 20 amperes for any voltage up to 250V. Dielectric withstanding voltage exceeds 2400 volts.

Mounting: Withstands 15 pound/inch (1.69Nm) mounting torque. Maximum panel thickness 18" (4.8).

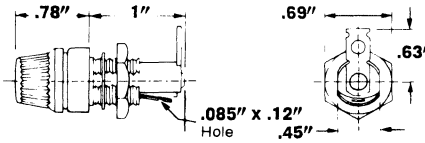
Molded Parts: Black thermoplastic.

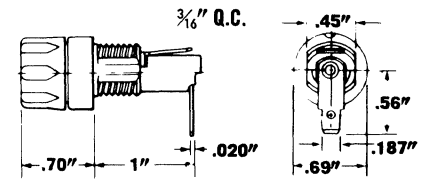
Knob: Bayonet style with white lettering.

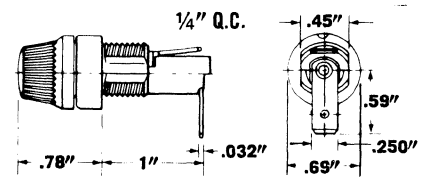
Copper and Copper Alloy Terminals: Tin plated except 1/4" quick connect terminals are nickel plated.

Hardware: Standard fuseholders supplied with a neoprene washer and a hex nut unassembled. Lockwasher (L) and drip-proof seal (P) variations available by adding appropriate suffix letters (L, P or PL) to catalog number.

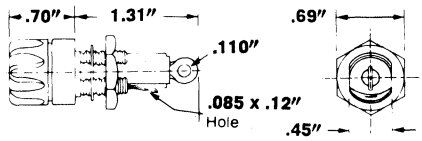
Right Angle Terminal
SOLDER

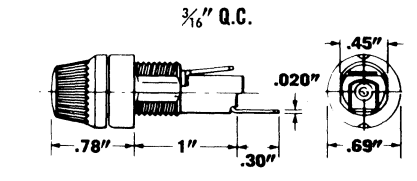


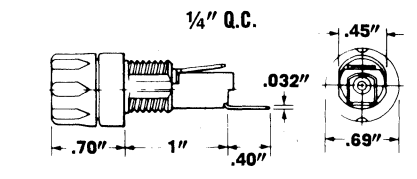




Straight Bottom Terminal
SOLDER







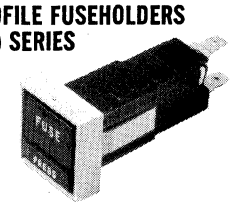
RIGHT ANGLE TERMINAL

Fluted Knob	Knurled Knob	Type of Terminal
342004	342022	Solder
342028	342048	3/16" Q.C.
342828	342848	1/4" Q.C.

STRAIGHT BOTTOM TERMINAL

Fluted Knob	Knurled Knob	Type of Terminal
342014	342012	Solder
342038	342058	3/16" Q.C.
342838	342858	1/4" Q.C.

LOW PROFILE FUSEHOLDERS 348 (000) SERIES



Snap into panel. Eliminate need for mounting hardware. Square cap design and choice of cap and bezel colors. 3/16" or 1/4" Q.C. terminals. **U.L. Recognized and Certified by CSA.**

SPECIFICATIONS

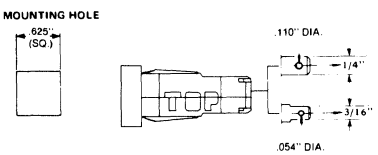
Molded Parts: Body-Black Thermoplastic. Cap-High temperature thermoplastic.

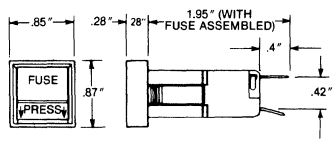
Terminals: One piece-brass-Electro-tin plated.

Electrical Characteristics: Rated at 15 amps for any voltage to 250. Dielectric withstanding voltage between terminals and terminals to ground at room temperature and 90% R.H. exceeds 1,500 volts.

Patents: U.S. Patent 3,659,252.

Mounting: .625" sq. hole in 1/32" through 1/8" thick chassis panel.





Mounting Hole: .625" square

HOW TO ORDER LOW PROFILE FUSEHOLDERS

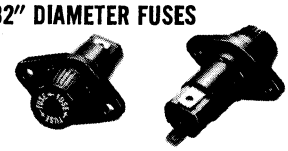
The six digit catalog number is a coded description of the finished unit. To specify type required, select appropriate code numbers from chart below. To order a cap assembly only for 3AG fuses, use **348** series numbers and insert a "0" in the terminal style and bezel color locations. To order a body assembly only, use **348** series number and insert a "0" in the cap color location.

SIX DIGIT CATALOG NUMBERS CONSIST OF

Series No.	Terminal Style	Bezel Color	Cap Color
348 For 3AG Fuses		1 Red	1
		2 Green	2
		3 Yellow	3
		4 Blue	4
	6 3/16" Wide Terminals	5 White	5
	8 1/4" Wide Terminals	7 Black	7
		9 Grey	9

For example: 348615 is a holder with 3/16" terminals, red bezel and white cap.

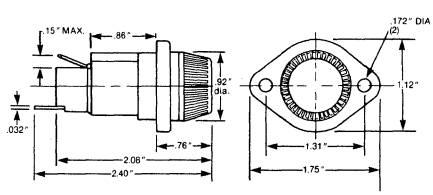
PANEL FUSEHOLDER FOR 13/32" DIAMETER FUSES

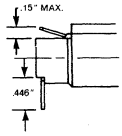


Recessed side terminal for additional shock-safe characteristics. **U.L. Recognized and Certified by CSA.**

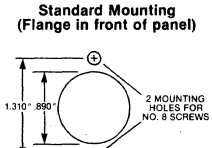
Catalog Number		Bottom Terminal	Fuse Length Range*
Standard	Watertight		
571 027 571 028	571 027P 571 028P	Straight Rt. Angle	$1^{5}/_{16}$" - $1^{3}/_{8}$"
571 007 571 008	571 007P 571 008P	Straight Rt. Angle	$1^{13}/_{32}$" - $1^{1}/_{2}$"

*Fuse diameter is $^{13}/_{32}$"





Standard Mounting (Flange in front of panel)



SPECIFICATIONS

Molded Parts: Black Thermoset.

Knob: Screw type, with engraved markings: Unfilled characters (571007, 571007P, 571008, 571008P), light blue characters (571027, 571027P, 571028, 571028P).

Terminals: Brass, tin plated. Combination solder/1/4" quick-connect. Side terminal has .125" diameter hole. Bottom terminal has .156" x .124" elongated hole.

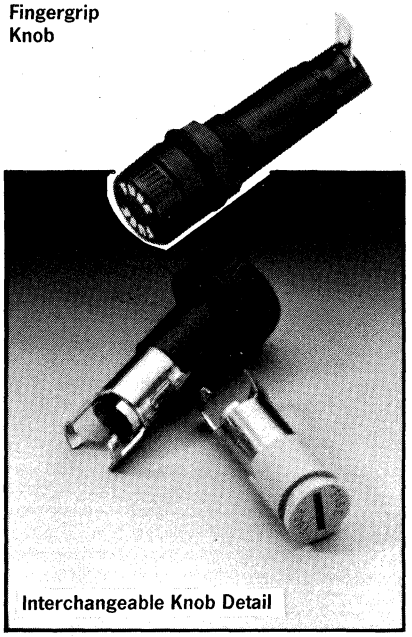
Mounting: Flange mounting either in front of or behind panel. Watertight version must be front panel mounted. Maximum panel thickness is .75".

Electrical Characteristics: Rated at 30 amps for any voltage up to 600. Dielectric withstanding voltage greater than 2400V.

Littelfuse® CIRCUIT PROTECTION DEVICES

INTERNATIONAL SHOCK-SAFE FUSEHOLDER

Low Profile
Fingergrip
Knob



Interchangeable Knob Detail

FEATURES:

- Designed to eliminate the possibility of electrical shock, as defined in IEC standards 65 and 257.
- Universal fuseholder body will accept 3AG, 5 × 20mm, and 2AG fuse sizes depending on knob selected. Permits inventory reduction of bodies and provides knob interchange versatility.
- Available with two knob styles—screwdriver slot or fingergrip. Drip-proof option is available on screwdriver slot knob style.
- Available in three terminal styles—dual-purpose for soldering or 3/16" quick connect; 3/16" NEMA quick connect; and 1/4" NEMA/DIN quick connect.

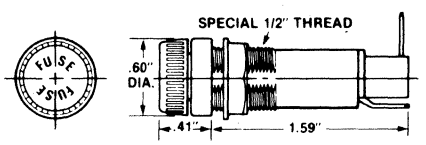
APPROVALS:

	3AG	5 × 20mm	2AG
	20A 250V	10A 250V	10A 250V
CSA	20A 250V	10A 250V	10A 250V
SEMKO	6.3A 250V	6.3A 250V	—
VDE	10A 250V	10A 250V	—

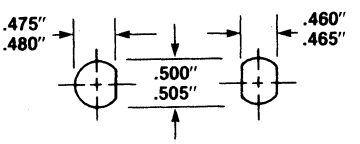
*Recognized under the Components Program of Underwriter Laboratories

DIMENSIONAL DRAWINGS

LOW PROFILE FINGERGRIP KNOB



SUGGESTED MOUNTING HOLES



ORDERING INFORMATION

EXAMPLE: 345 3 LS 7 L N (Complete Assembly with options)

Series Number

Fuse Size

- 2 — 2AG .177" x .588"
- 3 — 3AG .250" x 1.250"
- 5 — 5 x 20mm .197" x .787"

Body Type – Knob Type

- LF — Low Profile Body Black Fingergrip Knob
- RF — Rear Mount Body Black Fingergrip Knob
- Fingergrip Knob 2AG – Blue Letters 3AG – White Letters 5 x 20mm – Red Letters
- HS — High Profile Body Screwdriver Slot Knob
- LS — Low Profile Body Screwdriver Slot Knob
- QS — Quick Mount Body Screwdriver Slot Knob
- Screwdriver Slot Knob 2AG – Blue Knob 3AG – Grey Knob 5 x 20mm – Black Knob

Terminals

- 1 — 3/16" (Rt. Angle) Dual Purpose Solder/QC
- 2 — 3/16" (Straight) Dual Purpose Solder/QC
- 3 — 3/16" (Rt. Angle) NEMA QC
- 4 — 3/16" (Straight) NEMA QC
- 7 — 1/4" (Rt. Angle) NEMA/DIN QC
- 8 — 1/4" (Straight) NEMA/DIN QC

Options*

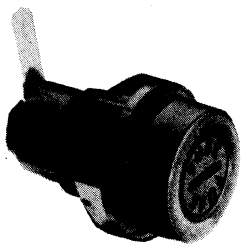
- L — Lockwasher
- N — Neoprene Washer
- P — Drip-Proof "O" Ring**

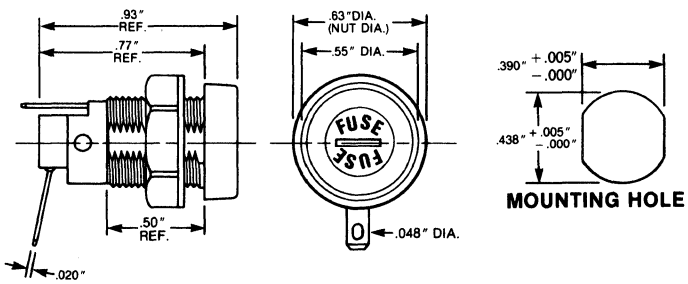
*Options (L,N,P) can be ordered individually or in combination.

**Screwdriver slot knob only.

Littelfuse® CIRCUIT PROTECTION DEVICES

2AG STANDARD PANEL MOUNT SHOCK-SAFE FUSEHOLDER

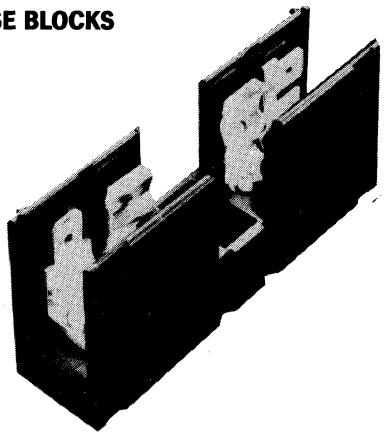


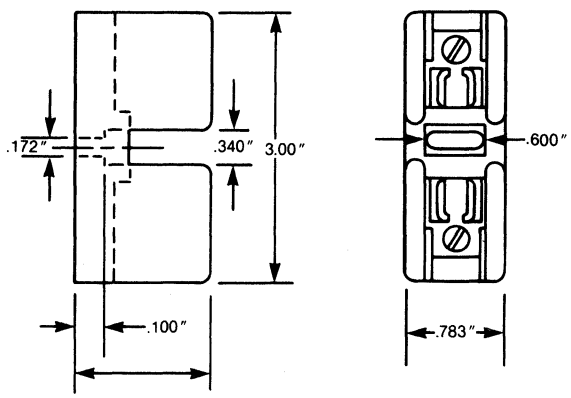


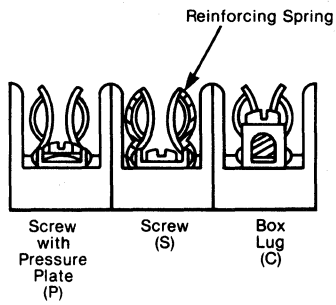
245 001 Solder/Q.C. Terminal
245 002 NEMA Q.C. Terminal

- Shock-safe design eliminates possibility of electrical shock, per IEC standards 65 and 257
- Additional hardware available by adding appropriate suffix to catalog number
- Rated at 10 amperes at any voltage up to 300 volts
- Popular screwdriver slot-knob style provides low profile which complements modern panels
- Dielectric strength of 4,000 volts minimum
- Temperature range of −40°C to +85°C
- Body, knob, and hex nut are glass reinforced thermoplastic with UL-94V0 flammability rating
- Solder type or NEMA quick-connect type terminals made of tin-plated brass
- Recognized under the Components Program of Underwriters Laboratories and Certified by CSA
- Withstands 10 lb.-in. mounting torque
- Patented

MIDGET FUSE BLOCKS







Space-saving, 600 volt, with side barriers for isolation. For use with $^{13}/_{32}$" × $1^{1}/_{2}$" midget fuses which are used in the protection of control devices, lighting circuits, motors and computers. Available in 1, 2, and 3 pole ganged configurations. By sliding and locking blocks together, any number of poles can be achieved.

APPROVALS: Recognized under the Components Program of Underwriters Laboratories and Certified by CSA.

SPECIFICATIONS:
Electrical: Screw terminal and box lug terminals rated for 30 amperes. Q.C. terminals rated for 20 amperes.
Dielectric Strength: 1200 volts minimum.
Clip/Terminals: Tin-plated copper alloy.
Box Lug: Copper.
Base: Thermoplastic. UL 94V0 flammability rating.
Ambient Temperature: 105°C maximum.

PATENTS: Patented.

Catalog Number	Number of Poles	Style
L60030M-1C	1	Copper Box Lug
L60030M-2C	2	Copper Box Lug
L60030M-3C	3	Copper Box Lug
L60030M-1SQ	1	Screw/Q.C. Terminal
L60030M-2SQ	2	Screw/Q.C. Terminal
L60030M-3SQ	3	Screw/Q.C. Terminal

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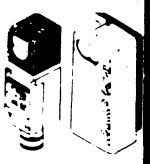
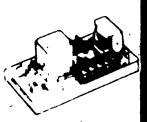
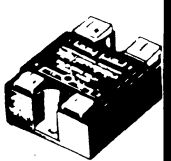
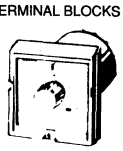

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS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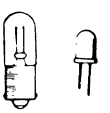
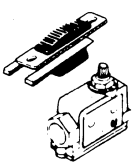
CIRCUIT BREAKERS FUSES & FUSEHOLDERS

KNOBS


LAMPS & LEDS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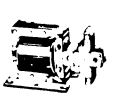
RELAYS

INDICATOR LIGHTS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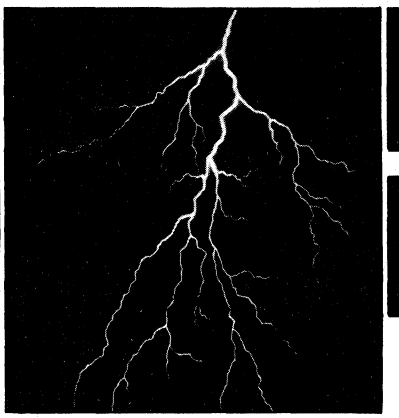
AC POWER LINE PROTECTOR

SPA/SPB/SPC SERIES



PROTECTS SENSITIVE EQUIPMENT FROM DAMAGING TRANSIENT OVERVOLTAGES!

Lightning and power line transients surge along AC power lines producing costly damage to computers, medical equipment and other sensitive electrical devices. Prevent these malfunctions and downtime with a reliable, maintenance-free SP Series AC power line protector.

Operating in nanoseconds, the SP series will vigorously clamp lightning and transient overvoltages on the AC line to safe levels whenever the clamping threshold is exceeded. After each transient, the protector recovers automatically—without power interruption. The use of redundant protection elements virtually guarantees no "downtime."

How to Choose the Proper Protector Size

A surge of voltage running into a facility will dissipate by subdividing throughout the building's power distribution system.

The capability of a surge suppressor is determined by its intended location. At the point of entry, the energy contained in a surge is at maximum. Fanning out on its journey through the system, it will offer less magnitude to each branch panel encountered. Finally, the least amount of damaging potential will be experienced by the local panels and outlets deep in the system.

The SP Series is designed to make the selection of a model not only easy, but also provide the best choice of protection versus cost.

Main Service Panel Protector—SPC Series

To keep damaging overvoltages from entering the building, choose the heavy-duty SPC series. These shunt connected protectors vigorously clamp high energy transients with a sophisticated combination of high speed and brute force MOV's. An SPC installed at the main service panel is your most cost-effective solution to protecting the facility's AC lines.

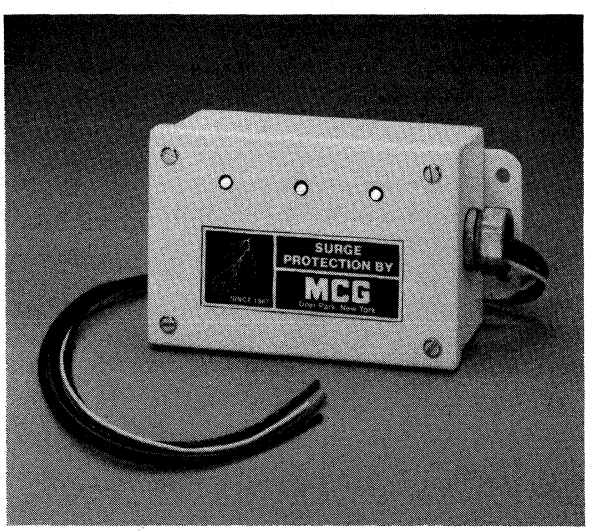
Branch Panel Protector—SPB Series

Installed in shunt at the branch distribution panel, the SPB series provides ideal protection for several rooms or an entire floor of a building. The SPB protectors, when located at the branch panel, also provide transverse protection (i.e., it prevents transients generated from one room being coupled through a common panel into another room).

Local Service Panel Protector—SPA Series

The SPA protectors install in shunt at the local panel or directly at the equipment. These compact units provide very substantial protection for one or more pieces of sophisticated equipment or a small computer room.

SPB/SPC protects branch distribution and main service panels.



SPA protects at the local service panel.

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2 year warranty

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AC POWER LINE PROTECTOR

SPA/SPB/SPC SERIES (con't)

SPA Features:

—Close clamping
—Automatic reset
—"Protection present" indicators
—Easy installation

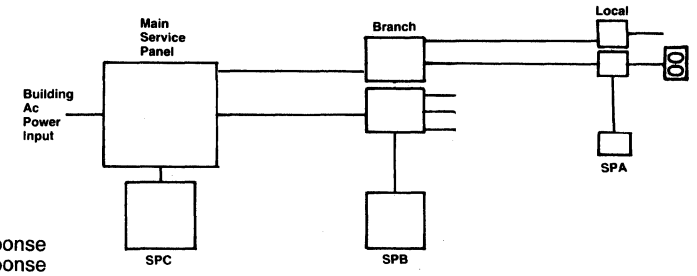
SPB/C Adds:

—Redundant protection
—Troubleshooting LED's
—Modular construction for on-site repair

General Specifications:

Response time	
SPA	5ns component response
SPB/C	1ns component response
Frequency	50/60/400 Hz
Operating temperature	– 40 to + 85 degrees C
Meets or exceeds	IEEE 587 Cat. B

Protector Placement Guide



Quantity Pricing is Available

SPA—Local Service Panel Protector

MODEL	RATED VOLTAGE (VAC)	SERVICE	ENERGY ABSORPTION* Joules Total	Per Leg	CLAMP VOLTAGE 1ma	Price
120S	120	1ph	1140	1140	200V	$350
120T	120/240	1ph	1140	570	200V	355
120Y	120/208	3ph wye	1140	380	200V	365
220S	220	1ph	1680	1680	400V	360
220Y	220/380	3ph wye	1680	560	400V	385
240Y	240/415	3ph wye	1680	560	400V	405
277Y	277/480	3ph wye	1800	600	400V	435
240D	240	3ph delta	1680	560	400V	415
480D	480	3ph delta	3360	1120	800V	455

SPB—Branch Service Panel Protector

MODEL	RATED VOLTAGE (VAC)	SERVICE	ENERGY ABSORPTION* Joules Total	Per Leg	CLAMP VOLTAGE 1ma	Price
120S	120	1ph	2400	2400	200V	$645
120T	120/240	1ph	2400	1200	200V	655
120Y	120/208	3ph wye	2400	800	200V	775
220S	220	1ph	6000	6000	400V	750
220Y	220/380	3ph wye	6000	2000	400V	800
240Y	240/415	3ph wye	6000	2000	400V	825
277Y	277/480	3ph wye	9000	3000	460V	845
240D	240	3ph delta	6000	2000	400V	805
480D	480	3ph delta	13800	4600	800V	985

SPC—Main Service Panel Protector

MODEL	RATED VOLTAGE (VAC)	SERVICE	ENERGY ABSORPTION* Joules Total	Per Leg	CLAMP VOLTAGE 1ma	Price
120S	120	1ph	4800	4800	200V	$1405
120T	120/240	1ph	4800	2400	200V	1425
120Y	120/208	3ph wye	4800	1600	200V	1475
220S	220	1ph	12000	12000	400V	1450
220Y	220/380	3ph wye	12000	4000	400V	1510
240Y	240/415	3ph wye	12000	4000	400V	1545
277Y	277/480	3ph wye	18000	6000	460V	1625
240D	240	3ph delta	12000	4000	400V	1590
480D	480	3ph delta	27600	9200	800V	1865

*Measured employing 8 × 20 μs waveform.

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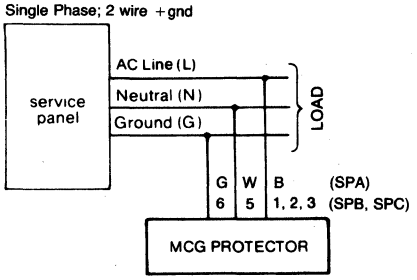
AC POWER LINE PROTECTOR

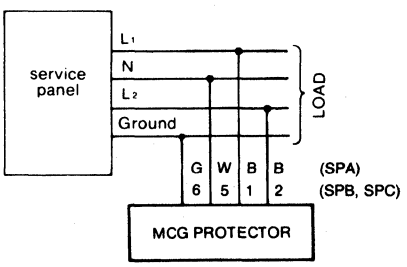
SPA/SPB/SPC SERIES (con't)

Connection Information

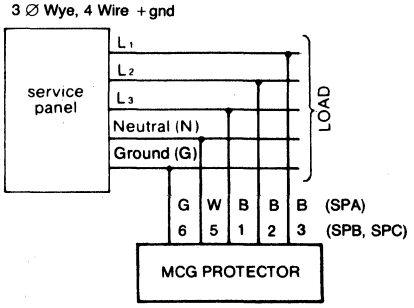
1) Single Phase; 2 wire +gnd



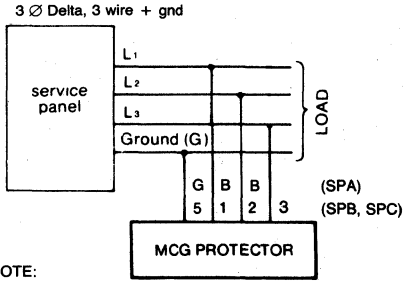
2) Single Phase; 3 wire + gnd.



3) 3 Ø Wye, 4 Wire +gnd



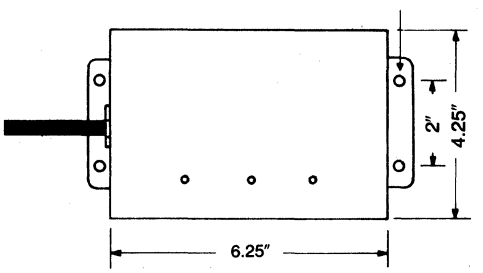
4) 3 Ø Delta, 3 wire + gnd



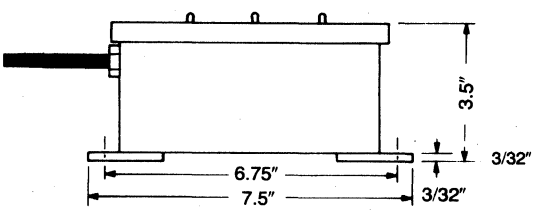
NOTE:
The protectors should be operated on "Load" side of service panel.

Mounting Information

SPA

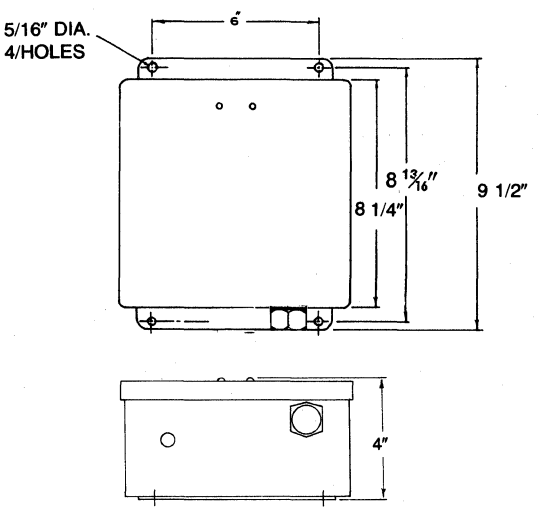


*3-5 LEADS 36"



Size: 6.25" × 4.25" × 3.5"
Weight: 4 lbs.

SPB/SPC



Size: 8" × 8" × 4"
Weight: 10 lbs

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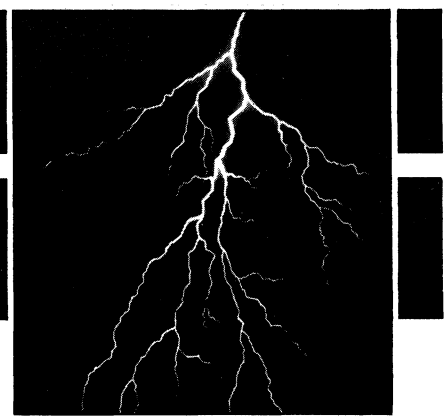
AC POWER LINE SURGE PROTECTOR

415 SERIES to 15A



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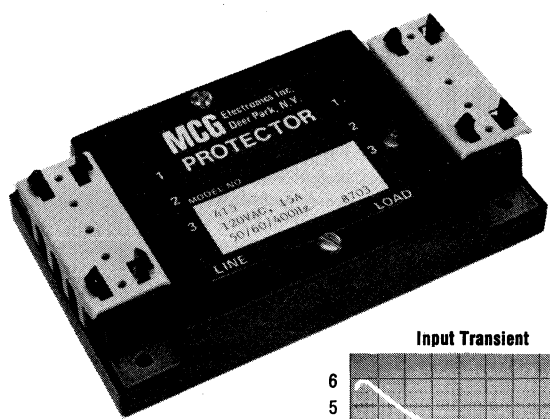
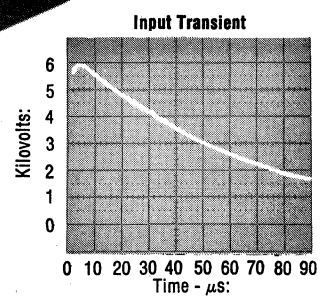
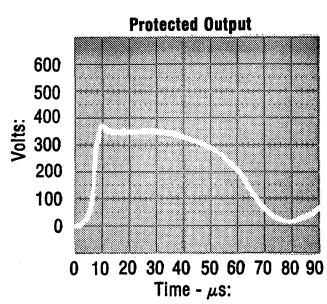
- **1 nanosecond response**
- **Low profile**
- **Brute force EMI/RFI filtering**
- **Field repairable**



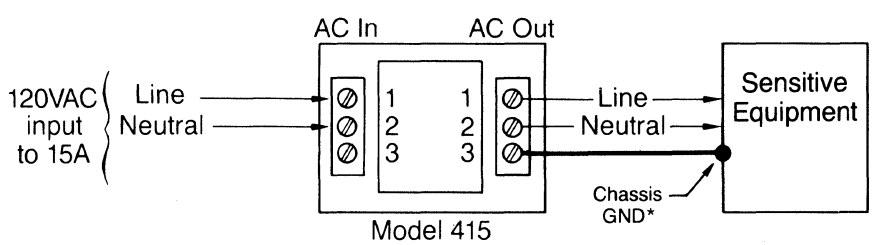
$68.60
(50 pieces)

Equipment level protection installed "within" a piece of equipment. Employs a sophisticated combination of brute force surge protection and impulse filtering to prevent equipment damage or malfunction. Reaction time less than 1 ns with automatic reset after transient has passed. Absorption capability exceeds 480 joules. Provides superior attenuation at the critical lower frequencies. For 120VAC single phase, 50/60/400 Hz power lines handling currents to 15A. Incorporates a green LED that indicates unit is operational and protection is present. Military versions are available.

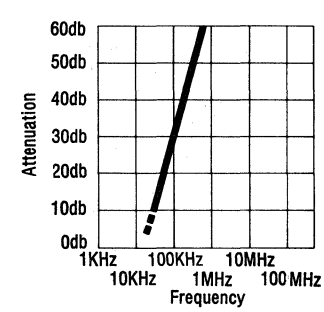




Connection Information



***Installation Note:** Important, connect protector terminal marked "ground" to frame, case or chassis of equipment being protected. Keep lead (#12 AWG) as short as possible, less than 6" is highly preferred.



Also available for 250 VAC single phase, 50/60/400 Hz, power lines handling currents to 30A. Consult factory for details.

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2 year warranty
Technical Assistance:
800-851-1508

Superior Power Protection Against Voltage Surges and Power Line "Noise"

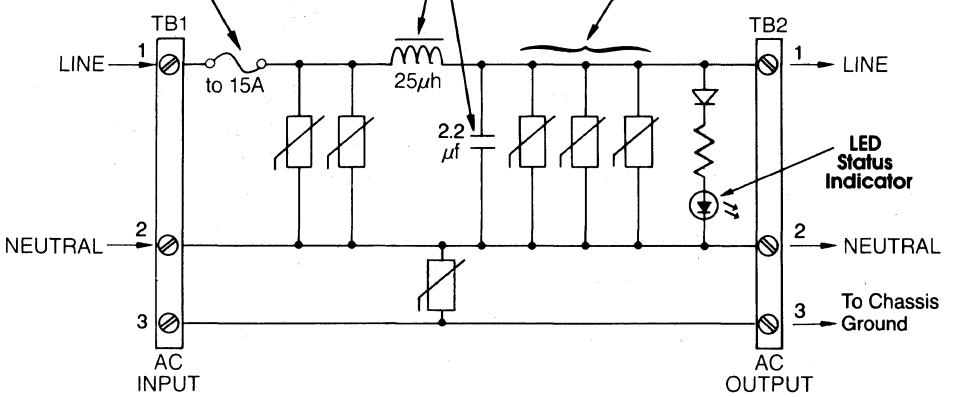
415 SERIES (con't)

The Inside Story . . . Heavy Duty Components . . . Superior Protection

Replaceable fuse
Automatically disconnects unit from power line in the event of serious line current overload.

Heavy duty EMI/RFI filtering
Provides superior attenuation at the lower frequencies (20db/65KHz, 40db/170KHz, 60db/650KHz). Wire wound inductors ensure continued performance under severe transient conditions.

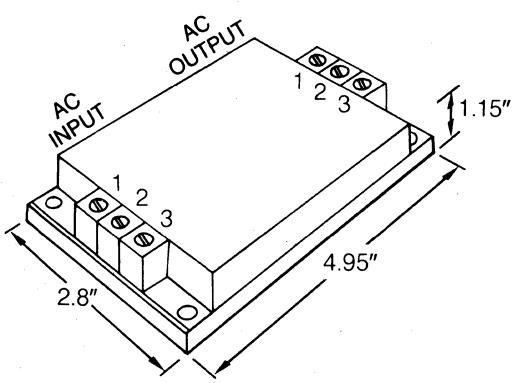
Extraordinary 480 joule protection
- "Brute Force" MOV transient suppressors
- The only protector engineered to provide protection against all possible transient entry conditions.
- 3 line L-G, L-N, N-G protection

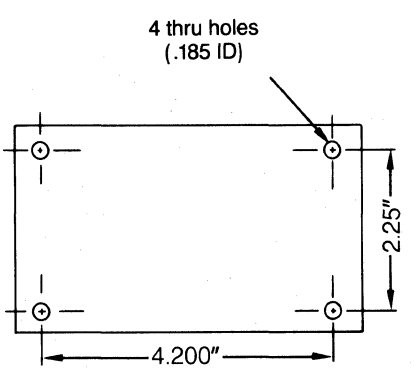


General Specifications

Rated voltage	120VAC
Rated current	15A RMS
Frequency/Service	50/60/400Hz, single phase
Energy absorption	480 joules (watt/sec)
Clamp voltage	235V (1ma) Threshold 375V peak 6KV (IEEE 587 Cat. B)
Response time	<1ns
Filter attenuation	65KHz—20db 170KHz—40db 650KHz—60db
Operating temperature	−40 to +85 degrees C
Efficiency	99+%
Size (L x W x H)	4.95″ x 2.8″ x 1.15″
Weight	<1.0 lb.

Mechanical Data—Model 415





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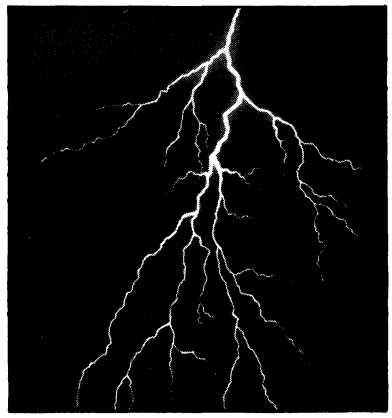
AC POWER LINE PROTECTOR

290 SERIES PLUG-INS AND STRIPS



Plug-in Protection

For sensitive electronic equipment, providing heavy duty clamping and filtering that prevents transients and noise (EMI/RFI) from damaging or disturbing the equipment. Reaction time is less than 1 nanosecond with automatic reset after the transient passes. Absorption capability of 400 joules, for 120V AC, 10/15A. The 290 units provide series fuse protection and green LED's to indicate when the unit is working and protection is present.

Modem and AC Protection

Plugs into protection sensitive computer equipment from damaging transients on telephone lines (tip/ring) and 120V AC power lines. Any transients caused by lightning, disk drives, switching surges, etc. are vigorously and rapidly clamped (in nanoseconds) to safe levels thus preventing damage to sensitive equipment. Installs in minutes with no special tools required. Green LED indicates the unit is working and protection is present.

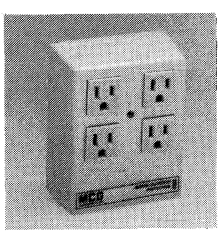
General Specifications For:	Models 290/293/296	Models 292/294/298
Rated voltage:	120 V Ac	120 V Ac
Rated current:	15A rms	10A rms
Frequency/service:	60Hz/1 phase	60Hz/1 phase
Energy absorption:	640 joules (watt/sec)	720 joules (watt/sec)
Clamp voltage (L-N)	200V peak (1mA)	200V peak (1mA)
Impulse:	410V peak (6kV/3kA)	360V peak (6kV/3kA)
Ringwave:	200V peak (6kV/500A)	165V peak (6kV/500A)
Response time:	Less than 1 ns	Less than 1 ns
Filter attenuation:	200kHz – 20 db	65kHz – 20 db
	700kHz – 40 db	170kHz – 40 db
	2MHz – 60 db	650kHz – 60 db
Operation temperature:	– 20 to + 80 degrees C	– 20 to + 80 degrees C
Size (H x W x D):	5.1″ x 4.1″ x 2.2″	5.1″ x 4.1″ x 2.2″
Weight:	1.1 lbs.	1.1 lbs.

Telephone Line Specifications for Models 293 and 294

Modem connections:	RJ11
Clamp voltage (+/–):	200V peak
Response time:	Less than 1 ns
Energy handling:	50 joules minimum
Effectively suppresses:	6kV/3kA
	IEEE 587 Cat. B
	1kV (10/1000) us waveform
	FCC Docket 68

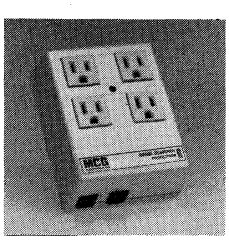
MODEL 290
$66.75
(10 pieces)

MODEL 292
$98.17
(10 pieces)



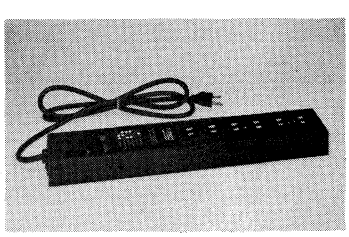
MODEL 293
$82.50
(10 pieces)

MODEL 294
$106.03
(10 pieces)



MODEL 296
$82.46
(10 pieces)

MODEL 298
$106.03
(10 pieces)



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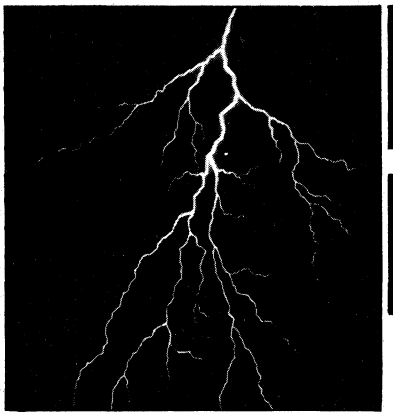
2 year warranty
Technical Assistance:
800-851-1508

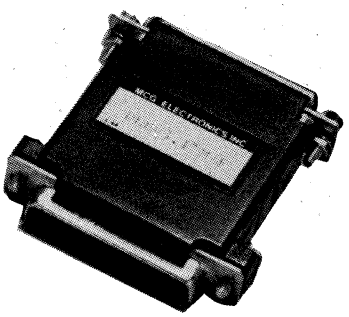
DATA LINE PROTECTORS



DLP-3.1
DLP-4.2, 4.4

DLP-3.1

$30.51
(50 pieces)



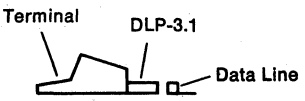
RS232 In-line computer and terminal protection from damaging transients caused by lightning and switching surges. Installs in minutes in series with data line providing a quick retrofit for existing equipment or new installations. Employs 25 pin D-Sub connectors and the standard unit (RS232) protects pins 2, 3, 4, 5, 6, 7, 8 and 20.

General Specifications

Clamp Voltage (±)	25V
Pins protected	2, 3, 4, 5, 6, 7, 8, 20 (Referenced to pin 1 and shell)
Meets or exceeds	IEEE 587 Cat. A Ringwave 1500V (100KHz, 125A)
Dimensions (L x W x H)	2.18″ x 1.86″ x .65″

Installation Information

Installs in series with existing data line

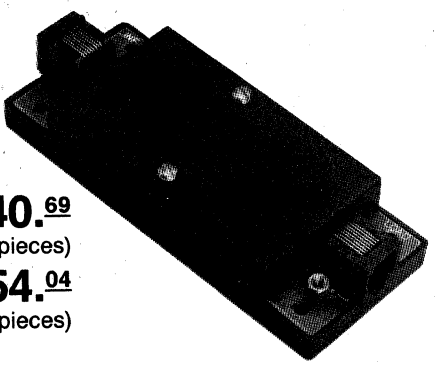


Ordering Information

If protected port has female connector
—order DLP-3.1 F/M
If protected port has male connector
—order DLP-3.1 M/F

DLP-4.2 $40.69
(50 pieces)

DLP-4.4 $54.04
(50 pieces)

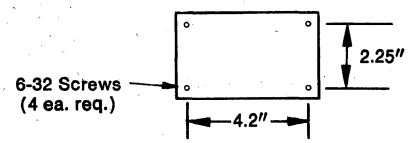


Dial-up/leased line modem protection. Prevents costly downtime and equipment failure due to lightning and transient overvoltages. Use DLP-4.2 for 2 wire (tip and ring) dial-up telephone lines. Use DLP-4.4 for 4 wire leased lines. Protects RS232, 422, 423 and 20ma loops. Installs between modem and wall outlet, telephone or leased lines. RJ11 jacks.

General Specifications

Clamp voltages available (±)	6V, 10V, 15V, 25V, 200V
Series resistance	25 ohms
Meets or exceeds	FCC Docket 68 IEEE Std. 472 (SWC) 1KV, (10 x 1000) μs waveform

Mounting Diagram



Ordering Information

Dial-up lines	DLP-4.2
Leased lines (4 wires)	DLP-4.4

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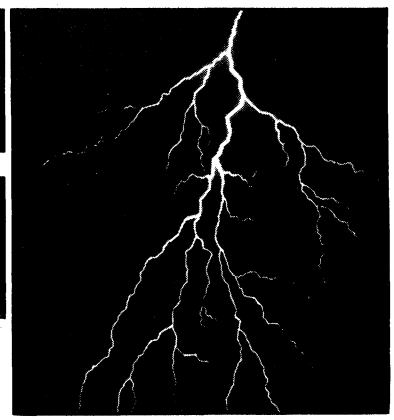
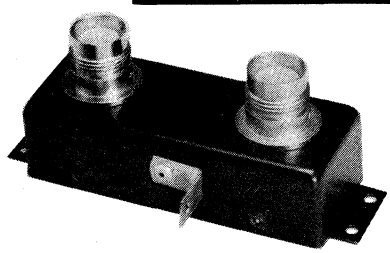
DATA LINE PROTECTOR



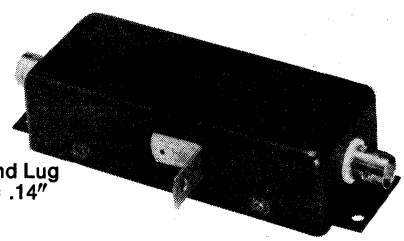
DLP-5.1, 5.2
Protects High Speed Video and Data Lines

WIDELY USED ON IBM SYSTEMS!

Protects high-speed video and data lines from damaging transients caused by lightning and switching surges. Provides 20 MHz or greater bandwidth, with attenuation of less than 1db. Installs in-line with coaxial or twin axial cable and is located adjacent to equipment to be protected. Ground lug accepts #10 AWG. Ideal for IBM and similar equipment having cable runs extending to 1500 feet.



$66.11
(50 pieces)
DLP-5.2-10V5
Height 1.9″



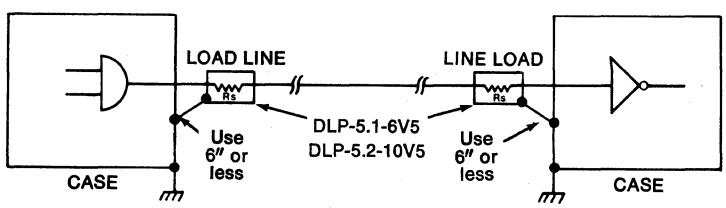
Ground Lug
I.D. = .14″

$48.31
(50 pieces)
DLP-5.1-6V5
Height 1.1″

General Specifications

Clamp Voltages	±6V (DLP-5.1) ±10V (DLP-5.2)
Series Resistance	5 ohms
Attenuation	<.8db to 20 MHz
Meets or Exceeds	IEEE 587 CAT. B IEEE Std. 472 (SWC) 1 KV (10 x 1000) μs waveform FCC Docket 68

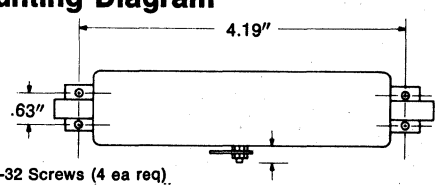
Typical Application



Ordering Information

BNC/Coaxial Systems	DLP-5.1-6V5
Twin Axial Systems	DLP-5.2-10V5 IBM Compatible

Mounting Diagram



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Technical Assistance:
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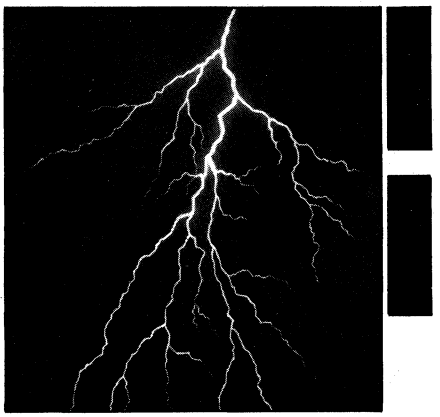
DATA LINE PROTECTOR

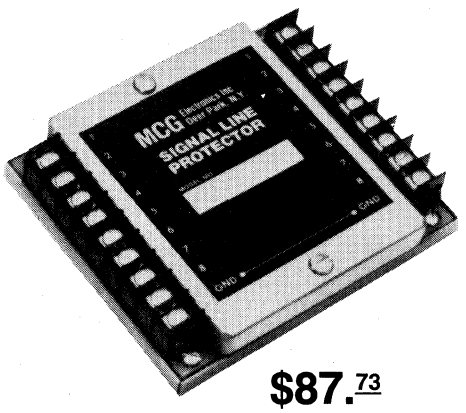


DLP-10, 20, 30

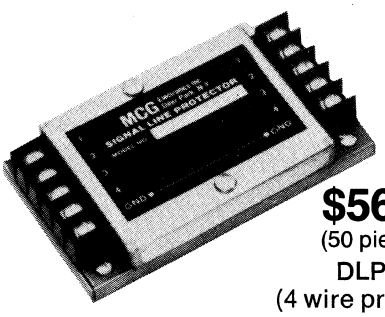
Multiple Line Protection for Computers, Terminals, Printers, etc.

Multiple line protection against damaging transients and overvoltages, in a single compact package. Protects computer main frames, terminals, printers and other peripherals. Ideal for data logging and monitoring, and complex instrumentation installations. Available for 2 wire (DLP-10), 4 wire (DLP-20) and 8 wire (DLP-30) protection for RS232, 422, 423 and 20 ma loops.

$36.87
(50 pieces)
DLP-10
(2 wire protection)



$87.73
(50 pieces)
DLP-30
(8 wire protection)



$56.58
(50 pieces)
DLP-20
(4 wire protection)

General Specifications

Clamp Voltages Available	±6V (RS422, 423) ±10V ±15V (RS232 typ.) ±25V (RS232 max.) ±50V ±200V (dial-up lines)
Series Resistance	25 ohms (standard)
Meets or Exceeds	IEEE 587 CAT. B IEEE Std. 472 (SWC) 1 KV (10 x 1000) μs waveform FCC Docket 68

Ordering Information

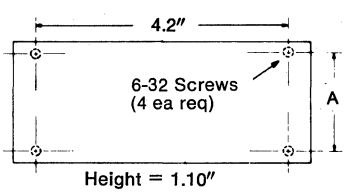
Example—to protect a 4 wire RS422 circuit, order **DLP-20-6V-25**

Model
Clamp Volt
Series Resistance

Installation Information

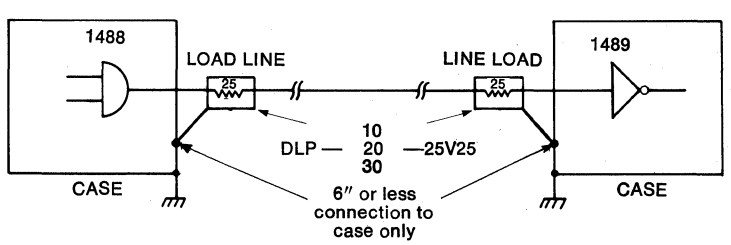
Installs in series with existing data lines. Ground terminal must be connected to cabinet frame by short lead, less than 6″ (#12 AWG) highly preferred.

Mounting Diagram



Dimension A
1.50″ (DLP-10)
2.25″ (DLP-20)
3.75″ (DLP-30)

Typical Application



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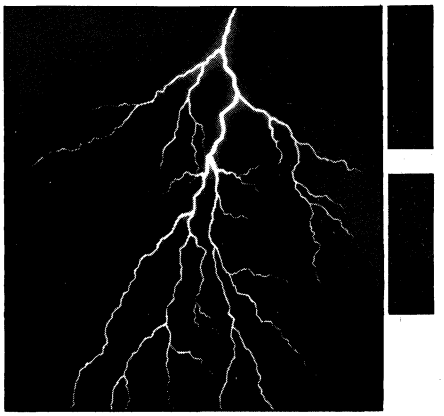
DATA LINE PROTECTORS



DLP-36 SERIES

MIX AND MATCH MODULAR PROTECTION FOR TELEPHONE AND DATA LINES

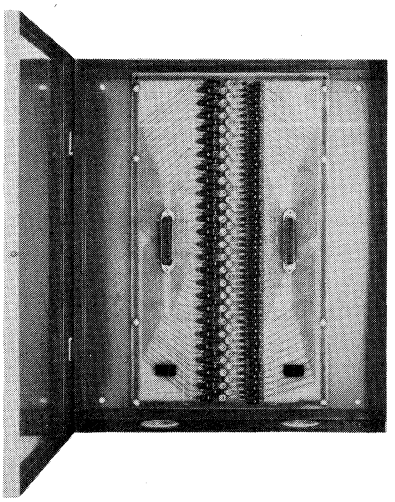
Protects PABX systems, CPU's, key systems, multiplexers, port selectors, etc. from damaging transients.

The DLP-36 is a new 25 pair, point-of-entry transient suppressor. The unit offers high speed protection for PABX systems, CPU's and instrumentation systems that use telephone lines, RS232, 423 and 20 ma loops.

Modular protection elements (25 provided) allow you to mix and match telephone and data lines at different clamping levels. This flexibility offers a convenient "one protector" solution to the varied protection needs in a building. And, if your application changes, simply switch the module to accommodate the new requirement. The plug-in module feature also permits on-site repair or replacement by non-technical personnel.

The unit uses fast-acting Avalanche diodes (1 nanosecond) and brute force gas tubes to ensure continued protection even under severe transient situations.

Utilizing 50 pin telephone industry connectors, the DLP-36 is ideal for termination to 66 blocks. To suit most applications, the unit is available with or without the enclosure.



General Specifications

Clamp voltages available	+/– 6, 10, 15, 25, 50, 200V peak
Energy handling capability	50 joules/line
Gas Discharge Tube	
Life	100 coulombs (amp/sec)
Energy handling	5000 joules (one time)
Current	5000 amps
Series resistance	25 ohms (standard)
Response time	less than 1 nanosecond
Effectively clamps	IEEE 587 Cat. B. 2KV (10/50μs, 8/20μs) IEEE Std. 472 (SWC) 1KV (10 × 1000 μs) waveform
Dimensions	H-18″ W-15″, D-4″
Operating temperature	–55 to + 125 degrees C
Circuit attenuation (db)	– 3db/3MHz (Rs = 25, RL = 1K, Cs = 2000pf)

$880 w/enclosure
$795 w/o enclosure

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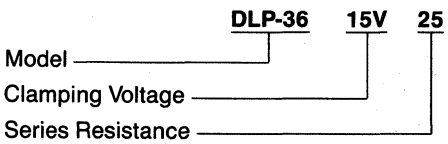
2 year warranty
Technical Assistance:
800-851-1508

DATA LINE PROTECTORS

DLP-36 SERIES (con't)

To Specify the DLP-36

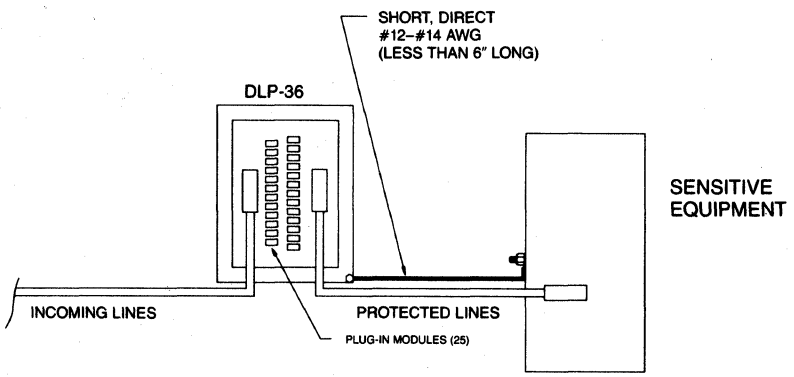
Determine the signal voltage:
a) look in the service manual
b) call your service company
c) use an oscilloscope
The most effective protection will be attained by clamping overvoltages as close to the normal signal voltage as possible (i.e. for a data line with a signal level of 12V, choose a clamping voltage of 15V).



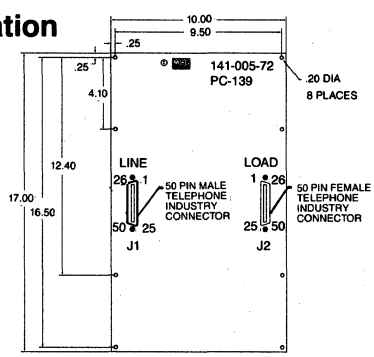
Installation

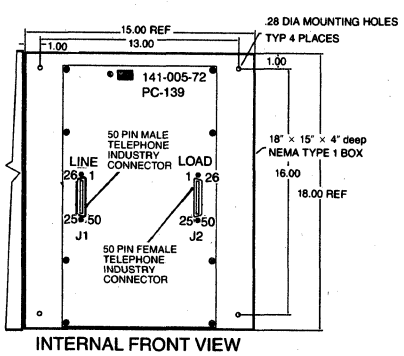
Preferred Installation: Important, connect protector terminal marked "ground" to frame, case or chassis of equipment being protected. Keep lead (#12AWG) as short as possible, less than 6 inches is highly preferred.
Alternate Installation: Locate the protector close to the building's structural steel at the building entry point. The protector terminal marked "ground" must be connected to the structure with a direct, short (less than 6 inches) #12AWG lead. It is essential that the building structure be grounded—verification is vital.

Application



Mounting Information





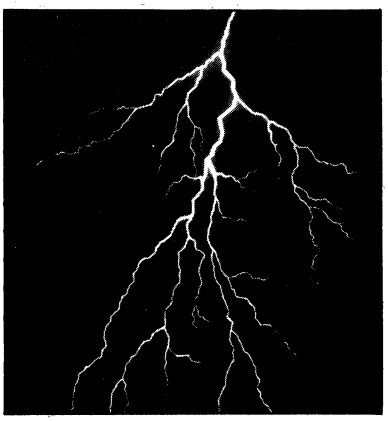
INTERNAL FRONT VIEW

NOTE: Had the need been for less than 50 wires protected, the user would have the option (because of the modular design) of buying only the number of protection modules required. If the unit is purchased fully-packed, the extra modules may be kept as spares or for expansion. Each module protects 2 wires.

MCG ELECTRONICS INC.
Specialists in Circuit Protectors, Transients, Lightning & Surges.
12 Burt Drive, Deer Park, NY 11729
516-586-5125 • FAX: 516-586-5120

2 year warranty
Technical Assistance:
800-851-1508

DATA LINE PROTECTORS



DLP-50 SERIES

MULTI-WIRE TRANSIENT PROTECTION FOR OVER 2000 PAIRS!

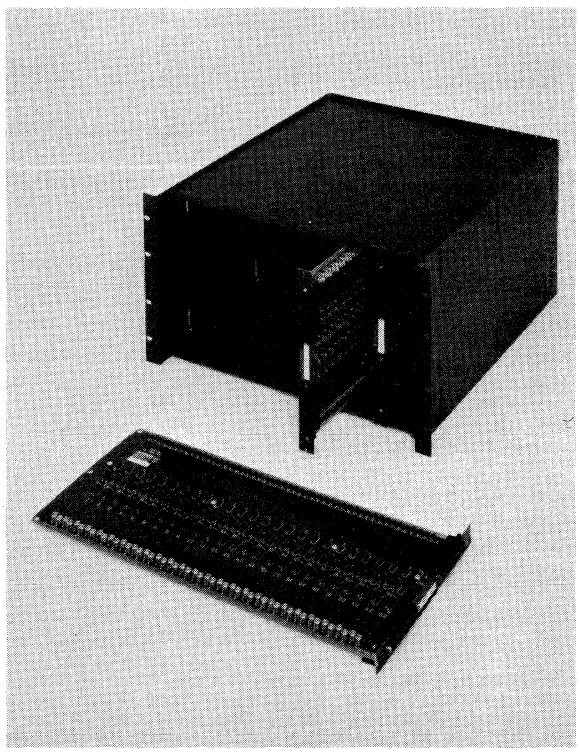
Protects PABX systems, mainframes, multiplexers, CPU's, etc. from damaging transients

Sensitive equipment using dial-up telephone lines, RS232, 423 or 20 ma loops is vulnerable to cumulative damage and serious disruption from high speed transients. The DLP-50 System transient protector offers reliable, cost-effective protection for multiple communication lines.

The DLP-50 System consists of a card cage assembly and protection cards. Each card cage holds up to 17 cards capable of protecting 25 pairs each or 425 pairs total. A fully loaded standard 19″ rack equipped with five DLP-50 systems will protect 2,125 pairs.

Incorporating field proven technology (32 failures in 132,000 wires), the protector combines fast acting Avalanche diodes and brute force gas tubes, ensuring continued protection even under severe transient situations.

The DLP-50 System comes standard with 50 pin telephone industry connectors for easy installation.



General Specifications

Clamp voltages available	+/−6, 10, 15, 25, 50, 200V peak
Energy handling capability	50 joules/line
Gas Discharge Tube	
Life	100 coulombs (amps/sec)
Energy handling	5000 joules (one time)
Current	5000 amps
Series resistance	25 ohms (standard)
Response time	less than 1 nanosecond
Effectively clamps	IEEE 587 Cat. B, 2KV (10/50μs, 8/20μs) IEEE Std. 472 (SWC) 1KV (10 × 1000μs) waveform
Connectors	M/F 50 Pin Telco Connectors
Dimensions	Fits standard 19″ rack 10.5″ (6U) high, 19″ deep.
Operating temperature	−55 to +125 degrees C
Circuit attenuation (db)	−3db/3MHz (Rs = 25, RL = 1K, C_S = 2000pf)

DLP-50 card cage (rack mountable) **$150** each

PICA-50-200V25 protection card **$630** each

All MCG Data Line Protectors come with a two-year, no nonsense warranty. Consult factory for details.

MCG ELECTRONICS INC.

Specialists in Circuit Protectors, Transients, Lightning & Surges.

12 Burt Drive, Deer Park, NY 11729
516-586-5125 • FAX: 516-586-5120

2 year warranty

Technical Assistance:

800-851-1508

DATA LINE PROTECTORS

DLP-50 SERIES (con't)

To Specify the DLP-50 System

The DLP-50 System includes a card cage plus up to 17 protection cards.

To Specify Protection Cards

Determine the signal voltage of the system:
a) look in the service manual
b) call your service company
c) use an oscilloscope

The most effective protection will be attained by clamping overvoltages as close to the normal signal voltage as possible. If you were protecting dial-up telephone lines, for example, with tip and ring voltages totalling 190V, a 200V clamping is appropriate. For this application, specify protection cards PICA-50-200V25.

PICA-50 200V 25

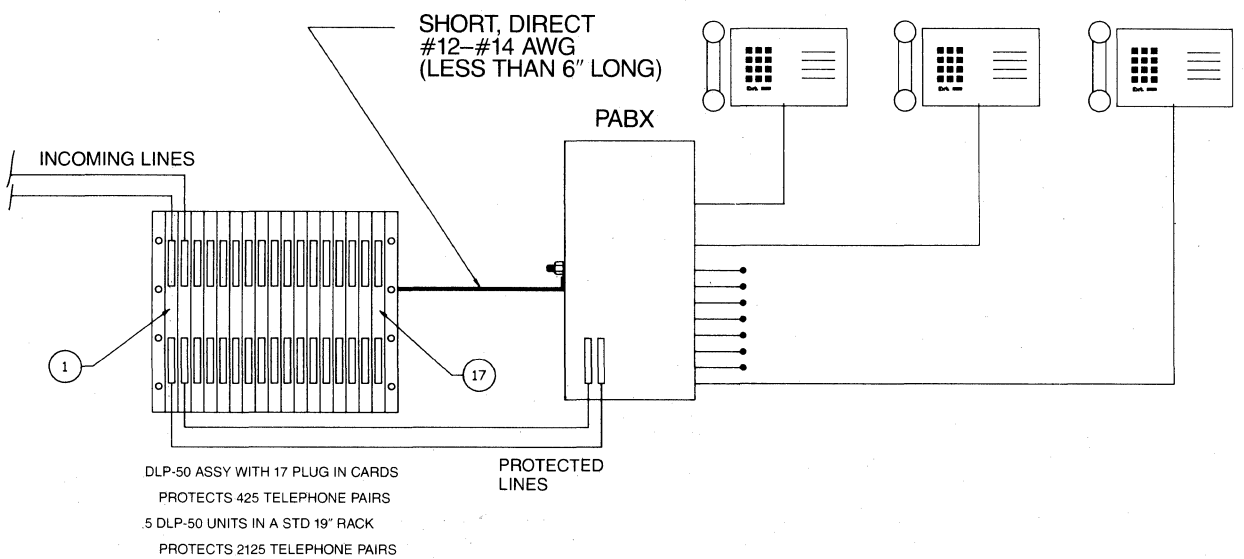
Model
Clamping Voltage
Series Resistance

Installation

Preferred Installation: Important, connect protector terminal marked "ground" to frame, case or chassis of equipment being protected. Keep lead (#12AWG) as short as possible, less than 6 inches is highly preferred.

Alternate Installation: Locate the protector close to the building's structural steel at the building entry point. The protector terminal marked "ground" must be connected to the structure with a direct, short (less than 6 inches) #12 AWG lead. It is essential that the building structure be grounded—verification is vital.

Application



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Technical Assistance:
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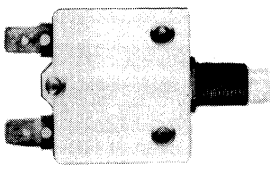
For U.S.-made circuit protection:

Mechanical Products, Inc.

1824 River Street / P.O. Box 729E / Jackson, MI 49204
(517) 782-0391 / TWX 8102530827 / FAX 517-782-2810

series 1600

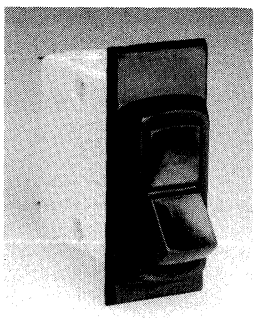


LOW AMP MODELS .05 - 4 amps
MID-AMP MODELS 5 - 35 amps
HIGH AMP MODELS 40 - 70 amps

Snap-in mount available.

UL 1077 recognized #E66224 in .05-25 amps versions
CSA: LR27156 in .05-25 amp versions
VDE on certain models
Minimum Ultimate Trip: 100% at 77°F
Maximum Ultimate Trip: 125% at 77°F
Interrupt Capacity: 1000A
Overload Capacity: 6x-10x Rating
Voltage Drop: .25 Volt Maximum
Dielectric Strength: 1500VAC
Voltage Rating: 250VAC/50VDC

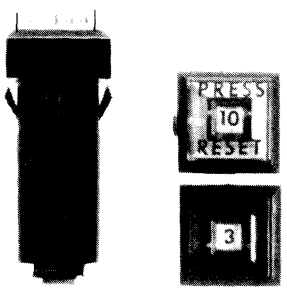
series 2200



ROCKER SWITCH CIRCUIT PROTECTION - SNAP-IN MOUNT

Standard Amp Ratings	5, 7½, 10, 15, 20, 25. Others on request.
Voltage Ratings	250VAC/50VDC
Regulatory Approvals	UL 1077(FILE E66224) & CSA (FILE LR27156) Approved for 250 VAC & 50 VDC Resistive Loads, and for 250 VAC Inductive (motor) Loads, VDE. 630/631, IEC 934
Endurance	50,000 Switching cycles at rated load
Minimum Ultimate Trip	100% rated current at 25°C/77°F
Maximum Ultimate Trip	125% rated current at 25°C/77°F
Limited Short Circuit Capacity	2,000 Amp at 250VAC, 1,000 Amp at 50VDC per UL 1077
Overload Capacity	10X Rating
Inrush Capacity	Will not trip at up to 35X rated current for ½ cycle (8 msec)
Voltage Drop	0.3 Volts Maximum
Dielectric Strength	1,500 Volts - UL/CSA, 2,000 Volts - VDE
Recommended Panel Thickness	0.020" min. - 0.090" max.

series 2000



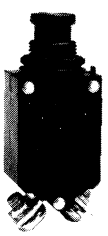
MODEL 2002

Std. Amp Rating	3, 4, 5, 7½, 8, 10, 12 & 15. Other on request.
Voltages	3-10A 240VAC/50VDC 12, 15A 120VAC
U.L. Recognized	1077 General Load. E 66224
CSA Certified	LR 27156
Minimum Ultimate Trip	100% @ 77°F
Maximum Ultimate Trip	135% @ 77°F
Interrupt Capacity	1000A (UL 1077)
Overload Capacity	6-10X Rating
Voltage Drop	.25 Volts Max.
Dielectric Strength	1500VAC
Recommended Panel Thickness	.020"-.075"

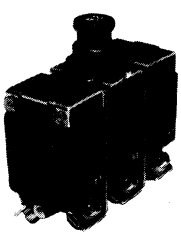
Note: Model 2000: Motor load rated 3, 4, 5 amps.

MILITARY SPECIFICATION CIRCUIT PROTECTORS • Qualified to MIL-C-5809

4000-004 Series
1 to 20 amp
MS26574A
Single Phase
Aux. Terminals
Subminiature

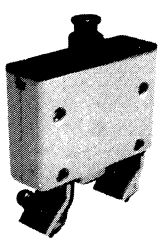


4310 Series
1 to 20 amp
MS3320
Single Phase
Ambient Compensated
Subminiature
Lightweight

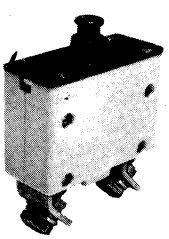


4330 Series
1 to 20 amp
MS14154
Three Phase
Ambient Compensated
Subminiature
Lightweight

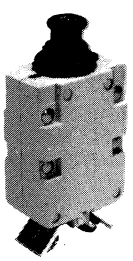
4200 Series
1 to 20 amp
MS26574
Single Phase
Subminiature
Lightweight



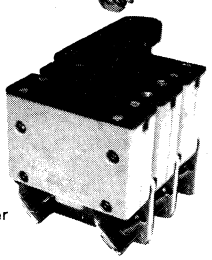
160 Series
50 to 100 amp
MS25361
Single Phase
Heavy Duty



170 Series
125 to 200 amp
Single Phase
Heavy Duty



700 Series
5 to 50 amp
MS25244
Single Phase
Rugged Performer



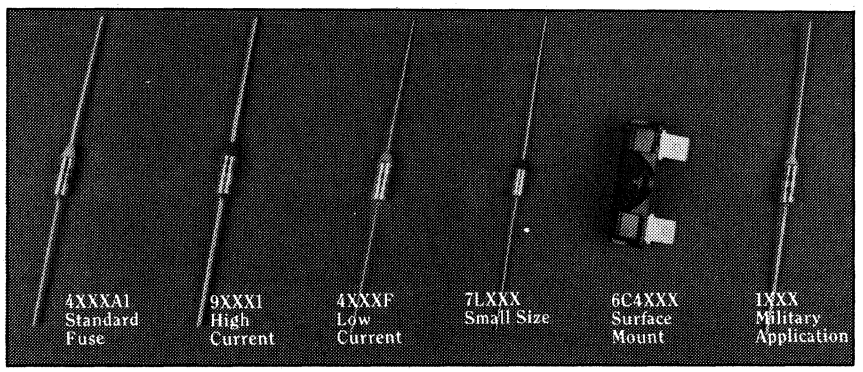
940 Series
50 to 100 amp
Three Phase
Heavy Duty

Series		Series		Series		Series		Series	
MS3320	4310-001 AMP	MS14154	4330-001 AMP	MS22073	4001-001 AMP	MS25361	160-012 AMP	MS26574V	4200-008 AMP
MS3320V	4310-019 AMP	MS14154V	4330-008 AMP	MS22073V	4001-008 AMP	MS25361V	160-086 AMP	MS26574D	4200-006 AMP
MS3320L	4310-005 AMP	MS14154L	4330-007 AMP	MS25244	700-001 AMP	MS26574	4200-001 AMP	MS26574A	4200-004 AMP
MS3320VL	4310-024 AMP	MS14154VL	4330-009 AMP	MS25244P	700-089 AMP	MS26574L	4200-003 AMP		

For manufacturer's sales offices, see Yellow Pages.

MICROTEMP® Thermal Cutoffs

MICROTEMP Thermal Cutoffs provide permanent over-temperature protection for motors, transformers, appliances, HVAC equipment and electronic equipment. Once a MICROTEMP Thermal Cutoff opens a circuit, it remains open until the fault is corrected and the fuse is replaced.



Thermal Cutoff Series Selection

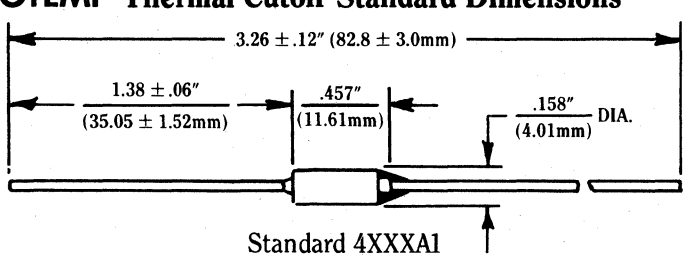
To determine which series is best for your application, remember:

- To consider the normal and abnormal electrical currents and voltages of your product.
- That the current passing through a MICROTEMP Thermal Cutoff can generate I^2R, self heating. This must be considered when selecting the proper series and opening temperature for your application.
- That the outer case of the MICROTEMP Thermal Cutoff is electrically live and may require insulation. Additionally, since insulation can reduce heat transfer, it also must be considered in selecting the final opening temperature.
- That custom configurations and packages are available.
- That a thermocoupled dummy should be installed in the product circuit to determine the correct temperature setting.

MICROTEMP® Thermal Cutoff Types

Type No.	Temp. (°C) Calibration Range	Wire Size AWG	Maximum Recommended Operating Current and Voltage (Resistive)
4XXXA1	60-240	18	15 Amp/240 VAC
9XXX1	60-240	15	25 Amp/240 VAC
4XXXF	60-240	23	5 Amp/240 VAC
7LXXX	72-184	23	6 Amp/240 VAC
6C4XXX	60-184	—	15 Amp/240 VAC
1XXX	60-240	18	15 Amp/240 VAC

MICROTEMP® Thermal Cutoff Standard Dimensions



Standard 4XXXA1

MICROTEMP® Thermal Cutoff Temperature Ratings

Reading the temperature chart.
All MICROTEMP Thermal Cutoffs are identified by their Type No. (4XXXA1, 9XXX1, etc.). The "XXX" digits are determined by the opening temperature you specify. For example: A 4136A1 is a MICROTEMP Thermal Cutoff with an opening temperature of 60°C.

Model # (XXX)	Max. Opening Temp. °C*
136	60
146	66
158	72
168	77
178	84
191	91
194	93
204	98
208	100
218	104
227	109
239	117
244	121
257	128
283	141
300	152
333	167
358	184
377	192
415	216
438	228
468	240

*Tolerance +0 -4°C

For further information on your specific design applicator, contact a Sales Engineer at our factory.

THERMODISC®
MICRO DEVICES PRODUCT GROUP
Thermo-O-Disc, Inc.
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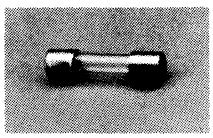
Cable: TOD MFL FAX: 419/525-8344
Therm-O-Disc, Inc. is a subsidiary of Emerson Electric Co.

EMERSON®

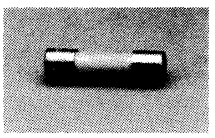
Interpower™ IEC 127 International 5 x 20mm Fuses



Quick-acting low-breaking capacity

to IEC 127–II; DIN 41661; SEMKO 104-1976; SEMKO app.; 250VAC

Model Number	Rated Current I_n	Breaking Capacity at 250V cosφ1
81411101	32* mA	
81411181	71	
81411221	100	
81411241	125	
81411261	160	
81411281	200	
81411301	250	
81411321	315	35 A
81411341	400	
81411361	500	
81411381	630	
81411401	800	
81411421	1 A	
81411441	1.25	
81411461	1.4	
81411481	1.6	
81411501	2	
81411521	2.5	
81411541	3.15	
81411561	4	
81411581	5	10 I_n
81411601	6.3	

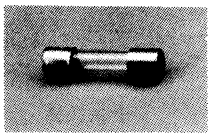


Quick-acting high-breaking capacity

to IEC 127–I; DIN 41660; SEMKO 104-1976; SEMKO app.; 250VAC

Model Number	Rated Current I_n	Breaking Capacity at 250V cosφ1
81413421	1 A	1500A: at 250V, 50Hz cos φ .7-0.8
81413441	1.25	
81413481	1.6	
81413501	2	
81413601	6.3	

* Not included in applicable standards



Time-lag low-breaking capacity

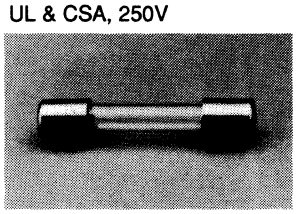
to IEC 127–III; DIN 41662; SEMKO 104-1976; SEMKO app.; 250VAC

Model Number	Rated Current I_n	Breaking Capacity at 250V cosφ1
81412161	63	
81412181	71	
81412221	100	
81412241	125	
81412261	160	
81412281	200	
81412301	250	
81412321	315	35 A
81412341	400	
81412361	500	
81412381	630	
81412401	800	
81412421	1 A	
81412441	1.25	
81412461*	1.4	
81412481	1.6	
81412501	2	
81412521	2.5	
81412541	3.15	
81412561	4	
81412581	5	10 I_n
81412601	6.3	

North American 1/4 x 1-1/4" fuses

Non-time delay

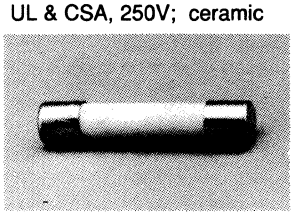
UL & CSA, 250V



Model Number	Rated Current I_n
AGC-1/8	1/8A
AGC-1/4	1/4
AGC-1/2	1/2
AGC-3/4	3/4
AGC-1	1
AGC-1-1/2	1-1/2
AGC-2	2
AGC-3	3
MTH-4	4
MTH-5	5
MTH-6	6

Time delay

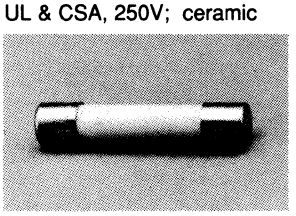
UL & CSA, 250V; ceramic



Model Number	Rated Current I_n
ABC-1/2	1/2
ABC-1	1
ABC-2	2
ABC-3	3
ABC-5	5
ABC-6	6
ABC-8	8
ABC-10	10
ABC-15	15
ABC-20	20

Time delay

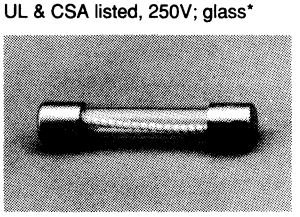
UL & CSA, 250V; ceramic



Model Number	Rated Current I_n
MDA-1/2	1/2
MDA-3/4	3/4
MDA-1	1
MDA-2	2
MDA-3	3
MDA-4	4
MDA-5	5
MDA-7	7
MDA-8	8
MDA-10	10
MDA-15	15
MDA-20	20

Time delay

UL & CSA listed, 250V; glass*



Model Number	Rated Current I_n
MSL-1/4	1/4
MSL-1/2	1/2
MSL-3/4	3/4
MSL-1	1
MSL-2	2
MSL-3	3
MSL-4	4
MSL-5	5
MSL-6	6
MSL-8	8

*spiral wound element for moderate inrush I.

PANEL COMPONENTS CORPORATION
Call for complete catalog: U.S. Toll Free (800) 662-2290 • Canadian Toll Free (800) 346-4526
P. O. Box 6626 • Santa Rosa, CA 95406 • Telephone (707) 523-0600 • Telex 176-747 • FAX (707) 578-5478

PERMA POWER®

TELE-LINE™ Surge Suppressors

LISTED

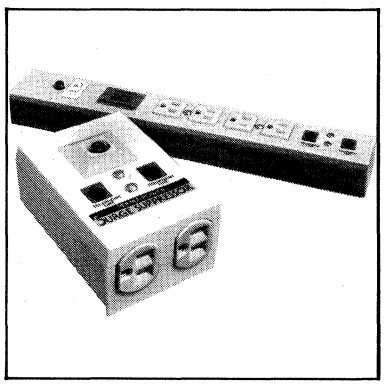
Protection From Surges on the Phone Line and the Power Line

CABLE-LINE™ Surge Suppressor

Protects TV, VCR, Stereo and Satellite from Surges on the Cable or Antenna Line *and* the Power Line

LISTED

MODEL PD 200/PTD 209/RTD 410 **MODEL PTC 209**



These Surge Suppressors protect your FAX and computers with modems or electronic telephone equipment from power surges on your phone lines, even if the primary telephone service entry surge arrestor is non-functional.

They meet FCC Part 68 requirements and are UL listed, Standard 497 (Secondary Protectors for Communications Circuits). Tele-Line™ surge suppression circuit employs a three-element gas tube and three metal-oxide varistors (MOV) in a coordinated two-stage design. Let-through voltage is 300V.Max. An indicator lamp confirms the existence of a positive earth ground connection (PD-200) or Failsafe Shutdown (PTD-209, RTD-410).

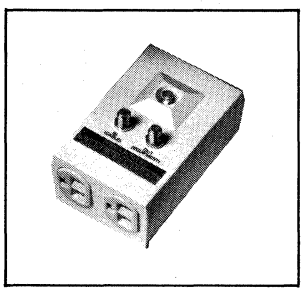
Plug-in Model PD-200 protects the phone line only. Models PTD 209 and RTD 410 also protect against surges on the power line. Model PTD 209 is a wall plug-in unit with two power outlets; Strip Unit Model RTD 410 has 4 outlets.

SPECIFICATIONS—
TELE-LINE™

Connectors Two modular telephone line jacks; 7' jumper wire included
D.C. Breakdown Voltage 140V.
Let-Through Voltage[1] 300V. peak
Response Time 1 nanosecond
Pulse Life[2] 10,000 cycles
WARRANTY
One year

TEST WAVES
1. FCC Docket 19528 (Part 68, Subpart D)
2. 8 x 20 microseconds, 500 Amp

FOR POWER LINE SURGE SUPPRESSOR SPECIFICATIONS, SEE ADJACENT LISTING.



Television sets and VCRs manufactured after 1984 usually incorporate sensitive electronics, which are highly susceptible to damage from transient voltage surges during thunderstorms and electric company switching. Additionally, satellite dish systems are highly vulnerable to damage from power surges and lightning, even several miles away. Such surges can pass through to your equipment from its connection to a cable, antenna, or satellite dish as well as through the power line.

Connecting your electronic equipment to a Perma CABLE-LINE™ Surge Suppressor will protect sensitive equipment from surge damage.

FAILSAFE AUTOMATIC SHUTDOWN
Any power line surge suppressor can wear out or burn out, but Perma Power provides for that eventuality. A patented circuit automatically disconnects the power if suppression is lost. This is the surest way to keep your electronic equipment safe from potentially damaging power line surges that would otherwise pass through. An indicator light goes out to show that power has been disconnected.

UNIQUE LOW-LOSS CABLE-LINE™ FILTER
The Perma Power CABLE-LINE Surge Suppressor is carefully designed to protect against surges without causing loss of picture signal. Typical cable line filters reduce signal strength as much as 90.9%, causing a snowy picture or no picture at all. By incorporating advanced filter technology rather than power line surge suppressor techniques, Perma Power CABLE-LINE filters offer a virtually unlimited lifetime. Yet these Surge Suppressors can be used on antenna or cable lead-in wires without reducing picture quality on any channels, even up to the UHF frequencies.

GOLD CONTACTS ENHANCE SIGNAL QUALITY
Perma Power CABLE-LINE Surge Suppressors incorporate gold-plated connectors to provide better conductivity and resistance to corrosion and carbonization. They thus assure superior signal quality and greater long-term reliability.

CONVENIENCE
The CABLE-LINE Surge Suppressor plugs directly into any standard grounded outlet. Plugged into one of two duplex outlets, it provides two more, for a total of three outlets. The second outlet in the duplex will be surge suppressed but will not automatically shut down if the suppressor fails. To protect additional system components, use the convenience outlets on your equipment.

POWER LINE SURGE SUPPRESSOR SPECIFICATIONS

Dimensions	3½"x 4¾"x 2¼"
Weight	11 ozs.
Case	Ivory Plastic
Electrical Rating	1800 Watts
Energy Dissipation	80 joules each mode, 240 joules total
Response Time[1]	1 nanosecond
Clamping Voltage	156 RMS (220VDC) (Nominal)
Protection Modes	normal (line/neutral) common (line/ground) common (neutral/ground)
Let-Through Voltage[2] (power line surge)	400 Volts
Pulse Life[3]	10^6 cycles
Steady State Power[4]	0.8 watts
Maximum Transient Voltage[5]	Greater than 6,000 volts
Peak Current[6]	4,500 amperes
Noise Filtering	More than 10dB, 5-50 MHz
Warranty	1 year

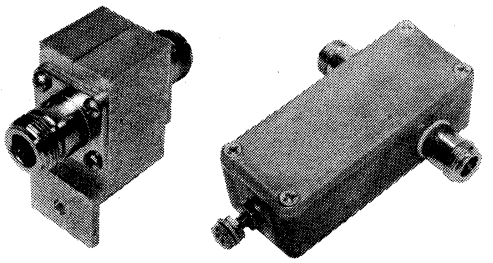
CABLE-LINE™ SURGE SUPPRESSOR SPECIFICATIONS

Cable-Type	75 Ohm, RG-59U, Gold-plated "F" connectors
Insertion Loss	40 MHz to 890 MHz, 0.1 dB or less
Let-Through[6]	less than 2 volts
Maximum Transient Voltage[7]	greater than 1500V
Response Time[1]	1 picosecond
Input Impedance	75 Ohms
Output Impedance	75 Ohms
Pulse Life[6]	Unlimited

TEST WAVES
[1]Manufacturer's specifications for the intrinsic component material.
[2]UL Std. 1449, Revisions effective July, 1987; 1.2 x 50 microsecond, 6000 Volts; 8 x 20 microsecond, 500 Amp.
[3]ANSI Std. C62.41 (IEEE 587-1980); 0.5 microsecond, 100 KHz, 6000 Volt, 200 Amp., ringwave.
[4]5KW peak, 10 x 1000 microsecond exponential. (Industry standard test impulse for inductive load switching transients.)
[5]Limited in 120 VAC distribution systems by wiring devices arc-over to 6000 Volts peak (ANSI Std. C62-41).
[6]1500V, 8 x 20 microsecond impulse.
[7]Limited in the 75 Ohm distribution system by connector and cable arc-over to 1500 volts peak.

Manufactured in U.S.A. by PERMA POWER® Electronics inc. **5601 West Howard Avenue • Chicago, Illinois 60648 • 312/647-9414**

Nano-Fast Coax Protection from PolyPhaser Corporation



The patented PolyPhaser Impulse Suppressor Family is your best answer for protecting those vital communication links from lightning and static induced impulses (as well as high altitude nuclear blasts-EMP).

With over 44 models of patented Impulse Suppression, PolyPhaser Corporation makes more reliable, longer lasting, faster, better VSWR, lower loss and having less throughput energy to your valuable equipment than air-gap type arrestors. Designed using the time proven controlled gas ionization discharge tube, these family members can handle tens-of-thousands of amperes time after time. They are made from quality, highly conductive aluminum with 18-8 stainless fasteners and weather-coated for marine applications.

BULKHEAD MOUNTABLE - TRANSMIT/RECEIVE

Model	Description	Frequency	Power	Connector	Max. Surge*	Thru put Energy	Loss dB	VSWR
IS-B50LU	Low power "UHF"	30-220 MHz 220-700 MHz	325 W 125 W	UHF	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-B50LN	Low power "N"	125-220 MHz 220-700 MHz 700-1 GHz	325 W 125 W 50 W	N**	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-B50HU	Hi power "UHF"	30-220 MHz 220-700 MHz	500 W 250 W	UHF	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-B50HN	Hi power "N"	125-220 MHz 220-700 MHz 700-1 GHz	500 W 250 W 125 W	N**	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-CT50HN	Cellular "N"	806-890 MHz	10 ch @ 70 W ea	N**	10,000 A	≤ 10uJ	0.1	1.1 to 1
IS-PT50HN	890-980 MHz	890-980 MHz	10 ch @ 70 W ea	N**	10,000 A	≤ 10uJ	0.1	1.1 to 1
IS-UT50HN	"UHF" Combiner/out	450-512 MHz	3-200 W trans. 5-100 W trans.	N† **	10,000 A	≤ 20uJ	0.1	1.1 to 1
IS-IE50LN	Isolated Equipment	125-220 MHz 220-500 MHz	325 W 125 W	N**	20,000 A	≤ 600uJ	0.1	1.2 to 1

BULKHEAD MOUNTABLE RECEIVE ONLY

Model	Description	Frequency	Power	Connector	Max. Surge*	Thru put Energy	Loss dB	VSWR
IS-GF50LN	GaAs Fet	125 MHz-1 GHz	N/A	N† **	10,000 A	≤ 150 pJ	0.1	1.2 to 1
IS-GC50LN	DC Pick-off +15VDC	400 MHz-1 GHz	N/A	N† **	10,000 A	≤ 150 pJ	0.3	1.2 to 1
IS-DC50LN	DC Injector +15VDC	400 MHz-1 GHz	N/A	N† **	10,000 A	≤ 150 pJ	0.3	1.2 to 1

FLANGE MOUNTABLE - TRANSMIT/RECEIVE

Model	Description	Frequency	Power	Connector	Max. Surge*	Thru put Energy	Loss dB	VSWR
IS-50UX-C0	HF transceive	1.5-50 MHz	2 KW	UHF	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-50UX-C1	Similar to IS-B50LU	30-220 MHz 220-700 MHz	325 W 125 W	UHF	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-50NX-C1	Like IS-50UX-C1-"N"	30-220 MHz 220-700 MHz	325 W 125 W	N**	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-50NX-C2	Similar to IS-B50LN	220-700 MHz 700-1GHz	125 W 50 W	N**	20,000 A	≤ 600uJ	0.1	1.1 to 1

DATA/VIDEO/NEMP

Model	Description	Frequency	Impedance Ω	Connector	Max. Surge*	Clamp Voltage	Loss dB	VSWR
IS-50BB	HF-NEMP-R.O.	DC to 30 MHz	50	BNC	5,000 A	5.4	0.1	1.1 to 1
IS-75BB	CCTV	DC to 20 MHz	75	BNC***	5,000 A	5.4	0.1	1.1 to 1
IS-93BB	Data	DC to 20 MHz	93	BNC	5,000 A	5.4	0.1	1.1 to 1
IS-TWAX	IBM-34-36-38 Data	DC to 9 MHz	100	Twin Ax	5,000 A	2.8	0.1	1.1 to 1
IS-NEMP	HF-NEMP	1 to 1,000 MHz	50	BNC† **	5,000 A	200	0.1	1.1 to 1

POWER LINE/TV

Model	Description	Frequency	Impedance & Misc.	Max. Surge*	Thru put Energy	Loss dB	VSWR
IS-PSP/240	120/240 VAC	50-60 Hz	3 wire (solder)	12,000 A	N/A	N/A	N/A
IS-75F-C1	Ch 2-83 TV	50-750 MHz	75Ω F58	20,000 A	≤ 600uJ	0.2	1.2 to 1
IS-300T-C2	TV Ribbon line	50-750 MHz	300Ω Screws	10,000 A	≤ 600uJ	1.0	1.5 to 1
IS-RCT	Rotor Cable 8 lines	N/A	24 VAC Max 8 Screws/lugs	2 KA ea. line	N/A	N/A	N/A
IS-PLDO	120 VAC line	50-60 Hz	Duplex Outlet	15,000 A	N/A	N/A	N/A

*Based on 8us rise/20us decay wave form; †also available in UHF; **also available in N/Male on Antenna port; ***also available in type F connector

Other products include: **Ground Interconnect Resistance/Inductance Tester, Field Impulse Suppressor Tester, EMP - Coaxial Protectors, Dedicated Line/Telephone Line Protectors, Protectors for 1.7 GHz - 2.3 GHz.**

For complete information and application assistance contact:

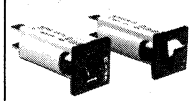
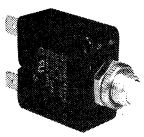
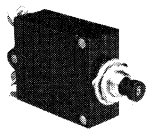
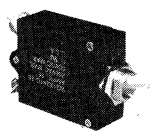
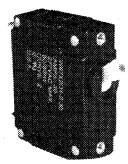
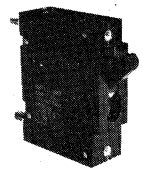
PolyPhaser Corporation

1425 Industrial Way • P.O. Box 1237 • Gardnerville, NV 89410-1237
Phone: 800-325-7170 • (702) 782-2511 • FAX: (702) 782-4476
RCA TELEX: 272718 POLYPHASER

Potter & Brumfield A Siemens Company

200 S. Richland Creek Dr., Princeton, Indiana 47671-0001 • 812/386-1000 • FAX 812-386-2335

Circuit Breakers

						
Series	**W28**	**W58**	**W23**	**W31**	**W67-W69**	**W91-W93**
Type	Thermal	Thermal	Thermal	Thermal	Magnetic-hydraulic	Magnetic-hydraulic
Number of Poles	1	1	1	1	1 to 3	1 to 3
Circuit Function	Series trip	Series trip	Series trip	Series trip	Series trip; Series trip w/aux. switch	Series trip
Current Rating	0.25-15A	1-35A	0.5-50A	0.5-50A	0.5-30A	1-50A
Maximum Operating Voltage	32 VDC 250 VAC	50 VDC 250 VAC	50 VDC 250 VAC	50 VDC 250 VAC	65 VDC 277 VAC	65 VDC 277 VAC
Trip Time at 200% of Rating	(0.25-2A) 4.5-28 sec. (3-15A) 2.2-15 sec.	(1-4A) 10-45 sec. (5-35A) 6-30 sec.	(0.5-4A) 11-30 sec. (5-50A) 6-22 sec.	(0.5-4A) 11-30 sec. (5-50A) 6-22 sec.	Various trip times available	Various trip times available
Interrupt Capacity	1,000 @ 32 VDC or 250 VAC	2,000A @ 50 VDC 1,000A @ 250 VAC	(0.5-25A) 2,500A @ 50 VDC 1,000A @ 250 VAC (26-50A) 1,000A @ 50 VDC or 250 VAC	(0.5-25A) 2,500A @ 50 VDC 1,000A @ 250 VAC (26-50A) 1,000A @ 50 VDC or 250 VAC	3,500A @ 65 VDC 5,000A @ 277 VAC	3,500A @ 65 VDC 5,000A @ 277 VAC
Actuator	Push-to-reset button	Push-to-reset button	Push/Pull button	Toggle	Toggle	Toggle
Approx. Dimensions inch (mm)	.54 x .63 x 1.54d (13.7 x 15.9 x 39.0d)	.66 x 1.38 x 1.38d (16.8 x 34.9 x 34.9d)	.69 x 1.38 x 1.60d (17.5 x 34.9 x 40.6d)	.69 x 1.38 x 1.60d (17.5 x 34.9 x 40.6d)	.75 x 2.00 x 1.50d (19.1 x 50.8 x 38.1d)	.75 x 2.50 x 2.00d (19.1 x 63.5 x 50.8d)
Terminals	.250" (6.35mm) quick connect	.250" (6.35mm) quick connect #6–32 screw type	#8–32 screw type	#8–32 screw type	.250" (6.35mm) quick connect	#10–32 threaded studs
Mounting	Snaps into 5/8" (15.9mm) panel cutout from front	7/16"–28 threaded bushing 15/32"–32 threaded bushing	3/8"–24 threaded bushing	15/32"–32 threaded bushing (double D)	#6–32 tapped holes	#6–32 tapped holes
Component Recognition	ⓊⓁ Ⓒ Ⓢ Ⓓ Ⓢ	ⓊⓁ Ⓒ Ⓢ	ⓊⓁ Ⓒ Ⓢ	ⓊⓁ Ⓒ Ⓢ	ⓊⓁ Ⓒ Ⓢ	ⓊⓁ Ⓒ Ⓢ

Call toll-free 800-255-2550 for the name and telephone number of your nearby P&B sales representative or authorized stocking distributor.

On-Off.

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No sooner does a fuse go to work than it quits forever. But when a PolySwitch® device stops overcurrent, it can reset itself. And go on protecting your product again and again.

PolySwitch circuit protectors do it with technology so elegant it makes other approaches look burnt out. When a current overload hits its conductive polymer compounds, the PolySwitch PTC (positive temperature coefficient) device heats and turns nonconductive. Lower the current and the device's conductivity resumes. Along with your product's reputation for reliability.

PolySwitch PTCs accomplish all this without manual resetting or replacement. Thereby eliminating any chance of going from a bad fuse to something worse—the wrong fuse.

But solving your product's most common reliability problem is only the start. PolySwitch PTCs are also small, monolithic, board-mountable, and testable. And they're available in hundreds of optimized designs—for everything from rechargeable batteries to telephones to stereo speakers.

Finally, PolySwitch PTCs are from Raychem. Which means they're reliable, and backed by experience and support that never shuts down.

Call for a free sample and more information. Because this is one time your product can clearly benefit from on-again, off-again performance.

Raychem

Raychem Corporation
PolySwitch Division
300 Constitution Drive
Menlo Park, CA 94025-1164
(415) 361-6900

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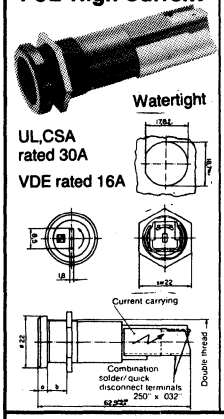
PROTECTIVE COMPONENTS •

Standard products for unique requirements

FUSEHOLDERS - IEC 257/VDE 0820, IEC 65/VDE 0860, IEC 529

5 x 20mm and ¼" x 1¼" 250 V

FUL-High Current



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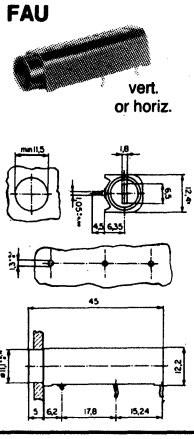

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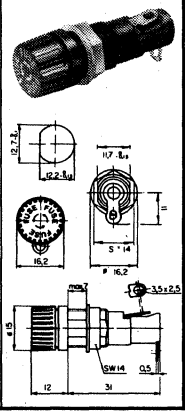
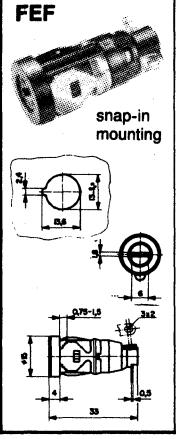


5 x 20mm 250 V

FEF



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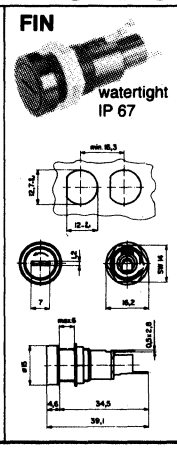

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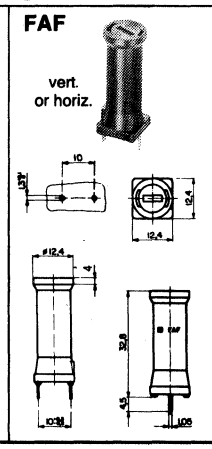

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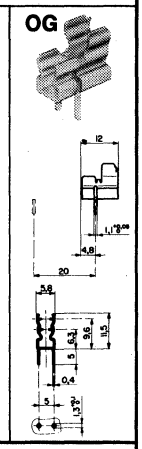


FUSES - IEC/UL

5 x 20mm 250 V

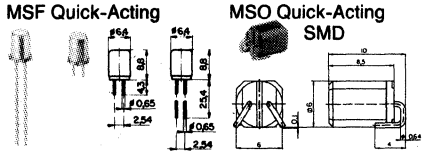
FSF Quick-Acting FST Time-Lag

UL rec. 32mA-6.3A
VDE approval
32mA-6.3A

UL rec. 125mA-6.3A
VDE approval
32mA-6.3A

Microfuses 125 V

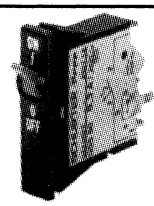
MSF Quick-Acting MSO Quick-Acting SMD



Circuit Breaker 250 V

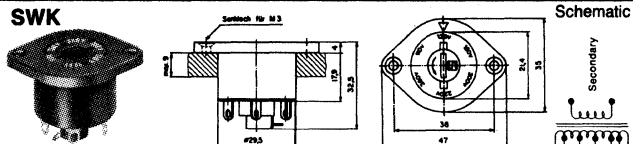
GSS-80 combines overload and short circuit protection

.5 A - 16 A



VOLTAGE SELECTORS WITH FUSEHOLDER - IEC 65/VDE D860, Protection class II/VDE 0630

SWK



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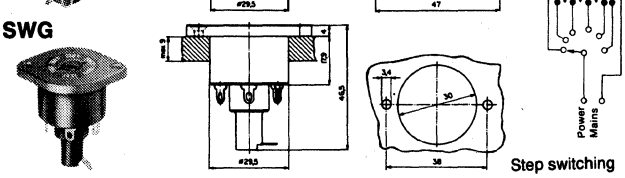

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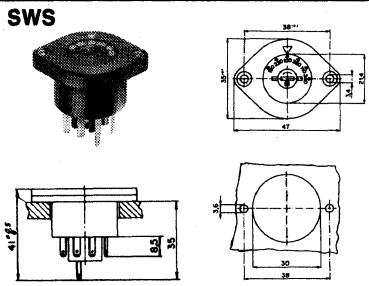
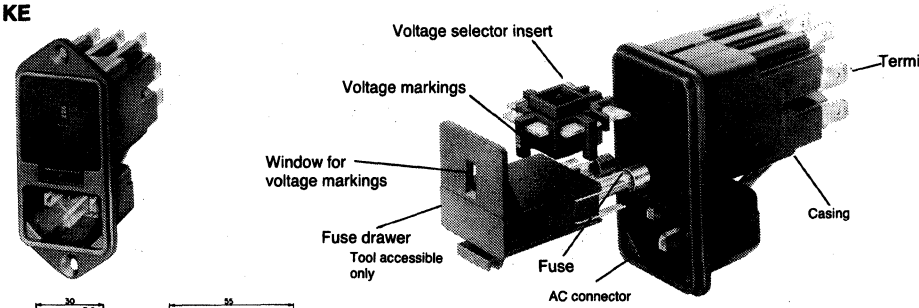
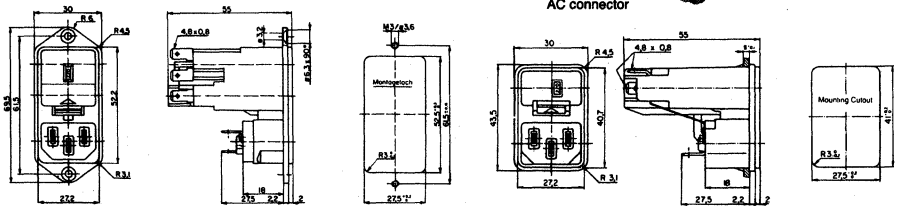


Combine transformer primaries in series and/or parallel

POWER ENTRY MODULES - IEC 320/VI, DIN 49457/1, CEE 22VI (XIV), SEV Typ 113, SNV 24573

KE





Combining:

- 1 or 2 pole fuse protection for 5 x 20mm or ¼" x 1¼" size fuses
- 4 position voltage selector (combine transformer primaries in series and/or parallel)
- AC connector
- Shock safety according to IEC
- 15 A/250 V rating

Reference section 2100 for more Power Entry Modules from Schurter. Reference section 2700 for units with RFI filters.

SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States (ANSI) American National Standards Institute

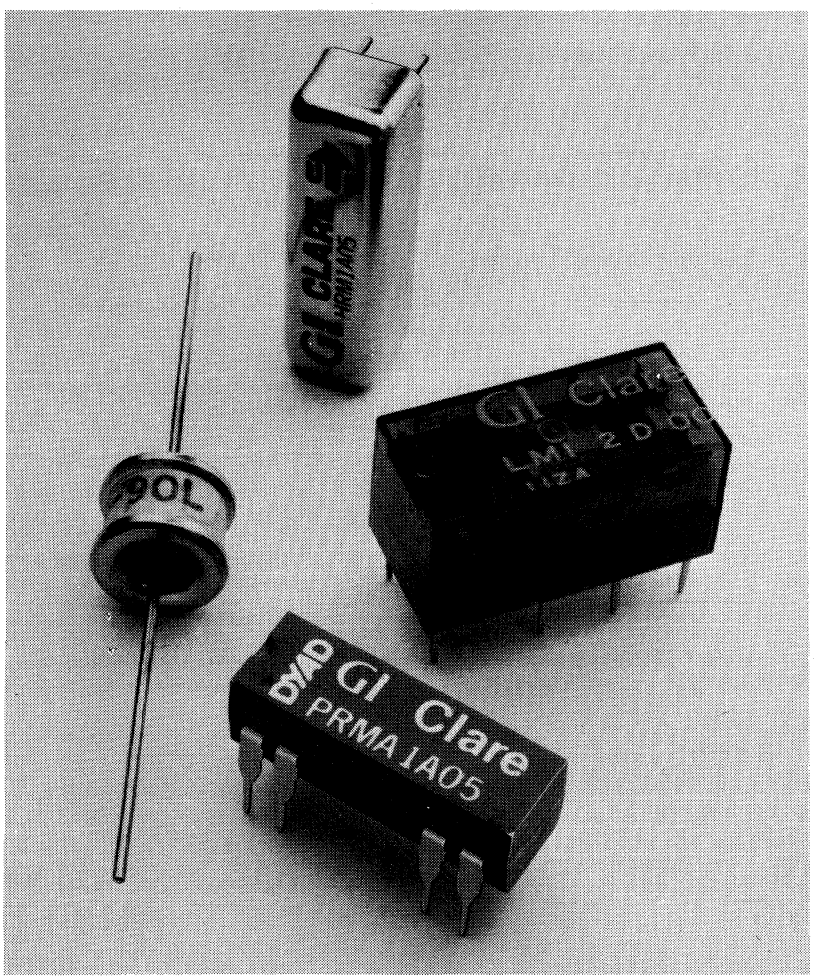
United States (NEMA) National Electrical Manufacturers Association

Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

Yugoslavia Federal Institute of Standardization

The Clare Division Family Of Quality Products.

Reliability Through Technology.



Quality in the Clare Tradition.

Clare Division has earned the position of being the world's largest supplier of mercury-wetted and dry reed relays.

This leadership position has not come easy, but has come as a result of Clare Division's total commitment to products offering improved technology through innovation . . . and to the quality and performance you expect from the leader in switching technology.

Couple this with high volume manufacturing capabilities, and you get superior quality products, at competitive prices, with fast off-the-shelf delivery.

Call your local Clare Representative or authorized Clare Distributor for more information about:

- Mercury-wetted contact relays
- Dry reed relays
- Electromechanical relays
- Surge arresters

Clare Division
General Instrument Corporation
3101 W. Pratt Avenue
Chicago, IL 60645
312/262-7700

We Help You Compete®

GENERAL INSTRUMENT

RELAYS

Manufacturer	Starting EEM Page No.	Reed		Solid State	Hybrid	Thermal	Time Delay	I/O Mdl.	General Purpose	Latching	Current Sensing	Sensitive	High Power	High Voltage	RF	Plug-in	PC Mount	DIP/SIP	Low Profile	Approvals/Ratings
		Mercury Wetted Contacts	Dry Contacts																	
Airpax Corp.	B•1413								√*							√*				
Alllied Control	B•1415			√			√		√*	√	√	√		√		√*	√*		√	UL, CSA
Altech Corp.	B•1421		√				√	√	√		√	√				√	√	√	√	UL, CSA, VDE
American Relays Inc.	B•1422	√	√							√	√	√	√	√			√	√	√	UL
American Zettler Inc.	B•1428			√				√			√		√				√		√	
Aromat Corp.	B•1432			√§						√	√	√				√	√§			
C.P. Clare Corp.	B•1442	√	√							√					√		√	√	√	UL, CSA, BSI
Communications Instruments Inc.	B•1444									√§*		√§*			√§*	√§*	√§*		√§*	MIL5757, MIL39016
Computer Compnents Inc.	B•1449	√	√						√	√	√	√*	√	√*	√	√*	√	√	√	
Coto Corp.	B•1451	√*	√*§	√*		√§*			√*	√*	√§*	√§*	√*	√§*	√§*	√§*	√§*	√*	√§*	UL
Crydom Co.	B•1456			√§	√§			√									√§			
Deltrol Controls	B•1462								√§	√§										UL, CSA
Douglas Randall	B•1464	√	√	√			√	√		√	√			√			√	√		UL, CSB
Eichhoff Electronics	B•1470			√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		VDE, UL, CSA, SEMKO, SEV
Electronic Specialty Corp.	B•1469				√		√			√		√	√		√	√	√			M39016/6 M39016/45 MS27401
Fifth Dimension Inc.	B•1474	√													√		√	√		
Fujitsu Components	B•1477							√	√				√				√			
Genicom	B•1488									√*			√*		√*	√*				
GlobTec Inc.	B•1493	√	√	√		√	√	√	√		√	√	√	√		√	√		√	UL, CSA, VDE, SEMKO, TUV, PTB, SEV, BSI
Gordos Corp.	B•1494	√		√§	√§			√§					√	√§	√		√			UL
Grayhill Inc.	B•1510			√				√									√			
Hamlin Inc.	B•1513	√§*	√§*																	
Hasco Components Inc.	B•1514								√*	√*		√	√			√	√	√*	√	UL, CSA
Hi-G Co.	B•1522			√*	√§*		√*				√*	√*			√*	√*	√§*		√§*	MIL-R-28750, MIL-R-39016, MIL-R-83726, MIL-R-5757
Hold Heat Products	B•1539						√													
IDEC Corp.	B•1540		√§	√§			√§		√§	√§						√§	√§	√§		UL, CSA
International Rectifier	B•1543			√§	√			√	√			√§					√§	√§	√§	UL, CSA

§ Surface Mount * Mil. Spec.

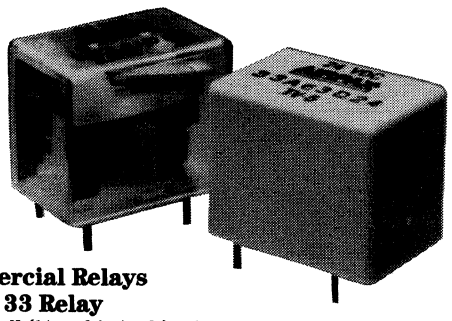
RELAYS

Manufacturer	Starting EEM Page No.	Reed		Solid State	Hybrid	Thermal	Time Delay	I/O Mdl.	General Purpose	Latching	Current Sensing	Sensitive	High Power	High Voltage	RF	Plug-in	PC Mount	DIP/SIP	Low Profile	Approvals/ Ratings
		Mercury Wetted Contacts	Dry Contacts																	
ITT Components	B•1544			√					√	√		√§			√	√	√	√§	√§	
Kilovac Corp.	B•1552													√						
Leach Corp.	B•1559			√	√		√		√	√					√	√				MIL-R-6106, MIL-R-83726
Line Electric	B•1565				√				√*	√	√	√	√			√	√		√	
Logitek, Inc.	B•1566				√*		√*					√	√							
LSI Jennings	B•1570				√§			√						√§						UL, CSA
Mallory Timer Co.	B•1575		√	√		√											√			
Master Elec. Controls	B•1576								√§				√§			√§	√			UL, CSA
Matrix Systems	B•1579	√			√			√	√				√		√					
Midtex Relays, Inc.	B•1580		√	√	√		√		√	√	√		√			√	√	√		UL, CSA
NEC Electronics	B•1586	√							√	√			√	√			√			UL, CSA, VDE
Omron Electronics	B•1592		√	√	√				√	√§		√§	√	√	√	√	√§	√§		UL, CSA, VDE
Potter & Brumfield	B•1597		√	√			√	√	√*	√*	√	√	√	√		√	√	√	√	UL, CSA, VDE TUV, SEV
Ross Engineering Corp.	B•1615						√*		√*	√*			√*	√*					√*	
Schrack North America	B•1616								√				√	√		√	√	√	√	
Sharp Electronics	B•1623			√	√	√							√		√		√			
Silicon Power Cube Corp.	B•1624			√	√			√			√		√	√			√	√		UL
Standex Electronics	B•1629		√							√	√							√	√	UL
STI-Control Comps.	B•1630			√*			√				√*		√*			√				
Struthers-Dunn Inc.	B•1634				√							√					√§			UL, CSA
Struthers-Dunn Military Relays	B•1632		√§*				√*		√*		√*									
Teledyne Relays	B•1640			√*	√*				√*						√*			√*		
Wabash Magnetics	B•1652		√							√								√	√	

§ Surface Mount * Mil. Spec.

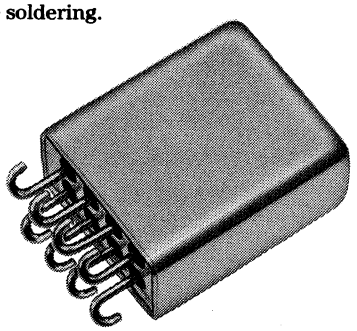
RELAYS AND SOLENOIDS

Airpax relays and solenoids are specified around the world for hundreds of PC board applications. In standard or custom designs. Contact Airpax Company, Husky Park, Frederick, MD 21701. (301) 663-5141. A division of North American Philips Corporation.



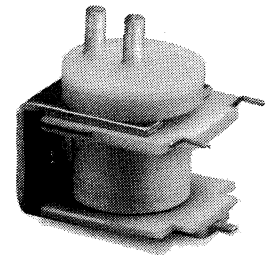
Commercial Relays
Series 33 Relay
This small (1/2 cubic inch) relay is especially suited for use as an output device for remote control and cable television, office equipment, appliances, door openers, automotive controls and various types of instruments. It offers complete isolation from noisy environments and can also handle high-inductive and tungsten filament loads. Coil voltages from 3 VDC to 48 VDC may be specified. Sensitive models, requiring as little as 180 mW of coil power, are available. Terminals are designed for PC board installation.

Features:
- Small size—1/2 cubic inch.
- Sensitive—as little as 180 milliwatts coil power.
- TV 5 rating available.
- Approval—
- Inexpensive—typically under $1.00.
- 4KV Dielectric available.
- Sealed for wave soldering.



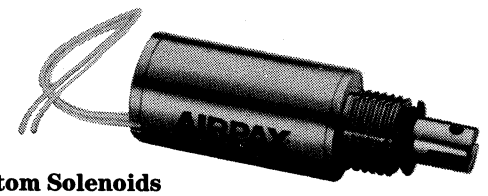
Military Relays
Series 07—Crystal Can
Developed specifically for the aerospace industry. The standard unit features a solder terminal arrangement, 26.5 VDC coil voltage and 10 amp contacts.

Features:
- Qualified to MIL-R-5757, M 5757/23, MS 27245, MS 27247 and MIL-R-6106.
- Withstands severe vibration and shock.
- DPDT Contacts.

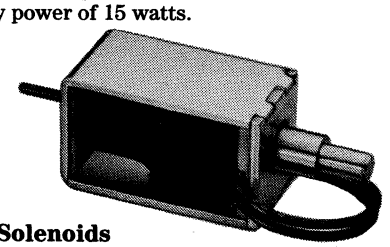


Custom Solenoids
Series 7150—Vacuum Solenoids
Applications for these custom solenoids include control functions for vacuum operated climate control modules and vacuum operated cruise control for the automotive industry. Our designers will work with you to develop a durable low cost package that will meet the requirements of your most difficult applications.

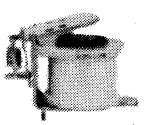
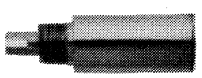
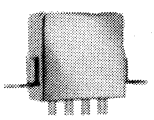
Features:
- PC board mounting available.
- Leakage rate of 10 cc/min. maximum @ 20 in. Hg vacuum to as low as −20°C.
- Sensitive: as little as 85 milliwatts coil power consumption.
- Duty cycle: continuous.
- Ambient temperature range: −40°C (−40°F) to +125°C (+257°F).



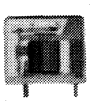
Custom Solenoids
7019 Solenoid
This direct Current Tubular Pull Type Solenoid is designed to provide up to 50 ozs. of force with a maximum stroke of .437". Actual usable force will depend on the stroke and power level. Coils are available from 6 VDC to 115 VDC with a continuous duty power level of 5 watts and an intermittent (25%) duty power of 15 watts.



Custom Solenoids
7007ED33-0013 D.C. Box-Frame Push-Type Solenoid
Provides up to 20 ozs. of force with a maximum stroke of .200". Actual usable force will depend on the stroke and power level. Coils are available from 6 to 115 VDC with a continuous duty power level of 3.0 watts and an intermittent (25%) duty power level of 9.0 watts.

AIRPAX®
FREDERICK DIVISION



eem MINIGLOSSARY ELECTROMECHANICAL RELAYS

RELAYS

Hybrid: Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

Differential: Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

Close-differential: The dropout value is specified close to the pickup value.

Frequency sensitive: Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

Hermetically sealed: Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

Encapsulated: Imbedded in a suitable potting compound.

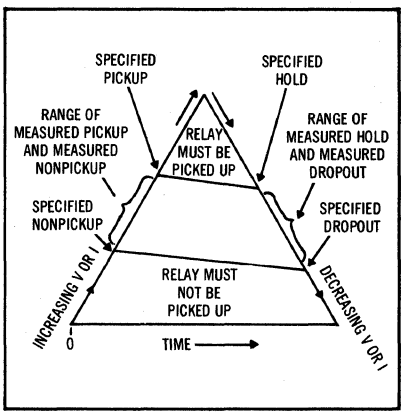
Sealed: Enclosed in a relatively airtight cover. (Not the same as hermetically sealed.)

Covered: Unsealed metal or plastic enclosure or housing.

CONTACTS

Dry circuit: contacts that carry current but do not open or close during energizing of the load circuit. Often wrongly used in reference to low level contacts.

Low Level: Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.



OPERATING CHARACTERISTICS

Measured dropout: The value at which all contacts restore to their unoperated position as current or voltage decreases.

Specified dropout: The value at or *above* which all contacts *must* restore to their unoperated position as voltage or current is decreased.

Specified hold: The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

Specified nonpickup: The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

Measured pickup: The value at which all contacts function as voltage or current increases on an unoperated relay.

Specified pickup. The value at or *below* which all contacts *must* function as voltage or current increases on an unoperated relay.

Sensitivity: Specified pickup expressed in watts.

Normal bridging: The make-before-break action between adjacent contacts on relays designed for this purpose.

Abnormal bridging: The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

Magnetic freezing: Sticking of the armature to the core as a result of residual magnetism.

TIME

Actuation: The interval from coil energization or de-energization to the functioning of a specified contact.

Initial actuation: The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

Final actuation: Sum of initial actuation *and* bounce intervals following an actuation.

Contact bounce: The interval from close or opening of a contact to the end of the bounce of "chatter."

Chatter: See bounce.

Operate: Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

Release: Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

Transfer: The interval between opening a closed contact and closing an open contact of a break-before-make relay.

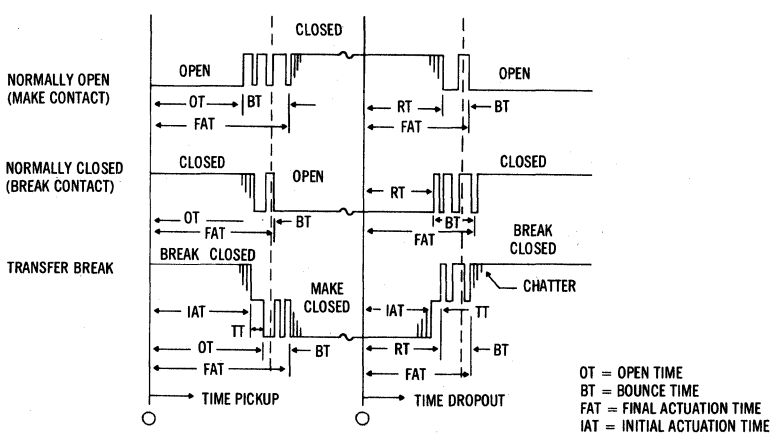
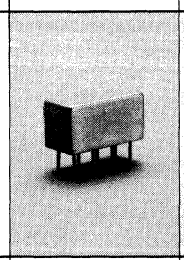
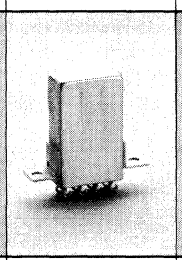
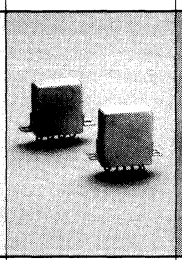
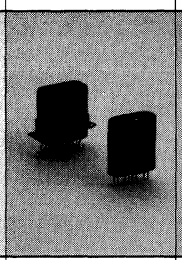


Fig. 2. Typical time vs. current (non-inductive load)

Allied Control® Relays

MILITARY RELAYS

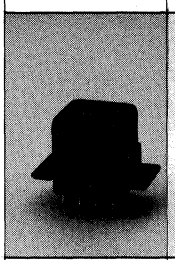
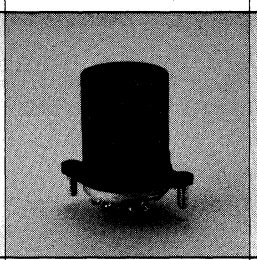
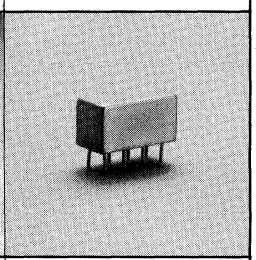
	RELAY TYPE	1/2 Size Crystal ERS & S	Long Coil Sensitive Crystal WJS	Full Size Crystal WKJ WKY	Full Size Crystal KHJ KHY	Miniature Round Sensitive RSH	Full Size Crystal 2 Pole JH
							
Contacts	Arrangement	2PDT	1PDT 2PDT	2PDT	2PDT	1PDT 2PDT	2PDT
	Amps DC	2	3	3	2	2	5
	Volts DC	28	29	29	29	29	29
	Amps AC	0.3 or 0.7	0.3	0.3	0.3	0.3	0.3
	Volts AC	115	115	115	115	115	115
Coil	DC Nominal Volts	6, 12, 26.5 or 48V	—	6, 12, 26.5, 48 or 115V	6, 12, 26.5, 48 or 115V	—	6, 12, 26.5, 48 or 115V
	AC Nominal Volts	—	—	—	—	—	—
	Operate Sensitivity Milliwatts DC	240	25 40	260	260	22 40	260
Mounting	Plain — No Mtg. Bkts.	X	X	X	X	X	X
	Flange Mtg.	X	X	X	X	X	X
	Stud Mtg.	X	X	X	X	—	X
	Side Bkts.	X	X	X	X	—	X
Terminals	Printed Ckt.	X	X	X	X	—	X
	Solder	X	X	X	X	X	X
	Plug-In	X	X	X	X	X	X
	Wire Leads	X	X	X	X	—	X
	Dielectric All Points VRMS	1000	1000	1000	1000	1000	1000
	Across Open Gap VRMS	500	500	500	500	500	500
	Coil to Frame	500	500	500	500	500	500
		S ERS					
	Vibration g's	20 30	15	20	20	10	20
	Hz	2000 3000	2000	2000	2000	500	2000
	Shock g's	50	50	100	100	50	50
Enclosure	Sealed by Welding	X	X	X	—	—	—
	Sealed by Solder	—	—	—	X	X	X
	Metal Dust Cover	—	—	—	—	—	—
	Plastic Dust Cover	—	—	—	—	—	—
	Open Frame	—	—	—	—	—	—
	Temperature Range °C	−65 +125	−65 +125	−65 +125	−65 +125	−65 +125	−65 +125
Dimensions	Length Inches	0.8	0.8	0.8	0.8	1.223	0.8
	Width Inches	0.4	0.4	0.4	0.4	0.343	0.4
	Height Inches	0.410	1.281	0.875	0.890	1.843	0.890
	MIL-Spec.	Mil-R-39016/6	Mil-R-5757/13	Mil-R-5757	Mil-R-5757	Mil-R-5757	Mil-R-5757

ALLIED CONTROL
100 Relay Road
Plantsville, CT 06479
(203) 621-6771

FAX No. 203-621-4932

Allied Control® Relays

MILITARY RELAYS

Full Size Crystal 4 Pole JH	Miniature Round 2 Pole MH-6 MHB-6	Miniature Round 4 Pole MH-12 MHB-12 MHJ-12	Miniature Round 6 Pole MH-18 MHB-18 MHJ-18	Miniature Round 4 Pole 10 Amp MHY	Military Type — Commercial Version for Industrial Use 1/2 Size Crystal ST
					
4PDT 2 29 0.3 115	2PDT 5 29 0.3 115	4PDT 5 29 0.3 115	6PDT 5 29 0.3 115	4PDT 10 29 0.5 115	2PDT 2 28 0.3 115
6, 12, 26.5, 48 or 115V — 480	6, 12, 26.5, 48 or 115V — 115V 525 520	6, 12, 26.5, 48 or 115V — — 115V 700 675 675	6, 12, 26.5, 48 or 115V — — 115V 875 845 845	6, 12, 26.5, 48 or 115V 115V 875V	26.5V — 240
X X — —	X X X —	X X X —	X X X —	X X X X	X — — —
X X X —	— X X —	— X X —	— X X —	— X X —	X — — —
1000 500 500	1000 1000 1000	1000 1000 1000	1000 1000 1000	1000 1000 1000	1000 500 500
20 2000	15 1000	15 15 20 1000 1000 2000	15 15 20 1000 1000 2000	20 500	20 2000
50	50	50	50	50	50
— X — — —	— X — — —	— X — — —	— X — — —	— X — — —	X — — — —
−65 +125	−55 +85 −65 +125	−55 +85 −65 +125 −65 +125	−55 +85 −65 +125 −65 +125	−65 +125 −55 +85 DC AC	−55 +125
1.360 0.8 0.890	1.062 0.712 1.796	1.656 1.125 1.75	1.812 1.312 1.75	1.812 1.265 1.953	0.8 0.4 0.410
Mil-R-5757	Mil-R-5757	Mil-R-5757	Mil-R-5757	Mil-R-5757	

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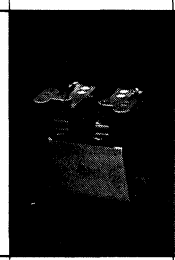
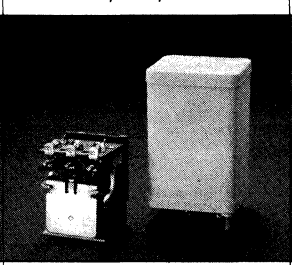
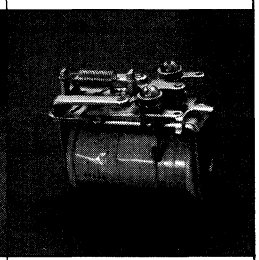
FAX No. 203-621-4932

Allied Control® Relays

GENERAL PURPOSE RELAYS

	RELAY TYPE	Miniature Power BOT/BOHR/BODR	Miniature Power BOY/BOYHR/BOYDR Sensitive	Miniature Power PO/POHR/PODR	Sensitive As Low As .003 Watts SWS	SWN	SWP
							
Contacts	Arrangement	1PDT 2PDT	2PDT	2PDT 3PDT/4PDT	1PDT	1PDT/2PDT	1PDT/2PDT
	Amps DC	15	10	15	1	2.5	5.0
	Volts DC	28	26.5	29	24	24	24
	Amps AC	15	10	15	1	2.5	5.0
	Volts AC	115	110	115	115	115	115
Coil	DC Nominal Volts or	6, 12, 24, 48 or 115V	5.5, 13, 24, 62, 87 or 115V	6, 12, 26.5, 48 or 115V	—	—	—
	AC Nominal Volts	6, 12, 24, 48, 115 or 230V	—	6, 12, 24, 48, 115 or 230V	—	—	—
	Operate Sensitivity	4.2VA AC 1.4W DC	360mW	4.2VA AC 1.4W DC	3mW	12mW	50mW
Mounting	Plain - - No Mtg. Bkts.	—	—	—		—	
	Flange Mtg.	X	X	X		X	
	Stud Mtg.	X	X	X		X	
	Side Bkts.	—	—	—		—	
Terminals	Printed Ckt.	—	—	—		—	
	Solder	X	X	X		X	
	Plug-In	X	X	X		X	
	Wire Leads	—	—	—		—	
	Dielectric All Points VRMS	1250	1250	1250		1000	
	Across Open Gap VRMS	1250	1250	1250		500	
	Coil to Frame	1250	1250	1250		500	
	Vibration g's	10	10	10	N/R	10	
	Hz	55	55	55	N/R	55	
	Shock g's	25	25	25	N/R	25	
Enclosure	Sealed by Welding	—	—	—		—	
	Sealed by Solder	X	X	X		X	
	Metal Dust Cover	X	X	X		X	
	Plastic Dust Cover	—	—	—		—	
	Open Frame	X	X	X		X	
	Temperature Range °C	0 +71	0 +71	0 +71		0 +71	
Dimensions		Open Frame Enclosed	Open Frame Enclosed	2 & 3 Pole Open Frame Enclosed	4 Pole Open Enclosed		
	Length Inches	1.62 1.796	1.843 1.796	1.906 1.906	1.906 2.281	1.625	
	Width Inches	1.5 1.672	1.5 1.672	1.718 1.906	2.281 2.156	1.141	
	Height Inches	1.937 2.687	1.937 2.687	2.81 3.218	2.281 3.515	1.406	
	Mil-Spec.						

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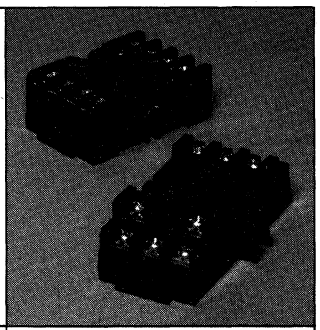
Allied Control® Relays

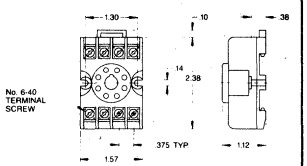
INDUSTRIAL RELAY SOCKETS

SNAP TRACK MOUNTED

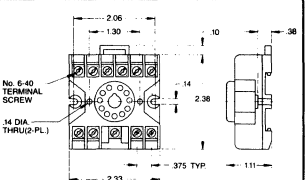


Construction	Self-extinguishing, black polycarbonate body with integral molded barrier.
Terminals	Combination slot/phillips head screws and captive self lifting terminal clamps.

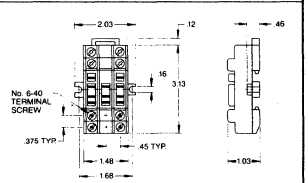
H50SL608S
8-pin octal socket. Rating: U/L and CSA, 10 amperes, 300VAC. Wire sizes: up to #12 AWG. Terminals: pan head 6-40 screw.



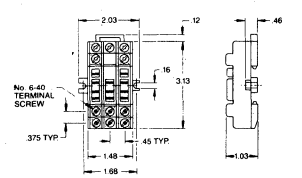
H50SL611S
11-pin magnol socket. Rating: U/L and CSA, 10 amperes, 300VAC. Wire sizes: up to #12 AWG. Terminals: pan head 6-40 screw.



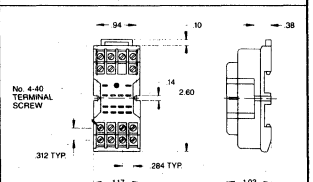
H50SL708S
8-pin blade type socket. Rating: U/L, 15 amperes, 300VAC; CSA, 10 amperes, 300VAC. Wire sizes: up to #12 AWG. Terminals: pan head 6-40 screw. Cascading mounting center 1.74 ± .010.



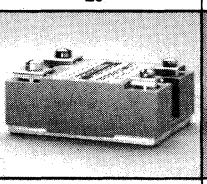
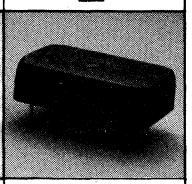
H50SL711S
11-pin blade type socket. Rating: U/L, 15 amperes, 300VAC; CSA, 10 amperes. Wire sizes: up to #12 AWG. Terminals: pan head 6-40 screw. Cascading mounting center 1.74 ± .010.

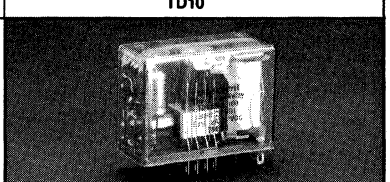


H50SL715S
14-pin blade type socket. Rating: U/L and CSA, 5 amperes, 300VAC. Wire sizes: up to #14 AWG. Terminals: pan head 4-40 slot.



Mounting Track	Standard Track SL601 and SL602 will accept either regular and snap track sockets.
U/L CSA	E48784 LR28098

	RELAY TYPE	E3	E22
	SOLID STATE RELAYS		
Output	Arrangement	1PST NO 1PST NC	1PST NO
	Amps AC	10, 25 or 40	4
	Volts AC	280	240
	Amps DC		
	Volts DC		
Input	DC Nominal Volts	3-32VDC	5, 12, 24 or 32
	AC Nominal Volts	20-28VAC 100-135VAC	—
Mtg	Panel	X	—
	Printed Ckt.	—	X
	Isolation	2500V	2500V
	Vibration g's	20	20
	Hz	2000	2000
	Shock g's	50	50
	Temperature Range °C	−30 +80	−30 +80
	Length Inches	2.250	1.6
	Width Inches	1.75	1.0
	Height Inches	1.0	.05
	Photo Isolation	X	X
	Zero Crossing	X	X
	U/L	E57093	
	CSA	LR34171	

	TIMER TYPE	TD10	
	SOLID STATE TIMER		
	Arrangement	2PDT	4PDT
	Amps	2 or 5	
	Volts	28VDC	115VAC
	Nominal Coil Voltage DC	12, 24 or 48	
	Nominal Coil Voltage AC	24, 115	
	Timer Delay — Operate Delay	0.1 to 300 sec.	
	Timing Adj.	Fixed or Adjustable (Internal or External)	
	Mounting	Printed Circuit Board Mounting Socket Mounting Chassis Mounting	
	Housing	Plastic Dust Cover	
	Vibration g's	10	
	Hz	55	
	Shock g's	25	
	Temperature	0°C to 55°C	
	Dimensions — Length	1.391	1.594
	Width	0.735	0.735
	Height DC	1.187	1.187
	Height AC	1.968	1.968

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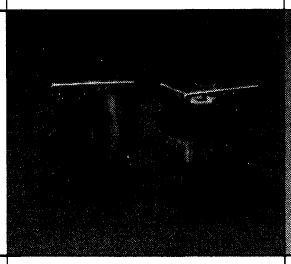
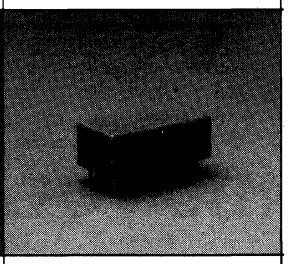
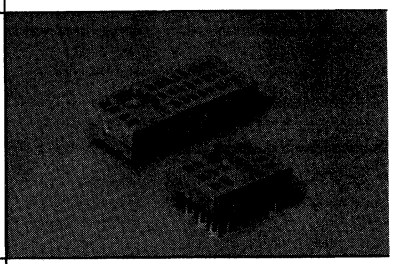
CRADLE & LOW PROFILE RELAYS

	RELAY TYPE	Miniature General Purpose Cradle Relay T154/T163/T351/T362 Incl. Mag Latch				Flat Pack MPC/MPCL Incl. Mag Latch	
							
Contacts	Arrangement	1PDT up to 8PDT				2PDT 4PDT	
	Amps DC	1, 2, 5 or 10				1 or 2	
	Volts DC	29				28	
	Amps AC	1, 2, 5 or 10				0.5 or 1	
	Volts AC	115				120	
Coil	DC Nominal Volts	3 to 115				5, 6, 12, 20, 24 or 48	
	AC Nominal Volts	6 to 220				—	
	Operate Sensitivity Milliwatts	20 to 1000				160 to 550	
Mounting	Plain — No Mtg. Bkts.	X				X	
	Flange Mtg.	—				—	
	Stud Mtg.	X				—	
	Side Bkts.	—				—	
Terminals	Printed Ckt.	X				X	
	Solder	X				—	
	Plug-In	X				—	
	Wire Leads	—				—	
	Dielectric All Points VRMS	1000				1000	
	Across Open Gap VRMS	500				500 (350 btwn. ckts.)	
	Coil to Frame	500				500	
	Vibration g's	10				10	
	Hz	55				55	
	Shock g's	25				30	
Enclosure	Sealed by Welding	—				—	
	Sealed by Solder	X				—	
	Metal Dust Cover	X				—	
	Plastic Dust Cover	X				X	
	Open Frame	X				—	
	Temperature Range °C	−55 +71				−55 +80	
Dimensions		2-P	4-P	6-P	8-P	2-P	4-P/2-P Mag Latch
		Plastic Dust Cover					
	Length Inches	.937	1.172	1.391	1.594	1.10	1.10
	Width Inches	.735	.735	.735	.735	0.6	0.780
	Height Inches	1.187	1.187	1.187	1.187	0.425	0.425
	Mil-Spec.						
	U/L	E20604				E20604	
	CSA	LR34171				LR34171	

Cradle Socket and Accessories



Construction

Body molded of glass filled flame retardant polyester (PBT). Meets UL94VO and is fungus resistant.
One piece contact/terminal construction of berylium copper.
Selectively plated gold over nickel on contact area. 60/40 Brite-Tin on terminal area.

Arrangement

Number of Poles
2 = 2-pole socket
4 = 4-pole socket
6 = 6-pole socket
8 = 8-pole socket

Terminal/Mounting

Type of Terminal
1 = Solder lug/chassis mounted
3 = Standard PC in-line mounting
5 = PC mounting .100″ x .100″ grid throughout
7 = PC mounting .100″ x .100″ grid in contact
.100″ x .150″ grid in coil

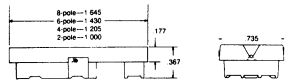
Accessories

Socket Assemblies
10 = Socket only
11 = Socket with ground spring installed
12 = Socket with ground spring installed and retainer
13 = Socket with retainer

Part Name	Part No.	Diagram	Retainer-Part No.	Diagram
Ground Spring for Solder Lug/Chassis	T-00101		T-00102 2-pole T-00104 4-pole T-00106 6-pole	to be inserted into recesses on narrow sides of sockets
Ground Spring for all P.C. mounted sockets	T-00105		T-00108 8-pole Flat Retainer	

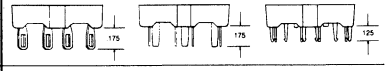
Dimensions

Body



Terminals

Chassis Mount (Solder Lug) | PC Mount (In-Line Spacing) | PC Mount (Staggered Spacing)



U/L	E20604
CSA	LR34171

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MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1404, **B**•1090, **C**•1119 **D**•1156
AC Power Supplies, Product Selection Guide ..... **D**•2156
ASCII Code ..... **D**•1080
Batteries, Product Selection Guide .... **D**•1447
Batteries & Fuel Cells, Characteristics ..... **D**•1450
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide **A**•1002
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1197
Conductors, Maximum Current Capacity of Copper & Aluminum ... **A**•2272, **C**•1316
Connectors, Miniglossary ..... **C**•1271
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1339
DC Power Supplies, Product Selection Guide ..... **D**•1537
Delay Lines, Product Selection Guide ..... **A**•1503
Dielectrics, Thermal Conductivity ..... **B**•1916
Discrete Semiconductors, Product Selection Guide ..... **A**•2154
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1041
EBCDIC Code ..... **D**•1086
Encapsulation, Miniglossary ..... **C**•1124
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide ..... **C**•1631
Fiber Optics, Miniglossary ..... **B**•1185
Fiber Optics, Product Selection Guide ..... B•1204
Filters, Power, Product Selection Guide ..... **A**•1642
Filters, Signal, Product Selection Guide ..... **A**•1683
IC Master ..... **A**•1740
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1210
Interconnection Systems, Product Selection Guide ..... **C**•1702
Keyboards & Keypads, Product Selection Guide ..... **B**•1854
Lamps, Lights, & Indicators, Product Selection Guide ..... **B**•1126
Logofinder & Trademark Directories ... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1776
Military Qualified Products List ..... **B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1221
Opto Semiconductors, Miniglossary ..... **A**•2169
Oscilloscopes, Product Selection Guide ..... **D**•1426
Panel Hardware, Product Selection Guide ..... **C**•1583
Panel Meters, Analog & Digital, Product Selection Guide ..... **D**•1376
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **A**•2078
Power Supplies, Miniglossary ..... A•2276, **D**•1541
Power Supplies, AC, Product Selection Guide ..... **D**•2156
Power Supplies, DC, Product Selection Guide ..... **D**•1537
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1351
Relay Contact Forms ..... **B**•1450
Relays, Electromechanical, Miniglossary ..... **B**•1414
Relays, Product Selection Guide ..... **B**•1411
Resistor Color Codes ..... **A**•1952
Resistors, Product Selection Guide ... **A**•1867
Servo Components, Miniglossary ..... **B**•1266
SI Units, Basic Guide To, ... **A**•1434, **B**•1472, **C**•1692, **D**•1386
Solenoids, Product Selection Guide ... **B**•1655
Switches, Product Selection Guide .... **B**•1673
Symbols—International Authorities ..... **A**•1454, **B**•1064, **C**•1104, **D**•1166
Thermal Components, Product Selection Guide ..... **B**•1886
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1916
Thyristors/High Power Diodes, Miniglossary ..... **A**•2211
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Trademark & Logofinder Directories ... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1928
Transformers, Product Selection Guide ..... **A**•2215
Voltage Drop Nomograph ..... **A**•2262, **C**•1469, **C**•1960 **D**•1718
Wire & Cable, Product Selection Guide ..... **C**•1755
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1343, **C**•1759

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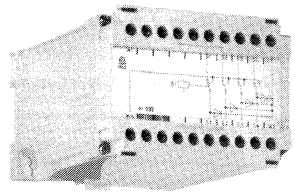
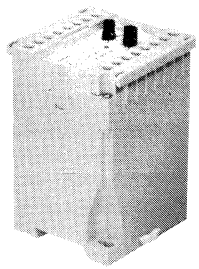


AI/AN SERIES

SELECT FROM ALTECH'S COMPREHENSIVE RELAY FAMILY

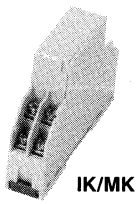
Altech relays meet electrical standards according to IEC, VDE, DIN and other important worldwide standards including UL and CSA. These relays offer various mounting configurations including snap-on DIN rail, panel mount, base mount and plug-in.



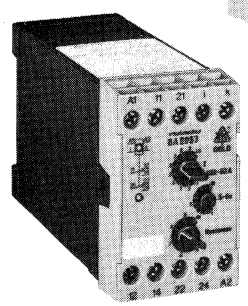
AI/AA SERIES

Altech Sensing Relays...

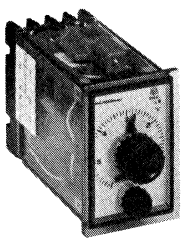
Available in present or user-programmable parameters...Voltage ranges from 15mV to 700V. Current ranges from 2 mA to 150 A. Hysteresis adjustment provides dead band selection of maximum and minimum set points. Consider Altech sensing relays to protect, control and monitor your system or equipment.



IK/MK SERIES



BA SERIES



EC TIMER

Some examples are...

Altech's BA 9054 relays for undervoltage and overvoltage problems.

Altech's AI 941N relays for phase-sequence control.

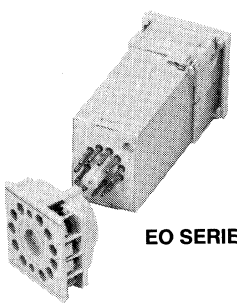
Altech's MK 9052 relays for thermistor monitoring of windings, shaft bearings and various other thermal concerns.

Altech's IK 8715 relays for circuit sharing control of more than one electrical device.

Altech's BA 9055 relays for precise sensing of rotary or linear motion.

Altech's AI 993 relays for early warning of malfunction or failure of your system components.

Altech's BA 7901 relays for on-time functioning of motors, annunciators, relays and contactors in sequencing applications.

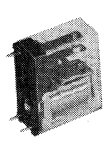


EO SERIES

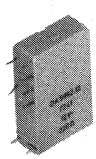
Altech Printed Circuit Board Relays

Predictable and reliable performance is ensured. Miniature sizes with washability offer desirable features for your electronic design. Contacts rated to 16 amperes and 380 volts. Coil power consumption can be less than 125 milliwatts and coil voltages up to 110V.

An example is...
Altech's tiny OW 5691 (0.4″ × 0.8″ × 0.4″) has a contact life up to 100 million operations and an incredible contact rating of 5A and coil voltages of 3–48 VDC.

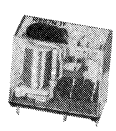


OA8870



OA5682

OW5691



R867

SEE OUR ENCLOSURES IN SECTION 1400 C•1035/SEE OUR TERMINAL BLOCKS IN SECTION 2100 C•1151-55/SEE OUR SWITCHES IN SECTION 5100 B•1677

REED RELAYS

From American Relays, Inc.

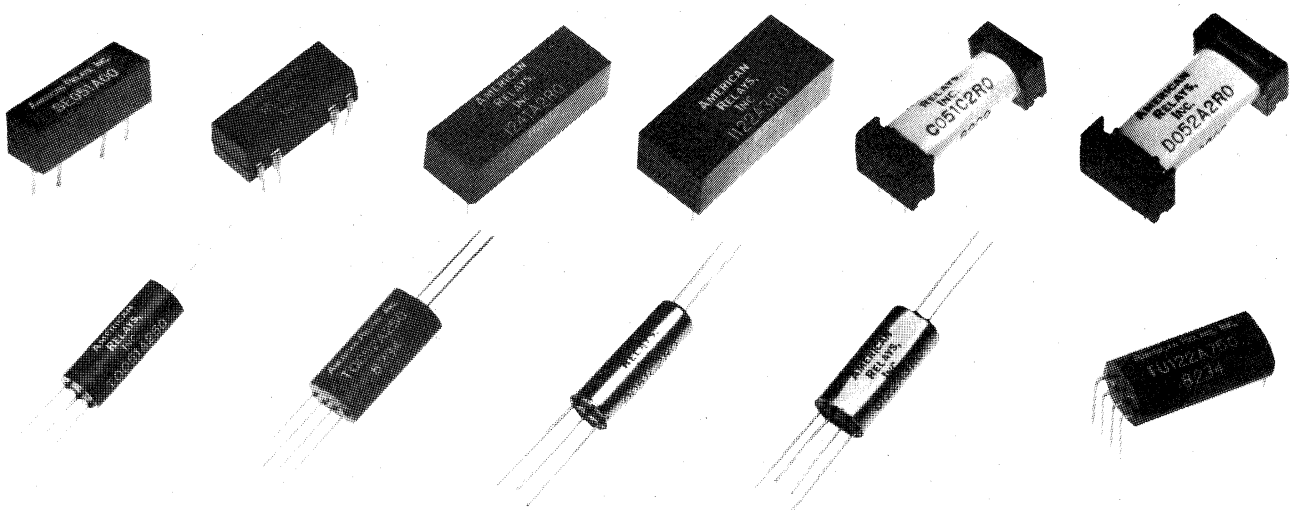
Whether you're looking for a **REED RELAY** that will meet FCC surge requirements, or a sensitive Low-Level **REED RELAY** to switch ATE signal...

AMERICAN RELAYS HAS IT ALL

High Quality — Low Price — On time Delivery

Dry and Mercury Wet contacts
With High Voltage, High Power or Low Level switching

Standard or Specified to YOUR Application,
AMERICAN RELAYS can Build the **REED RELAY** you need.



American Relays, Inc., offers a comprehensive line of super-reliable reed relays. American Relays, Inc., 100% tests all reed switches **AND** 100% final tests all reed relays. We are specialists in **"THE REED RELAY INDUSTRY".**

PACKAGE STYLES

- **Encapsulated**
- **Open Frame**
- **Axial Leeds**
- **DIP**
- **SIP**

SWITCHING TYPE

- **General Purpose Dry Reed**
- **Low Level Switching**
- **High Power**
- **High Voltage**
- **Mercury Wetted Contacts**

- **UL Recognized Relays Available**

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TEL (213) 944-0447 • FAX (213) 944-0590

American Relays, Inc.

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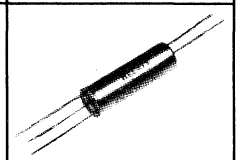
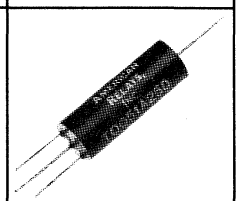
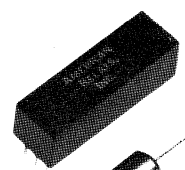
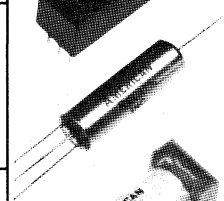
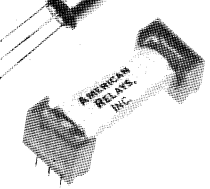
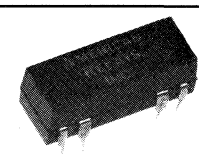
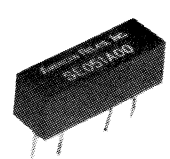
REED RELAY INDEX

RELAY TYPE	DESCRIPTION	TERMINAL GRID	CONTACT FORMS AVAILABLE POLES	PACKAGE
ENCAPSULATED	Epoxy encapsulated. Total Environmental protection. Wide range of contact forms and coil voltages are available.	1.000 × .100 1.000 × .150	Form A (1 to 6) Form B (1 & 2) Form A/B (1 & 2) Form C (1 to 4) Form A Latching (1 & 2)	
OPEN FRAME	Durable glass filled polyester bobbin construction. Switch and coil leads are securely held with epoxy potting. Cost efficient plug-in type reed relay.	1.000 × .100 1.000 × .150	Form A (1 to 4) Form B (1 & 2) Form C (1, 2, 3) Form A Latching (1)	
AXIAL	Rugged axial lead tubular relay. Nickel plated metal jacket provides magnetic shield. 1.000″ center formed leads are available.	Axial 1.000 × .100	Form A (1 & 2) Form B (1) Form C (1 & 2) Form A Latching (1)	
T SERIES	Most economical, high performance tubular relay. Completely sealed in a flame retardant plastic tube. 1.000″ center formed leads are available.	Axial 1.000 × .100	Form A (1 & 2) Form B (1)	
HIGH POWER	50W contact rating. Available with encapsulated, open frame and axial lead packages.	Axial 1.000 × .100 1.000 × .150	Form A (1 & 2)	
HIGH VOLTAGE	25W, 1000 VDC switching. 2500 VDC breakdown voltage. Miniature size. Available with encapsulated, open frame and axial lead package.	Axial 1.000 × .100 1.000 × .150	Form A (1 & 2)	
MERCURY WETTED	Mercury wetted contact relay. 50W contact rating. Extremely long life expectancy. No contact bounce. Stable low contact resistance.	Axial 1.000 × .100 1.000 × .150	Form A (1 & 2) Form C (1 & 2)	
DIP RELAYS	Epoxy molded DIP reed relay. Logic compatible. Stable contact resistance. Fits all standard DIP sockets and is automatic insertion compatible.	DIP .300 × .100	Form A (1 & 2) Form B (1) Form C (1)	
SIP RELAYS	High quality economical Single-In-Line package reed relays. Epoxy encapsulated package. Various contact ratings are available. UL recognized series available.	SIP .2 × .4 × .2 .2 × .2 × .2	Form A (1) Form B (1) Form C (1)	
SPECIAL RELAYS	Let us design reed relays for your application. Special relays are cost competitive with standard relays in most cases. Consult the factory or your local representative with your specific requirements.			

American Relays, Inc.

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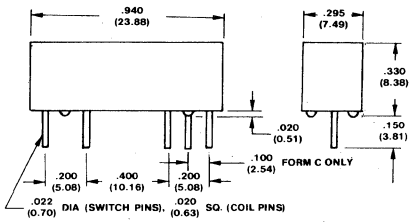
REED RELAYS

SINGLE-IN-LINE SERIES (S SERIES)



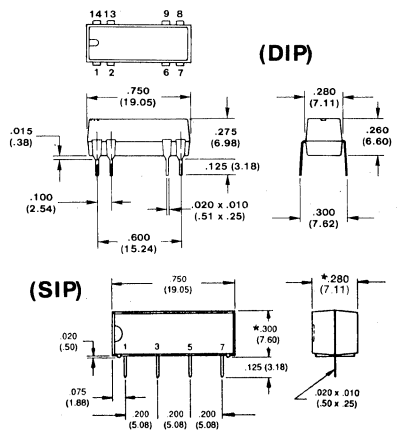
- High Quality Low Cost Single-In-Line
- Sturdy Bobbin and Encapsulated in a Polyester Case
- UL Recognized (File #E104383)

GENERAL SPECIFICATIONS

Contact resistance: .150 ohms max.
Operate time: 0.5 ms typ.
Release time: 0.2 ms typ.
Bounce time: (Form A & B) 0.25 ms typ. (form C, NO/NC) 0.5/1.5 ms typ.
Insulation resistance: 10^{10} ohms min. (form A), 10^{9} ohms min. (form C)
Operating temperature: −40° to +85°C
Vibration: 20G (10 — 2000 Hz)
Shock: 50G @ 11 ms duration

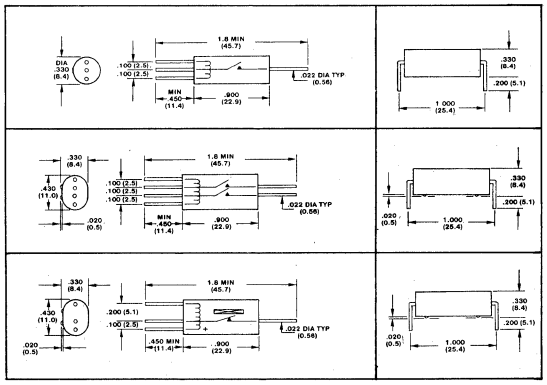
Contact Form	Part Number	Coil VDC	Coil Res. (Ohms)	Must Operate VDC	Must Release VDC	Contact Ratings	Break Down Voltage	Schematic
1A Standard ®RU	SE051A00	5-6	500	3.8	0.5	10 Watts	250	
	SE061A00	5-6	125	3.8	0.5	200 VDC		
	SE121A00	12	500	8.0	1.0	0.5 Amps		
	SE241A00	24	2000	16.0	2.0			
1A High Power ®RU	SE051A10	5-6	300	3.8	0.5	50 Watts	500	
	SE061A10	5-6	125	3.8	0.5	200 VDC		
	SE121A10	12	500	8.0	1.0	1.0 Amps		
	SE241A10	24	2000	16.0	2.0			
1A High Voltage	SE051A20	5-6	300	3.8	0.5	25 Watts	2500	
	SE061A20	5-6	125	3.8	0.5	1000 VDC		
	SE121A20	12	500	8.0	1.0	1.0 Amps		
	SE241A20	24	2000	16.0	2.0			
1A Mercury	SE051A30	5-6	200	4.0	0.5	50 Watts	1500	
	SE061A30	5-6	125	4.0	0.5	500 VDC		
	SE121A30	12	500	9.0	1.0	1.0 Amps		
	SE241A30	24	2000	18.0	2.0			
1A Low Level Ruthenium Contact	SE051A40	5-6	500	3.8	0.5	10 Watts	300	
	SE061A40	5-6	125	3.8	0.5	200 VDC		
	SE121A40	12	500	8.0	1.0	0.5 Amps		
	SE241A40	24	2000	16.0	2.0			
1B ®RU	SE051B00	5-6	300	3.8	0.5	10 Watts	250	
	SE061B00	5-6	125	3.8	0.5	200 VDC		
	SE121B00	12	500	8.0	1.0	0.5 Amps		
	SE241B00	24	2000	16.0	2.0			
1C	SE051C00	5-6	200	3.8	0.5	3 Watts	200	
	SE061C00	5-6	125	3.8	0.5	100 VDC		
	SE121C00	12	500	8.0	1.0	0.25 Amps		
	SE241C00	24	2000	16.0	2.0			

DIP AND SIP REED RELAYS



*MICRO SIP WIDTH .200
*MICRO SIP HEIGHT .225

Contact Form	Part Number: No Diode	Part Number: With Diode	Coil VDC	Coil Res. (Ohms)	Must Operate VDC	Must Release VDC	Contact Ratings	Break Down Voltage	Schematic
1A	AD1A05	AD1A05D	5	500	3.8	0.5	10 Watts	250	
	AD1A12	AD1A12D	12	850	8.0	1.0	150 VDC		
	AD1A24	AD1A24D	24	2200	16.0	2.0	0.5 Amps		
2A	AD2A05	AD2A05D	5	200	3.8	0.5	10 Watts	250	
	AD2A12	AD2A12D	12	500	8.0	1.0	150 VDC		
	AD2A24	AD2A24D	24	1750	16.0	2.0	0.5 Amps		
1B	AD1B05	AD1B05D	5	500	3.8	0.5	10 Watts	250	
	AD1B12	AD1B12D	12	500	8.0	1.0	150 VDC		
	AD1B24	AD1B24D	24	1750	16.0	2.0	0.5 Amps		
1C	AD1C05	AD1C05D	5	200	3.8	0.5	3 Watts	250	
	AD1C12	AD1C12D	12	500	8.0	1.0	100 VDC		
	AD1C24	AD1C24D	24	1750	16.0	2.0	0.25 Amps		
1A Hg Wet	AD1A05HG	AD1A05HGD	5	90	4.0	0.5	50 Watts	1000	
	AD1A12HG	AD1A12HGD	12	360	9.0	1.0	100 VDC		
	AD1A24HG	AD1A24HGD	24	1440	18.0	2.0	2.0 Amps		
1A Mini SIP	SD1A05	SD1A05D	5	500	3.8	0.5	10 Watts	250	
	SD1A12	SD1A12D	12	850	8.0	1.0	150 VDC		
	SD1A24	SD1A24D	24	2200	16.0	2.0	0.5 Amps		
1A Micro SIP	SH1A05	N/A	5	500	3.8	0.5	10 Watts	200	
	SH1A12		12	1800	8.0	1.0	100 VDC		
	SH1A24		24	1800	16.0	2.0	0.5 Amps		



"T" SERIES

- Most Economical High Quality Relay
- Axial Leads for Flexible Mounting
- Formed Leads for P.C. Board Mounting

Contact Form	Part Number: Axial	Part Number: Formed (1.00" Center)	Coil VDC	Coil Res.	Must Operate	Must Release	Contact Ratings	Break Down Voltage
1A	T0051A500	TU051A500	5	500	4.0	0.5	10 Watts	300
	T0121A500	TU121A500	12	500	9.0	1.2	200 VDC	
	T0241A2K0	TU241A2K0	24	2000	18.0	2.4	0.5 Amps	
2A	T0052A250	TU052A250	5	250	4.0	0.5	10 Watts	300
	T0122A1K0	TU122A1K0	12	1000	9.0	1.2	200 VDC	
	T0242A2K0	TU242A2K0	24	2000	18.0	2.4	0.5 Amps	
1B	T0051B250	TU051B250	5	250	4.0	0.5	10 Watts	300
	T0121B1K0	TU121B1K0	12	1000	9.0	1.2	200 VDC	
	T0241B2K0	TU241B2K0	24	2000	18.0	2.4	0.5 Amps	

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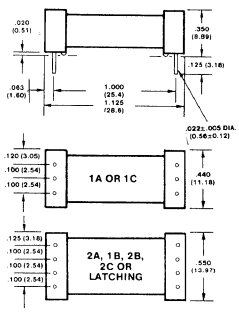
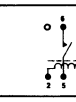
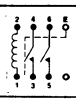
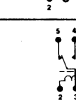
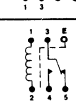
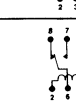
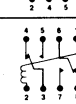
REED RELAYS

OPEN FRAME REED RELAYS (SERIES C AND D)



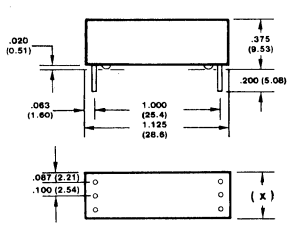
- High Performance, Low Cost Open Frame, PC Mount Dry Reed Relays
- Popular 1.000″ x .100″ or 1.000″ x .150″ Pin Spacing
- Rigid Polyester Relay Body with Epoxy Filled Ends

Specifications	Form A/B	Form C
Power (Resistive Load)	10 Watts	3 Watts
Voltage (Max. Switching)	200 VDC	28 VDC
Voltage (Min. Breakdown)	300 VDC	200 VDC
Current (Max. Switching)	0.5 Amps	0.25 Amps
Current (Max. Carry)	2.0 Amps	1.2 Amps
Capacitance (Typical)	0.2 Pf	0.8 Pf.
Contact Resistance (Max. Initial)	0.2 Ohms	0.2 Ohms
Operate Time (Typical)	0.5 ms	0.5 ms
Release Time (Typical)	0.2/0.5 ms	0.5 ms
Insulation Resistance (Min.)	10^{10} Ohms	10^{9} Ohms
Life (Low Level)	100 x 10^{6} Oper.	50 x 10^{6} Oper.
Life (Rated Load)	10 x 10^{6} Oper.	5 x 10^{6} Oper.
Temperature	−40°C to +85°C	
Vibration	20G to 2000 Hz	
Shock	50G @ 11 MS Duration	

Contact Form	Part Number C End Coil	Part Number D Side Coil	Nom. Coil VDC	Coil Res. (Ohms) ±10%	Max. Pick-up VDC	Min. Drop-out VDC	Width	Schematic Top View C End Coil	Schematic Top View D Side Coil
1A	C051A2R0	D051A2R0	5	500	3.8	0.5	.440		
	C121A2R0	D121A2R0	12	1000	9.0	1.2			
	C241A2R0	D241A2R0	24	2000	18.0	2.4			
2A	C052A2R0	D052A2R0	5	300	3.8	0.5	.550		
	C122A2R0	D122A2R0	12	750	9.0	1.2			
	C242A2R0	D242A2R0	24	1500	18.0	2.4			
4A	C054A2R0	D054A2R0	5	150	3.8	0.5	.640		
	C124A2R0	D124A2R0	12	375	9.0	1.2			
	C244A2R0	D244A2R0	24	1000	18.0	2.4			
1B	C051B2R0	D051B2R0	5	500	3.8	0.5	.550		
	C121B2R0	D121B2R0	12	1000	9.0	1.2			
	C241B2R0	D241B2R0	24	2000	18.0	2.4			
1C	C051C2R0	D051C2R0	5	500	3.8	0.5	.440		
	C121C2R0	D121C2R0	12	1000	9.0	1.2			
	C241C2R0	D241C2R0	24	2000	18.0	2.4			
2C	C052C2R0	D052C2R0	5	300	3.8	0.5	.550		
	C122C2R0	D122C2R0	12	750	9.0	1.2			
	C242C2R0	D242C2R0	24	1500	18.0	2.4			
1A Latching	C051K3R0	D051K3R0	5	375	3.8	0.5	.550		
	C121K2R0	D121K2R0	12	500	9.0	1.2			
	C241K3R0	D241K3R0	24	2000	18.0	2.4			

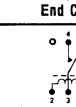
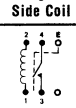
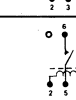
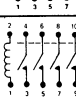
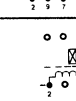
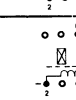
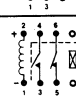
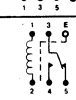
ENCAPSULATED REED RELAYS (SERIES I AND J)

- Total Environmental Protection
- A Wide Variety of Coil and Contact Arrangement Available



Specifications	Form A/B	Form C
Power (Resistive Load)	10 Watts	3 Watts
Voltage (Max. Switching)	200 VDC	28 VDC
Voltage (Min. Breakdown)	300 VDC	200 VDC
Current (Max. Switching)	0.5 Amps	0.25 Amps
Current (Max. Carry)	2.0 Amps	1.2 Amps
Capacitance (Typical)	0.2 Pf	0.8 Pf
Contact Resistance (Max. Initial)	0.2 Ohms	0.2 Ohms
Operate Time (Typical)	0.5 ms	0.5 ms
Release Time (Typical)	0.2/0.5 ms	0.5 ms
Insulation Resistance (Min.)	10^{10} Ohms	10^{9} Ohms
Life (Low Level)	100 x 10^{6} Oper.	50 x 10^{6} Oper.
Life (Rated Load)	10 x 10^{6} Oper.	5 x 10^{6} Oper.
Temperature	−40°C to +85°C	
Vibration	20G to 2000 Hz	
Shock	50G @ 11 MS Duration	

NOTE:
1. Electro-static shielding (E) is optional.
2. On latching relays, (+) indicates set positive.

Contact Form	Part Number I End Coil	Part Number J Side Coil	Nom. Coil VDC	Coil Res. (Ohms) ±10%	Max. Pick-up VDC	Min. Drop-out VDC	Width (X)	Schematic Top View I End Coil	Schematic Top View J Side Coil
1A	I051A2R0	J051A2R0	5	500	3.8	0.5	.375		
	I121A2R0	J121A2R0	12	1000	9.0	1.2			
	I241A2R0	J241A2R0	24	2000	18.0	2.4			
2A	I052A2R0	J052A2R0	5	300	3.8	0.5	.475		
	I122A2R0	J122A2R0	12	750	9.0	1.2			
	I242A2R0	J242A2R0	24	1500	18.0	2.4			
3A	I053A2R0	J053A2R0	5	250	3.8	0.5	.575		
	I123A2R0	J123A2R0	12	500	9.0	1.2			
	I243A3R0	J243A3R0	24	2000	18.0	2.4			
4A	I054A2R0	J054A2R0	5	150	3.8	0.5	.700		
	I124A2R0	J124A2R0	12	375	9.0	1.2			
	I244A2R0	J244A2R0	24	1000	18.0	2.4			
1B	I051B2R0	J051B2R0	5	500	3.8	0.5	.475		
	I121B2R0	J121B2R0	12	1000	9.0	1.2			
	I241B2R0	J241B2R0	24	2000	18.0	2.4			
1A1B	I052F2R0	J052F2R0	5	250	3.8	0.5	.575		
	I122F2R0	J122F2R0	12	500	9.0	1.2			
	I242F3R0	J242F3R0	24	2000	18.0	2.4			
1C	I051C2R0	J051C2R0	5	500	3.8	0.5	.375		
	I121C2R0	J121C2R0	12	1000	9.0	1.2			
	I241C2R0	J241C2R0	24	2000	18.0	2.4			
2C	I052C2R0	J052C2R0	5	300	3.8	0.5	.500		
	I122C2R0	J122C2R0	12	750	9.0	1.2			
	I242C2R0	J242C2R0	24	1500	18.0	2.4			
4C	I054C2R0	J054C2R0	5	50	3.8	0.5	.875		
	I124C2R0	J124C2R0	12	300	9.0	1.2			
	I244C2R0	J244C2R0	24	800	18.0	2.4			
1A Latching	I051K3R0	J051K3R0	5	375	3.8	0.5	.475		
	I121K2R0	J121K2R0	12	500	9.0	1.2			
	I241K3R0	J241K3R0	24	2000	18.0	2.4			

American Relays, Inc.

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REED RELAYS

HIGH POWER SERIES

- Miniature High Power Reed Relays. 50W Contact Rating.
- Open Frame, Encapsulated and Axial Lead Packages are Available

HIGH VOLTAGE SERIES

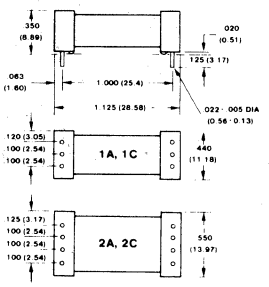
- Miniature High Voltage Reed Relays
- Meets FCC Part 68 Voltage Breakdown Requirement
- Open Frame, Encapsulated and Axial Lead Packages are Available

MERCURY WETTED SERIES

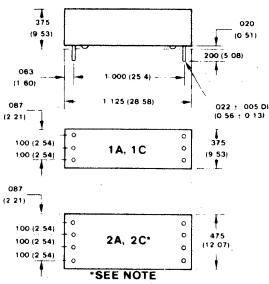
- Miniature Reed Relay with Mercury Wetted Contacts
- No Contact Bounce
- 50 Watts Contact Rating
- Open Frame, Encapsulated and Axial Lead Packages are Available

Specifications	High Power	High Voltage	Mercury Wetted	
			Form A	Form C
Power (Resistive Load)	50 Watts	25 Watts	50 Watts	50 Watts
Voltage (Max. Switching)	200 VDC	1000 VDC	500 VDC	500 VDC
Voltage (Min. Breakdown)	300 VDC	2500 VDC	1500 VDC	1500 VDC
Current (Max. Switching)	1 Amp	1 Amp	2 Amps	1 Amp
Current (Max. Carry)	2 Amps	2 Amps	3 Amps	2 Amps
Capacitance (Typical)	0.2 Pf	0.2 Pf	0.3 Pf	0.7 Pf
Contact Resistance (Max. Initial Typ.)	0.5 Ohms	0.2 Ohms	0.07 Ohms	0.07 Ohms
Operate Time (Typical)	0.5 ms	0.5 ms	1.5 ms	2.0 ms
Release Time (Typical)	0.5 ms	0.2 ms	1.0 ms	2.0 ms
Insulation Resistance (Min. Typ)	10^{10} Ohms	10^{10} Ohms	10^{10} Ohms	10^{9} Ohms
Life (Medium Load)	10 x 10^{6} Oper	100 x 10^{6} Oper.	10^{9} Oper.	10^{9} Oper.
Life (Rated Load)	1 x 10^{6} Oper	10 x 10^{6} Oper	5 x 10^{7} Oper.	5 x 10^{7} Oper.

OPEN FRAME

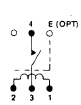
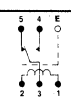
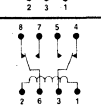


ENCAPSULATED



Note: Dimension for 2 Form C Mercury Encapsulated Relays. Length: 1.175, Width: .600, Height: .375.

PART NUMBERS AND OPERATING CHARACTERISTICS (@ 25°C)

Contact Form	Nom. Coil VDC	Max. Pick-up VDC	Min. Drop-out VDC	High Power			High Voltage			Mercury Wetted*			Schematic Top View
				Coil Res. (Ohms) ±10%	Part Number		Coil Res. (Ohms) ±10%	Part Number		Coil Res. (Ohms) ±10%	Part Number		
					Open Frame	Encapsulated		Open Frame	Encapsulated		Open Frame	Encapsulated	
1A	5	3.8	0.5	500	C051A2TO	I051A2TO	500	C051A2HO	I051A2HO	125	C051A1MO	I051A1MO	
	6	4.5	0.6	125	C061A1TO	I061A1T0	125	C061A1HO	I061A1HO	125	C061A1MO	I061A1MO	
	12	9.0	1.2	750	C121A1TO	I121A1TO	1000	C121A2HO	I121A2HO	750	C121A1MO	I121A1MO	
	24	18.0	2.4	2000	C241A2TO	I241A2TO	2000	C241A2HO	I241A2HO	2000	C241A2MO	I241A2MO	
2A	5	3.8	0.5	100	C052A1TO	I052A1TO	100	C052A1HO	I052A1HO	100	C052A1MO	I052A1MO	
	6	4.5	0.6	100	C062A1TO	I062A1TO	100	C062A1HO	I062A1HO	100	C062A1MO	I062A1MO	
	12	9.0	1.2	300	C122A1TO	I122A1TO	750	C122A2HO	I122A2HO	300	C122A1MO	I122A1MO	
	24	18.0	2.4	1500	C242A2TO	I242A2TO	1500	C242A2HO	I242A2HO	1500	C242A2MO	I242A2MO	
1C	5	4.0	0.5	—	NA	—	—	—	—	100	C051C1MO	I051C1MO	
	12	9.0	1.2	—	NA	—	—	—	—	350	C121C1MO	I121C1MO	
	24	18.0	2.4	—	NA	—	—	—	—	1500	C241C1MO	I241C1MO	
2C	5	4.0	0.5	—	NA	—	—	—	—	75	C052C1MO	I052C1MO	
	12	9.0	1.2	—	NA	—	—	—	—	300	C122C1MO	I122C1MO	
	24	18.0	2.4	—	NA	—	—	—	—	1200	C242C1MO	I242C1MO	

* Mercury wetted relays should be mounted within ±30° from vertical position.

AXIAL LEAD SERIES

- Encapsulated Axial Lead Reed Relays
- Axial Leads Allows Various Mounting Configurations.
- Total Environmental Protection
- Nickel Plated Metal Tube Provides Magnetic Shielding
- Formed Leads are Also Available
- 1 Form A, 2 Form A, 1 Form B, 1 Form C and 2 Form C Types are Available
- Various Contact Ratings Available
- Contact American Relays, Inc. for Specific Part Numbers and Additional Options

SPECIAL RELAY DESIGN

American Relays, Inc. is a custom relay specialist. Our major objective is to design and build parts that fulfill special requirements for the reed relay user.

Our facility is designed and equipped for prompt, systematic processing of samples, prototype and production orders.

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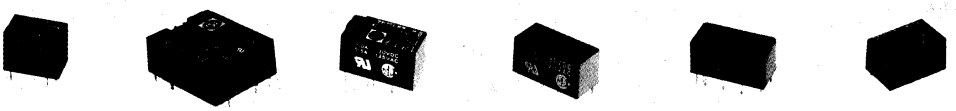
RELAY SELECTION GUIDE



Low Profile Relays

SERIES		AZ 5	AZ 7	AZ 820	AZ 830	AZ 830P	AZ 835
FEATURES		• High Sensitivity • Subminiature Size • Low Cost • Meets FCC Part 68.302 and 68.304	• Meets FCC 1500V Surge Requirement • Low Profile • High Sensitivity • Ag-Pd Contacts Available	• Meets FCC Part 68.302 and 68.304 • Bifurcated Pd-Ag Contacts • Low Profile • Dip Package	• Meets FCC Part 68.302 and 68.304 • Polarized Coil • Dip Package • Bifurcated Contacts • Pd-Ag Contacts Available	• Polarized Magnetic Bistable (Latching) Relay • Meets FCC Part 68.302 and 68.304 • Dip Package • Bifurcated Contacts • Pd-Ag Contacts Available	• Low Profile, 0.32" High • High Sensitivity • Meets FCC Part 68.302 • Latching Versions Available
EPOXY SEALED		Yes	Yes	Yes	Yes	Yes	Yes
CONTACTS	Form	1 Form C	2 and 4 Form C Form D Available	2 Form C	2 and 4 Form C	2 and 4 Form C	2 Form C
CONTACTS	Rating (Resistive)	1A @ 30 VDC or 125 VAC	2A @ 30 VDC or 50 VAC 0.5A @ 125 VAC	2A @ 15 VDC or 30 VAC 1A @ 30 VDC or 60 VAC 0.5A @ 60 VDC or 125 VAC	2 Pole: 2A @ 30 VDC or 60 VAC 1A @ 60 VDC or 125 VAC 0.5A @ 120 VDC or 240 VAC 4 Pole: 2A @ 30 VDC or 30 VAC	2 Pole: 2A @ 30 VDC or 60 VAC 1A @ 60 VDC or 120 VAC 0.5A @ 120 VDC or 240 VAC 4 Pole: 2A @ 30 VDC or 30 VAC	1A @ 30 VDC or 40 VAC
COIL VOLTAGE		5, 6, 9, 12, 24V (DC)	5, 6, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)	5, 6, 9, 12, 24V (DC)
OPERATING POWER AT PICK UP VOLTAGE		Standard Coils: 220 mW Sensitive Coils: 100 mW	2 Pole: 190 mW 4 Pole: 310 mW	250 mW	Standard Coils: 200 mW Sensitive Coils: 100 mW	Standard Coils Monostable: 200 mW Bistable (Latching) Two: 180 mW Sensitive Coils Monostable: 100 mW Bistable (Latching) Two: 90 mW	Monostable Coil: 100 mW Bistable (Latching) Single Coil: 100 mW Bistable (Latching) Two Coil: 130 mW
DIELECTRIC STRENGTH		Between Open Contacts: 1000 Vrms Coil to Contact: 1500 Vrms	Between All Points: 1500 Vrms Between Open Contacts: 750 Vrms	Between All Points: 1500 Vrms Between Open Contacts: 1000 Vrms	Between Open Contacts: 1000 Vrms Between Contact Sets: 1000 Vrms Contact to Coil: 1500 Vrms	Between Open Contacts: 1000 Vrms Between Contact Sets: 1000 Vrms Contact to Coil: 1500 Vrms	Between Open Contacts: 500 Vrms Between Contact Sets: 1000 Vrms Contact to Coil: 1000 Vrms
TYPICAL LIFE OPERATIONS	Electrical	5×10^5 – 1A/30 VDC 5×10^5 – 0.5A/125 VAC	5×10^6 – 1A/26 VDC 10^6 – 2A/30 VDC	5×10^5 – 1A/30 VDC	5×10^5 – 2A/30 VDC or 1A/125 VAC 2×10^6 – 1A/30 VDC or 0.5A/125 VAC	5×10^5 – 2A/30 VDC or 1A/125 VAC 2×10^6 – 1A/30 VDC or 0.5A/125 VAC	10^5 – 1A/30 VDC or 0.3A/125 VAC
TYPICAL LIFE OPERATIONS	Mechanical	5×10^6	10^8	10^7	10^8	10^8	12×10^6
MAXIMUM SIZE IN INCHES L x W x H		0.630 x 0.430 x 0.450	2 Pole 1.200 x 0.826 x 0.458 4 Pole 1.200 x 0.965 x 0.458	0.795 x 0.394 x 0.453	2 Pole 0.788 x 0.390 x 0.371 4 Pole 1.09 x 0.390 x 0.390	2 Pole 0.788 x 0.390 x 0.366 4 Pole 1.39 x 0.390 x 0.390	0.630 x 0.390 x 0.315
TERMINALS	PC	X	X	X	X	X	X
	Solder/Plug-in	—	—	—	—	—	—
UL/CSA/VDE		UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA

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General Purpose Relays

SERIES		AZ 845	AZ 2530/2531	AZ 3	AZ 4	AZ 8	AZ 420
FEATURES		• Micro Miniature Size • High Sensitivity • Meets FCC Part 68.302 • Bistable (Latching) Versions Available	• Low Profile • High Insulation Resistance • High Sensitivity • Long Life	• Ultra High Sensitivity • Wide Switching Range • Rugged Construction	• Subminiature Size • Low Cost • Rugged Construction • Meets FCC Part 68.302 and 68.304 • Wide Switching Range	• High Sensitivity • Subminiature Size • Low Cost • Wide Switching Range • Class F (155°C) Version Available	• Versatile Contact Configurations • Wide Switching Range • High Sensitivity • Long Life
EPOXY SEALED		Yes	Yes	Yes	Yes	Yes	Yes
CONTACTS	Form	2 Form C	1 and 2 Form C	1 Form C	1 Form C	1 Form A and C	1-6 Form C Forms A, B, & D Available
CONTACTS	Rating (Resistive)	1A @ 30 VDC or 60 VAC 0.5A @ 125 VAC	2A @ 26 VDC 1A @ 120 VAC	3A @ 30 VDC or 240 VAC 5A @ 30 VDC or 240 VAC 10A @ 30 VDC or 240 VAC	3A @ 30 VDC or 125 VAC 5A @ 30 VDC or 125 VAC	Form A 10A @ 30 VDC or 120 VAC Form C 3A @ 30 VDC or 200 VAC 6A @ 30 VDC or 300 VAC	2A @ 28 VDC or 115 VAC 3A @ 30 VDC or 115 VAC 7.5A @ 30 VDC or 115 VAC
COIL VOLTAGE		3, 5, 6, 9, 12, 24V (DC)	5, 6, 12, 24, 48V (DC)	6, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)	3 thru 115V (DC)
OPERATING POWER AT PICK UP VOLTAGE		Monostable Coil: 79 mW (3-12 VDC) 113 mW (24 VDC) Bistable (Latching) Two Coil: 113 mW (3-12 VDC) 169 mW (24 VDC)	Standard 1 Form C: 125 mW Sensitive 1 Form C: 80 mW Standard 2 Form C: 250 mW	3 & 5A Contact: 70 mW 10A Contact: 150 mW	230 mW	110 to 210 mW Standard Coil: 210 mW Sensitive Coil: 110 mW to 140 mW	Standard Coils: 450 to 850 mW Sensitive Coils: 40 mW per pole, 25 mW per pole Available
DIELECTRIC STRENGTH		Between Open Contacts: 750 Vrms Between Contact Sets: 1000 Vrms Contact to Coil: 1000 Vrms	Contact to Contact: 500 Vrms Contact to Coil: 500 Vrms	Between All Points: 1500 Vrms Contact to Contact: 750 Vrms	Contact to Contact: 1000 Vrms Contact to Coil: 1500 Vrms	Contact to Contact: 750 Vrms Contact to Coil: 2000 Vrms	Between All Points: 1000 Vrms 1500 Vrms Versions Available
TYPICAL LIFE OPERATIONS	Electrical	2×10^5 – 1A/30 VDC 10^5 – 0.5 A/125 VAC	10^6 – 1A/26 VDC or 0.5A/115 VAC 2×10^5 – 2A/26 VDC or 1A/115 VAC	2×10^5 (at rated load)	10^5 (at rated load)	(LD) 10^5 – 3A/120 VAC 5×10^5 – 3A/24 VDC (MD) 10^5 – 6A/24 VDC or 120 VAC (HD) 5×10^4 – 10A/30 VDC or 120 VAC	1×10^8 – 10 mA/6 VDC 1.5×10^6 – 2A/28 VDC or 115 VAC 2×10^5 – 5A/28 VDC or 115 VAC 1×10^5 – 7.5A/28 VDC or 115 VAC
TYPICAL LIFE OPERATIONS	Mechanical	5×10^7	10^7	5×10^6	10^7	2×10^7	5×10^8
MAXIMUM SIZE IN INCHES L x W x H		0.551 x 0.354 x 0.158	1 Pole 1.090 x 0.593 x 0.445 2 Pole 1.090 x 0.888 x 0.445	1.210 x 0.750 x 1.190	0.866 x 0.635 x 0.745	0.830 x 0.630 x 0.560	2 Pole 0.940 x 0.735 x 1.230 6 Pole 1.395 x 0.735 x 1.230
TERMINALS	PC	X	X	X	X	X	X
	Solder/Plug-in	—	—	—	—	—	X
UL/CSA/VDE		UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA

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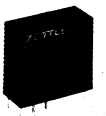
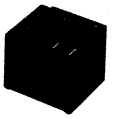
AZ





Power Relays

SERIES		AZ 690	AZ 695	AZ 730	AZ 735	AZ 2100
FEATURES		• High Dielectric Strength, 4000 Vrms • Complete List of International Approvals • 10 Amp Switching Capability in Compact Size	• Utilizes only 0.18 Sq. in. of PCB Area • 5 Amp Switching in Miniature Size • High Dielectric Strength, 3000 Vrms • High Sensitivity	• High Dielectric Strength, 4000 Vrms • Complete List of International Approvals • 8 Amp Switching Capability in Compact Size	• High Dielectric Strength, 5000 Vrms • Complete List of International Approvals • 16 Amp Switching Capability in Compact Size	• Oversize Contact Switching Up to 30 Amps • Versatility of Both PC and .250" Fast-On Tabs for Contacts • Complete UL and CSA Approvals • Class F (155°C) Version Available
EPOXY SEALED		Yes	Yes	Yes	Yes	Yes
CONTACTS	Form	1 Form A, B, or C	1 Form A	2 Form A, B, or C	1 Form A or C	1 Form A, B, or C
CONTACTS	Rating (Resistive)	10A @ 30 VDC or 200 VAC 1/4 HP 120 VAC Motor Load	5A @ 30 VDC or 250 VAC	8A @ 30 VDC or 120 VAC 1/8 HP 120 VAC Motor Load	16A @ 30 VDC or 200 VAC 1/2 HP 120 VAC Motor Load A300 Pilot Duty TV5 Rating	Form A – 30A @ 30 VDC or 240 VAC Form B – 15A @ 30 VDC or 300 VAC Form C (NO)– 20A @ 30 VDC or 300 VAC
COIL VOLTAGE		5, 6, 12, 24, 48V (DC)	5, 6, 9, 12, 18, 24V (DC)	5, 6, 12, 24, 48V (DC)	6, 12, 24, 48V (DC)	5, 6, 9, 12, 16, 18, 24, 48, 70, 110V (DC)
OPERATING POWER AT PICK UP VOLTAGE		Standard Coils: 350 mW Sensitive Coils: 250 mW	100 mW	Standard Coils: 350 mW Sensitive Coils: 250 mW	350 mW	500mW
DIELECTRIC STRENGTH		Coil to Contact: 4000 Vrms Between Open Contact: 1000 Vrms	Contact to Contact: 750 Vrms Coil to Contact: 3000 Vrms	Coil to Contact: 4000 Vrms Contact to Contact: 2500 Vrms Between Open Contacts: 1000 Vrms	Coil to Contact: 5000 Vrms Between Open Contact: 1000 Vrms 10,000 V Surge, Max., 40 Micro Seconds, Contact to Coil	Coil to Contact: 2500 Vrms Between Open Contacts: 1500 Vrms
TYPICAL LIFE OPERATIONS	Electrical	5×10^4 – 10A/30 VDC or 115 VAC 2×10^5 – 8A/250 VAC	10^5 – 5A/30 VDC or 250 VAC	10^5 8A/30 VDC 2×10^5 – 8A/115 VAC or 6A/250 VAC	10^5 – 16A/30 VDC 2×10^5 – 16A/120 VAC 10^5 – 14A/250 VAC	10^5 (at rated load)
TYPICAL LIFE OPERATIONS	Mechanical	3×10^7	2×10^7	3×10^7	10^7	10^7
MAXIMUM SIZE IN INCHES L x W x H		SLIMPAK — 1.110 x 0.467 x 1.030 THINPAK — 1.110 x 1.030 x 0.441	0.690 x 0.256 x 0.492	1.110 x 0.496 x 1.030	1.110 x 0.469 x 1.040	OPEN 1.200 x 0.970 x 0.618 ENCASED 1..270 x 1.080 x 1.100
TERMINALS	PC	X	X	X	X	X
	Solder/Plug-in	—	—	—	—	Quick Connect
UL/CSA/VDE		UL/CSA/VDE	UL/CSA	UL/CSA/VDE	UL/CSA/VDE	UL/CSA

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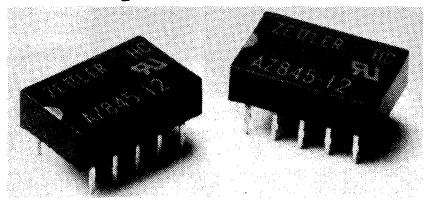
The AZ 845: The Industry's Smallest Relay Sets the Standard in Peformance and Space Economy.

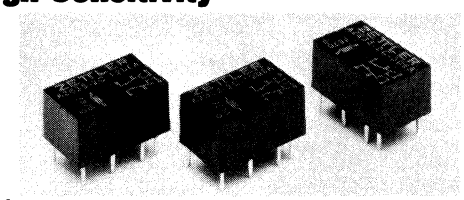


FEATURES

- Micro Miniature Size: .158 inches (4 mm) in height; .551 inches (14 mm) in length; .354 inches (9 mm) in width
- High Sensitivity, 79 mW Pick Up
- Monostable and Bistable (Latching) Two Coil Versions Available
- Meets FCC Part 68.302 1500 V Lightning Surge
- DIL Terminal Layout, Fits 10 Pin IC Socket
- Epoxy Sealed for Automatic Wave Soldering and Cleaning
- UL File E43203; CSA LR 36664

NEW PRODUCT SHOWCASE

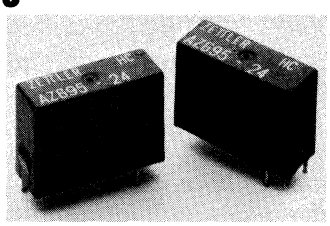
The AZ 835: This Polarized 1 Amp Relay Features Low Profile & High Sensitivity



Features

- Low Profile, 0.32" High
- High Sensitivity, 100mW Pickup
- Non-Latching or Latching, Single or 2 Coil Versions Available
- Bifurcated Crossbar Contacts
- Epoxy Sealed for Automatic Wave Soldering and Cleaning
- 2 Form C Contact with up to 1 Amp Switching Capability
- Meets FCC Part 68.302 1500 V Lightning Surge
- UL File E43203; CSA LR 36664

The AZ 695: This Sensitive 5 Amp Relay Requires Less Space Yet Provides More Performance



Features

- Extremely Small Footprint Utilizing Only 0.18 Square Inch of PCB Area
- Thin Vertical Profile Only 0.256" Wide
- 1 Form A Contact with up to 5 Amp Switching Capability
- High Sensitivity, 100 mW Pickup
- Dielectric Strength 3000 Vrms Contact to Coil
- Coils to 24 VDC
- Epoxy Sealed for Automatic Wave Soldering and Cleaning
- Sockets are also Available
- UL File E44211; CSA LR 36664

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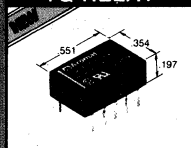
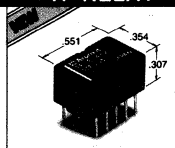
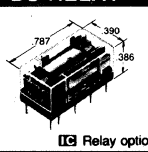
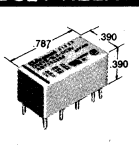
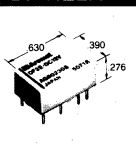
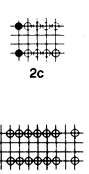
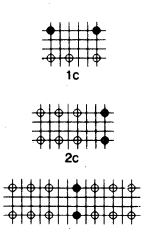
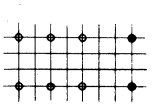
Aromat Relay Selector Chart

	NEW T-SERIES		High Breakdown Voltage Capacity	2C, 200mW Sensitive Miniature Relay	High sensitive DIL Miniature
	TQ-RELAY	TF-RELAY	DS-RELAY	DS2Y-RELAY	DF-RELAY
• Type of relay			 IC Relay option		
• Features	• Ultra-small size • High sensitivity • 1,500V FCC • 4 pole model available	• Most sensitivity • Ultra-small size • 1,500V FCC	• 1,500V FCC surge satisfied • High sensitivity • High switching power • M.B.B. contact available	• High sensitivity • 2 Form C contact • 1,500V FCC • Sealed construction	• Smaller than most 2 form C relays • High sensitivity • DIL
• Sealed types availability	●	●	●	●	●
• Latching types availability	●	●	●	●	●
• Contact material	Gold-clad silver	Gold-clad silver	Gold-clad silver (Silver palladium)	Gold-clad silver	Gold-clad silver
• Rating (Reference value) Nominal (Note 1)	1 A 30 V DC	1 A 30 V DC	2 A 30 V DC	2 A 30 V DC	1 A 30 V DC
Minimum	10 µA 10 mV DC	10 µA 10 mV DC	10 µA 10 mV DC	10 µA 10 mV DC	1 mA 1 V DC
• Contact arrangement	2C, 4C	2C	1C, 2C, 2D, 4C	2C	2C
• Life (Min. operations) Electrical	2×10^5	2×10^5	5×10^5	10^5	10^5
Mechanical	10^8	10^8	10^8	10^8	(Single) 5×10^6 (Latching) 10^6
• Breakdown voltage between open contacts	750Vrms	750Vrms	1,000Vrms (500 Vrms for DS1-S)	750Vrms	500Vrms
• Breakdown voltage between contact sets	1,000Vrms	1,000Vrms	1,000Vrms	1,000Vrms	500Vrms
• Breakdown voltage between contact and coil	1,000Vrms	1,000Vrms	1,500Vrms (1,000 Vrms for DS1-S)	1,000Vrms	1,000Vrms
• Operating speed	—	—	—	—	—
• Surge withstand voltage	1,500V FCC	1,500V FCC	1,500V FCC	1,500V FCC	1,500V FCC
• Coil ratings	(DC) 3, 5, 6, 9, 12, 24 V	(DC) 3, 5, 6, 9, 12, 24, 48V	(DC) 1.5, 3, 5, 6, 9, 12, 24, 48V	(DC) 1.5, 3, 5, 6, 9, 12, 24, 48V	(DC) 1.5, 3, 5, 6, 9, 12, 24V
• Power consumption	(Single) (2C) 140mW (4C) 280mW (−L2) 200mW	80mW (DC 3 to 12V) 140mW (DC 24V) 360mW (DC48V)	M type (Single) 400mW (−L2) 360mW S type (Single) 200mW (−SL2) 180 mW	(Single) 200mW (300mW: 48V) (−L2) 180mW (360mW: 48V)	(Single) 200mW (−L) 100mW (−L2) 200mW
• Terminal layout (Bottom View) PC board terminal (0.100 inch grid)	 2c 4c		 1c 2c 4c		
• Mounting					

Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals

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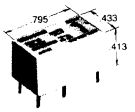
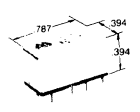
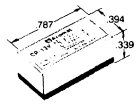
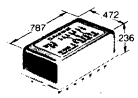
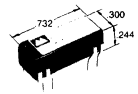
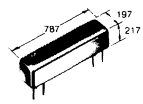
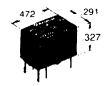
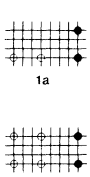
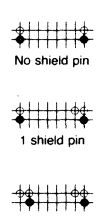
DSP-RELAY	**R-RELAY**	**DR-RELAY**	**DX-RELAY**	**DA-RELAY**	**DB-RELAY**	**HD-RELAY**
	 IC Relay option	 IC Relay option				
• High switching capacity • High sensitivity • High contact welding resistance • High breakdown voltage	• Magnetically shielded • High sensitivity • High speed operation	• High sensitivity • High contact force • High breakdown voltage • High speed operation	• DX2-HT types with 200°C resistance available • High radio frequency characteristics • High shock and vibration resistance	• DIL terminal • Glass encapsulated reed switch	• High insulation resistance • High sensitivity • High speed operation	• Ultra-small type • High sensitivity • Sealed construction
●	●	●	●	●	●	●
●	●	●	●			
Gold flash over silver alloy	Gold cobalt	Gold cobalt	Gold-clad silver alloy	Rh-plated nickel-iron alloy	Rhodium	Gold-clad silver
8 A 250 V AC 5 A 30 V DC 5 A 250 V AC 5 A 30 V DC 1a 1a1b, 2a	1 A 20 V DC 10 µA 100 mV DC	1 A 20 V DC 10 µA 100 mV DC	1 A 30 V DC 10 µA 30 mV DC	0.2 A 48 V DC 1 mA 100 mV DC	0.4 A 24 V DC 100 µA 5 V DC	1 A 30 V DC 1 mA 1 V DC
1a, 1a1b, 2a	1C	1C	2C	1a, 2a	1a	1C
10^5	10^6	10^6	2×10^5	10^6	10^6	10^5
5×10^7	10^9	10^9	3×10^7	10^8	2×10^8 (2 shield pin)	5×10^6
1,000Vrms	350Vrms or 500VDC	750Vrms	500Vrms	200VDC (1 min.)	200VDC (1 min.)	500Vrms
2,000Vrms	—	—	500Vrms	—	—	—
3,000Vrms	1,000Vrms	1,500Vrms	500Vrms	500VDC (1 min.)	500VDC (1 min.)	500Vrms
—	1,000Vrms	1,000Vrms	500Vrms	—	500VDC (1 min.)	—
5,000V surge		1,500V FCC				
(DC) 3, 5, 6, 9, 12, 24V	(DC) 5, 6, 12, 24, 48V	(DC) 3, 5, 6, 12, 24, 48V	(DC) 3, 5, 6, 12, 24V	(DC) 5, 6, 12, 24V	(DC)1.5, 3, 5, 6, 9, 12, 15, 18, 24V	(DC) 1.5, 3, 5, 6, 9, 12, 24V
(Single) 300mW (–L) 150mW (–L2) 300mW	(Single) 150 to 280mW (–L) 70 to 100mW (–L2) 150 to 230mW	(Single) 96 to 209mW (–L) 56 to 109mW (–L2) 111 to 290mW	(Single) 125 to 144mW (–L) 125 to 144mW (–L2) 250 to 288mW	(1a) 230mW (2a) 325mW	(Standard) 130mW (High sensitivity for 5V type) 80mW	280 to 300mW
						

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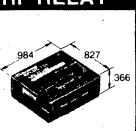
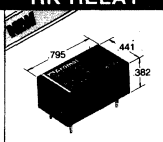
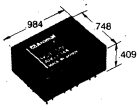
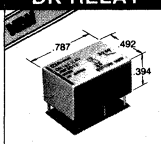
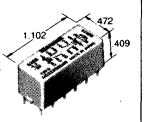
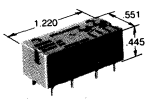
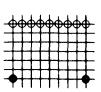
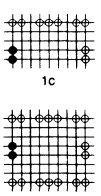
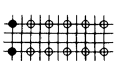
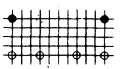
Aromat Relay Selector Chart

	High Frequency	High Frequency	1C and 2C High Frequency	Miniature Power	High Density	Field Switching Power
	RF-RELAY	RK-RELAY	RG-RELAY	DK-RELAY	SEB-RELAY	STE-RELAY
• Type of relay inch					 IC Relay option	 IC Relay option
• Features	• Excellent high frequency • High reliability and long life • Flux-resistant molded construction	• Excellent high frequency characteristics • High sensitivity in small size	• Excellent high frequency • Wide selection • 1A 24VDC	• Large capacity in small size • High sensitivity • High breakdown voltage	• High sensitivity • High vibration and shock resistance • Low thermal electromotive force	• Large capacity in small size • Capable of switching field inductive loads • High inrush capability
• Sealed types availability	●	●	●	●	●	●
• Latching types availability		●	●	●	●	●
• Contact material	(Stationary contact) Gold-plated nickel silver (Movable contact) Gold-clad phosphorus bronze	Gold-clad silver	Gold-clad silver	Gold flash over silver alloy	Gold-clad silver alloy	Gold flash over silver alloy
• Contact rating chart Maximum (cos φ = 1) 15 A / 10 A / 6 A / 5 A / 3 A / 2 A / 1 A	0.01 A 24 V DC	0.01A 24VDC	1 A 24 V DC	10A 250VAC 10A 30VDC	4 A 250 V AC	8 A 250 V AC
Minimum 1 mA / 100 µA / 10 µA	30 µA 3 mA DC				100 µA 100 mV	1 mA 1 V
• Contact arrangement	1C	1C	1C, 2C	1a	2a2b, 4a	1a1b, 2a
• Life (Min. operations) Electrical	10^5	3×10^5	10^5	10^5	10^5	10^5
• Life (Min. operations) Mechanical	5×10^6	5×10^6	5×10^6	5×10^7	10^8	10^7
• Breakdown voltage Between open contacts	1,000Vrms	500Vrms	1,000Vrms	1,000Vrms	750Vrms	1,200Vrms
• Breakdown voltage Between contact sets	—	—	—	4,000Vrms	1,000Vrms	2,000Vrms
• Breakdown voltage Between contacts and coil	2,000Vrms	1,000Vrms	2,000Vrms	4,000Vrms	1,500Vrms	3,750Vrms
• Breakdown voltage Between live parts and ground	Between contacts and ground: 500Vrms. Between ground and coil: 2,000Vrms	500Vrms	500Vrms	—	—	—
• Surge withstand voltage	—	—	—	—		6,000V surge
• Coil voltage	(DC) 5, 6, 9, 12, 24, 48V	(DC) 3, 5, 6, 9, 12, 24V	(DC) 3, 5, 6, 9, 12, 24, 48V	(DC) 3, 5, 6, 9, 12, 24V	(DC) 3, 5, 6, 12, 24, 48V	(DC) 3, 5, 6, 9, 12, 24, 48V
• Nominal operating power	450mW	(Single) 200mW (−L) 200mW (−L2) 400mW	(Single) 350 to 400mW (−L) 180 to 200mW (−L2) 350 to 400mW	200mW	192 to 355mW	240mW
• Terminal layout (Bottom View) ●: coil terminal (.100 inch grid) mm inch			 1c 2c			
• Mounting method						

Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals

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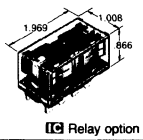
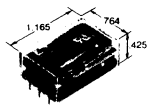
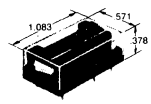
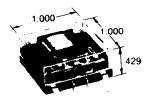
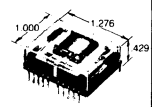
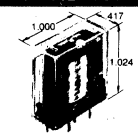
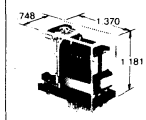
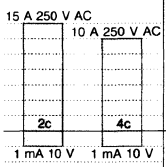
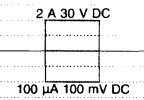
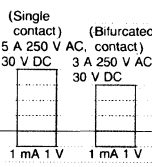
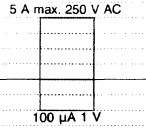
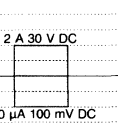
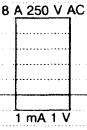
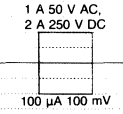
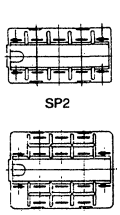
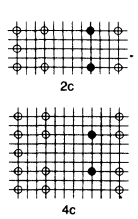
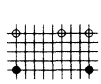
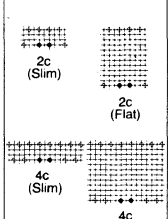
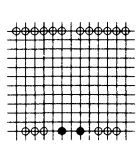
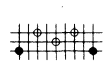
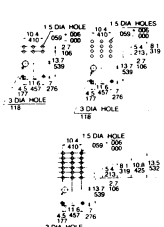
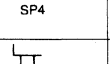
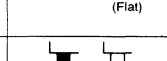
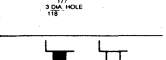
SP-RELAY	NF-RELAY	NB-RELAY	NC-RELAY	NL-RELAY	NT-RELAY	K-RELAY
 TÜV Relay option						
• High sensitivity • High vibration and shock resistance • Wide switching range	• 1,500V FCC surge satisfied • Low profile • High sensitivity • MBB contacts available	• 1500V FCC surge staisfied • Thin height • 5A contact rating • Low profile	• Flatpack and lean line • DIL terminal • Bifurcated contacts	• 6PDT Flat-pack • Low operating power • MBB contacts available	• Large capacity 8A • Compact size	• Patented magnetic system • Long life • Bifurcated contact
	●	●	●	●		●
●		●	●	●		
Silver alloy/gold-plated silver alloy	Gold-clad silver (Silver palladium)	(Single) Silver nickel (Bifurcated) Gold-clad silver nickel	Gold-clad Silver nickel	Gold-clad silver	Gold-clad silver nickel	Gold-clad silver/ silver
						
2C, 4C	2C, 4C, 2D, 4D	1C	2C, 4C	6C, 6D	1C	2C, 4C, 6C
10^5	10^6	2×10^5	(2C) 10^5 (4C) 10^5	5×10^5	10^5	10^6
5×10^7	(2C) 3×10^8 (4C) 10^8	10^7	2×10^7	5×10^7	10^7	10^8
1,500Vrms	750Vrms	1,000Vrms	1,000Vrms	1,000Vrms	1,000Vrms	750Vrms
3,000Vrms	1,000Vrms	—	1,000Vrms	1,000Vrms	—	750Vrms
3,000Vrms	1,000Vrms	2,000Vrms	2,000Vrms	2,000Vrms	2,000Vrms	1,500Vrms
—	1,000Vrms	—	—	—	—	1,250Vrms
	1,500V FCC	1,500V FCC				
(DC) 3, 5, 6, 12, 24, 48V	(DC) 5, 6, 12, 24, 48, 60V	(DC) 3, 5, 6, 12, 24, 48V	(DC) 5, 6, 12, 24, 48, 110V	(DC) 5, 6, 12, 24, 48V	(DC) 5, 6, 12, 24, 48V (AC) 6, 12, 24, 48, 115V	(DC) 3, 6, 12, 24, 42, 48, 60, 110V (AC) 6, 12, 24, 28, 42, 48, 60, 110, 220V
300mW	(2C) 300mW (4C) 480mW	400mW	(Single) (2C) 360mW (4C) 720mW (−L2) (2C) 800mW (4C) 1,600mW	(single) 720mW (−L2) 1,600mW	(DC) 290mW (AC) 0.75VA	(2C) 200 to 400mW (4C) 500 to 700mW (6C) 1,300mW
						
						

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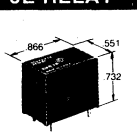
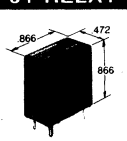
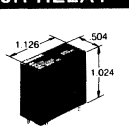
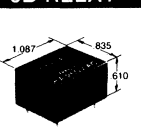
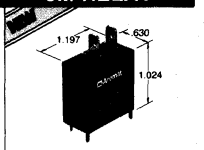
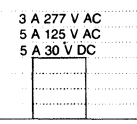
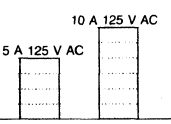
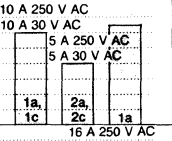
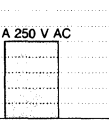
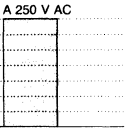
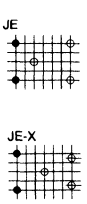
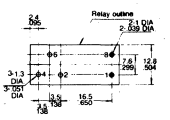
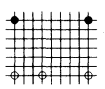
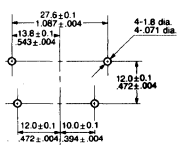
Aromat Relay Selector Chart

	Compact Economical Power	Compact Power	Slim Type Power	Compact Power	Compact Power Relay for Inductive Load
	JE-RELAY	JY-RELAY	JR-RELAY	JB-RELAY	JM-RELAY
• Type of relay (inch)					
• Features	• Compact size • High contact capacity • Safety-oriented design • Close mounting type available	• 5A, 10A types • Class B coil type available • High dielectric withstanding: 5,000V surge	• 16A type available • Wide insulation distance • High inrush current capability	• High dielectric withstanding 10,000V surge • Large capacity 8A in compact size	• Super welding resistance • High surge resistance • Compact high capacity relay for inductive load
• Sealed types availability	●	●			
• Latching types availability					●
• Contact material (Optional material)	Silver alloy	Silver alloy	Silver alloy	Silver alloy	Silver alloy
• Contact rating chart Maximum (cos φ = 1) 20 A 10 A 8 A 5 A 3 A 2 A 1 A					
Minimum 1 mA 100 μA 10 μA			16 A 250 V AC 16 A 30 V AC		
• Contact arrangement	1a, 1C	1C	1a / 1C / 2a / 2C / 1a	1C	1a
• Life (Min. operation) Electrical	10^5	10^5	10^5	10^5	10^5
• Life (Min. operation) Mechanical	5×10^6	5×10^6	5×10^5	10^7	10^6
• Breakdown voltage: Between open contacts	750Vrms	800Vrms	1,000Vrms	1,000Vrms	1,000Vrms
• Breakdown voltage: Between contact sets	—	—	3,000Vrms	—	—
• Breakdown voltage: Between coil and contact set	1,500Vrms	2,000Vrms	5,000Vrms	2,500Vrms	5,000Vrms
• Breakdown voltage: Between coil and ground	—	—	—	—	—
• Surge withstand voltage	5,000V surge	5,000V surge	10,000V surge	10,000V surge	—
• Coil voltage	(DC) 5, 6, 9, 12, 24, 48V	(DC) 5, 6, 9, 12, 24, 48 V	(DC) 6, 12, 24, 48V	(DC) 5, 6, 12, 24, 48V	(DC) 5, 6, 9, 12, 24, 48V
• Nominal operating power	400mW	400mW	530mW	(Up to 24V DC) 480mW (48V DC) 560mW	0.9W
• Terminal layout (Bottom View) ●: coil terminal (.100 inch grid) mm inch					
• Mounting method					

Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals

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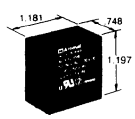
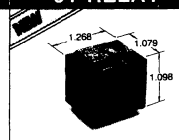
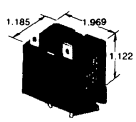
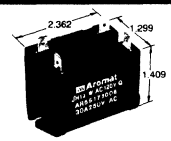
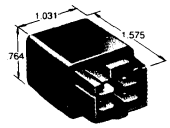
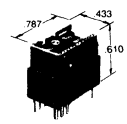
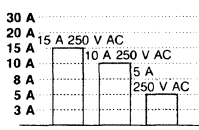
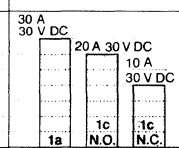
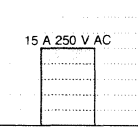
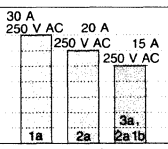
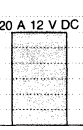
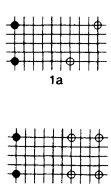
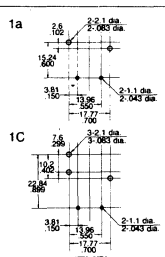
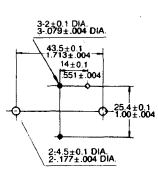
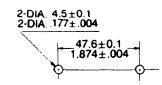
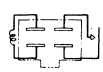
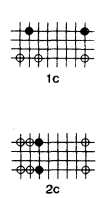
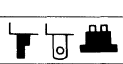
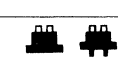
JC-RELAY	JT-RELAY	JA-RELAY	JH-RELAY	CA-RELAY	HB-RELAY
					
• Class B coil type available • TV-rated type available • High dielectric withstanding: 10,000V surge	• High switching capacity • Open, Dust cover, Sealed types available • Class B coil type available	• High switching capacity 55A inrush, 15A steady • TV-rated type available	• High dielectric withstanding: 10,000V surge • High inrush resistance	• Small size • Light weight • Completely water tight • Automotive direct plug-in	• DIP terminal • Flux-resistant • Ag-Pd contacts type available
	●			●	●
			●		
Silver alloy	Silver alloy	Silver alloy	Silver alloy	Silver alloy	Silver nickel (Silver palladium)
					
1a | 2a | 1a1b	1a, 1C	1a, 1b, 1C	1a | 2a | 3a, 2a1b	1a, 1b	1C, 2C
10^5	10^5	10^5	10^5	10^5	2×10^5
5×10^6	10^7	5×10^6	5×10^6	2×10^5	10^7
2,000Vrms	1,500Vrms	1,000Vrms	2,000Vrms	500Vrms	500Vrms
2,000Vrms	—	—	2,000Vrms	—	500Vrms
4,000Vrms	1,500Vrms	2,000Vrms	5,000Vrms	500Vrms	1,000Vrms
—	—	—	—	—	—
10,000V surge	—	5,000V surge	10,000V surge		
(DC) 6, 12, 24, 48V	(DC) 5, 6, 9, 12, 15, 18, 24V	(DC) 6, 12, 24V (AC) 6, 12, 24, 115V	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 120, 220, 240V	(DC) 5, 9, 12, 24V	(DC) 3, 5, 6, 12, 24, 48V
(1a) 0.9W (2a, 1a1b) 1W	890mW	(DC) 1.2W (AC) 1.3VA	(DC) 1.9W (AC) 3.2VA	1.8W	(1C) 360mW (2C) 576mW
					
					

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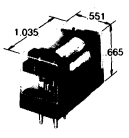
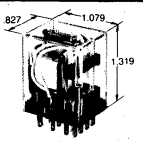
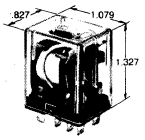
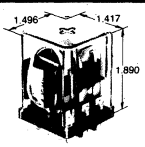
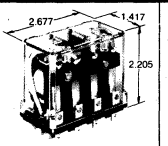
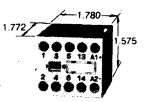
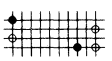
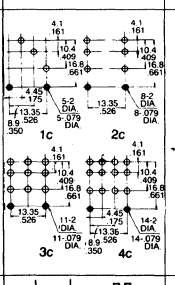
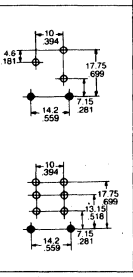
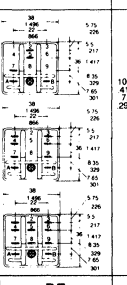
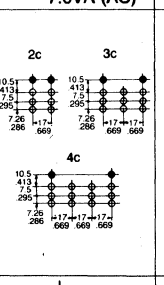
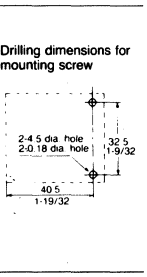
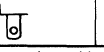
	Subminiature	Miniature Power	Compact Power	10 Amp Power	20 Amp Power	Polarized High Power Relay
	HA-RELAY	HC-RELAY	HL-RELAY	HP-RELAY	HG-RELAY	PC-5 RELAY
• Type of relay inch						
• Features	• Compact size • AC coils	• Wide applications • Versatile range • Foot print compatible with competitive types	• Large capacity • Compact size • Foot print compatible with competitive types	• Long life • Foot print compatible with competitive types	• Large capacity 20A	• Direct motor drive by IC output • Surge suppresion circuit incorporated • Screw terminals
• Sealed types availability	●	●				
• Latching types availability						
• Contact material (Optional material)	Silver nickel	Gold-flashed silver alloy	Silver alloy	Silver alloy	Silver-cadmium-oxide	Silver alloy
• Contact rating chart Maximum (peak current) 20 A 10 A 5 A 3 A 2 A 1 A	3 A 250 V AC, 30 V DC	10 A 250 V AC; 7 A 250 V AC; 5 A 250 V AC; 1c 2c 3c 4c	15 A max. 125 V AC; 10 A max. 250 V AC	10 A max. 250 V AC	20 A max. 250 V AC	15 A 120 V AC X contact; 10 A 240 V AC Y contact
Minimum 100 mA 10 mA 1 mA	10 mA 1 V	1 mA 0.1 V	1 mA 1 V; 1 mA 1 V	10 mA 1 V	10 mA 10 V	
• Contact arrangement	1C	1C 2C 3C 4C	1C 2C	1C, 2C, 3C	2C, 3C, 4C	4X, 3X1Y, 2X2Y
• Life (Min. operation) Electrical	10^5	2×10^5	5×10^5	2×10^5	2×10^5	25×10^4
Mechanical	10^7	(DC) 10^8 (AC) 5×10^7	(DC) 10^8 (AC) 5×10^7	10^7	(DC) 10^6 (AC) 10^7	10^7
• Breakdown voltage Between open contacts	750Vrms	700Vrms	1,000Vrms	(HP31, 32) 1,000Vrms (HP33) 2,000Vrms	2,000Vrms	2,500Vrms
Between adjacent contact sets	—	700Vrms	1,500Vrms	2,000Vrms	2,000Vrms	—
Between contact and coil	1,500Vrms	1,500Vrms	1,500Vrms	2,000Vrms	2,000Vrms	—
Between coil and ground	—	1,500Vrms	—	—	—	—
• Surge withstand voltage						
• Coil voltage	(DC) 5, 6, 9, 12, 24, 48V (AC) 6, 12, 24, 48, 115V	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 115, 220, 240V	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 115, 220, 240V		(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 115, 220, 240V	(DC) 12, 24V
• Nominal operating power	(DC) 360mW (AC) 0.9VA	(DC) 0.9W (AC) 1.2VA	(DC) 0.9 to 1.0W (AC) 1.2 to 1.3VA	(DC) 1.5W (AC) 2.0VA	(2C) 1.4W (DC) 3.6VA (AC) (3C) 1.6W (DC) 5.2VA (AC) (4C) 2.0W (DC) 7.6VA (AC)	500mW
• Terminal layout (Bottom view) • mm/inch (100 mil) grid						
• Mounting						

Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals

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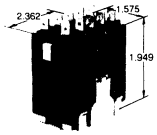
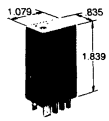
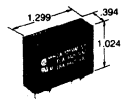
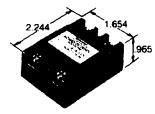
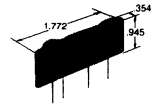
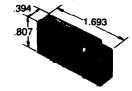
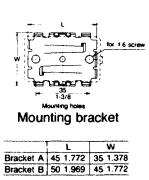
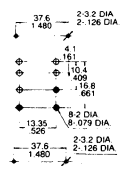
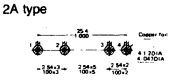
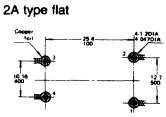
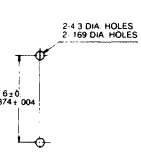
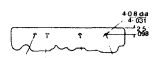
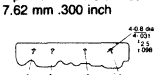
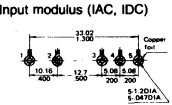
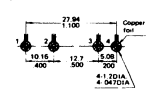
VC-RELAY	H-OP RELAY	AQ1-RELAY	AQ2-RELAY	AQ8-RELAY	I/O-RELAY
					
• Large capacity with Form X contacts	• No heat sink required • Long life • Latching types available	• Both slim and flat package • Zero-voltage turn ON and zero-current turn OFF • No chattering or bouncing	• 2 types of isolation zero-cross reed relay • Triac use for load control	• Slim type • Snubber circuit integrated • Zero-cross and nonzero-cross	• Input and output modules for interfacing between CPU and load • 4 types: IAC, OAC, IDC, ODC
		●		●	●
	●				
Silver-cadmium-oxide	Gold flash silver alloy				
20 A max. 220 V AC	5 A type 10 A type	1 A 1 A type 2 A 2 A type 5 A 5 A type	10 A 10 A type 20 A 20 A type	2 A	input module 15 mA Output module 2 A
1X, 2X, 3X, 4X, 1X1Y, 2X1Y, 2X2Y, 3X1Y	1a	—	—	—	Input module Output module
2.5×10^5	10^7	—	—	—	—
10^6	10^7	—	—	—	—
2,500Vrms	—	—	—	—	—
2,500Vrms	—	—	—	—	—
2,500Vrms	3,000Vrms (HOP5A) 3,750Vrms (HOP10A)	3,000Vrms for input-output	1,500Vrms for input-output	3,000Vrms for input-output	4,000Vrms for input-output
—	—	—	—	—	—
	6,000V surge (HOP10A)				
(AC) 24, 48, 110, 120, 220, 240V (DC) 12, 24, 48V	(DC) 3, 5, 12, 24V	(Input) 3 to 28VDC	(Input) AQ10A1: 19.2 to 28.8VDC AQ10A2, AQ20A2: 4 to 30VDC	(Input) 5, 12, 24 V DC	(Input module) AC: 5mA 80 to 140VAC DC: 20mA, 3 to 32VDC
5.0 to 6.6VA	HOP5A (Single) (−L2) 300–360mW (−L) 150mW HOP10A (Single) (−L2) 240–280mW (−L) 120mW	—	—	—	—
 Mounting bracket L W Bracket A 45 1.772 35 1.378 Bracket B 50 1.969 45 1.772	HOP 5 A HOP 10 A 	2A type  2A type flat 	 Mounting hole	Input terminals distance 5.08 mm .200 inch  Input terminals distance 7.62 mm .300 inch 	Input modulus (IAC, IDC)  Output modules (OAC, ODC) 

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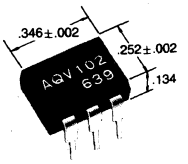
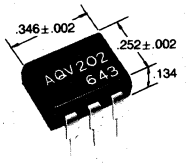
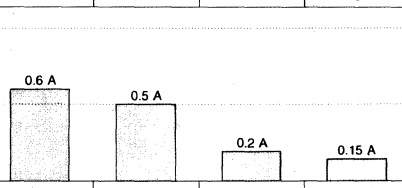
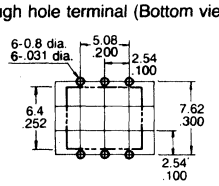
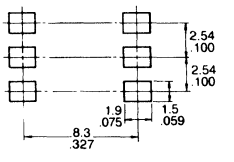
Aromat Relay Selector Chart

			Photo-MOS Relay							
			AQV10 Types				AQV20 Types			
			DC Type				AC/DC Type			
• Type of relay										
inch										
• Features			• Low on-resistance • Control with an input current of 10 mA							
• Output	Load voltage*	Peak AC	—	—	—	—	40 V	60 V	250 V	400 V
		DC	40 V	60 V	250 V	400 V	40 V	60 V	250 V	400 V
	Load current	1 A 0.5 A								
	Peak load current		1.8 A	1.5 A	0.6 A	0.5 A	1.8 A	1.5 A	0.6 A	0.5 A
	Power dissipation*		180 mW				180 mW			
	ON resistance	Typical	0.3 Ω	0.37 Ω	2.7 Ω	6.3 Ω	0.6 Ω	0.74 Ω	5.5 Ω	12.4 Ω
		Maximum	0.5 Ω	0.7 Ω	4 Ω	8 Ω	1 Ω	1.4 Ω	8 Ω	16 Ω
	Off state leakage current		1 μA or less				1 μA or less			
• Input	LED continuous forward current*		50 mA				50 mA			
	LED reverse voltage*		6 V				6 V			
	Peak forward current		1 A				1 A			
	Power dissipation*		150 mW				150 mW			
	LED operate current	Typical	2.3 mA				2.4 mA			
		Maximum	5 mA				5 mA			
	LED turn off current	Typical	0.8 mA				0.8 mA			
		Maximum	2.2 mA				2.2 mA			
	LED drop out voltage	Typical	2.3 V				2.3 V			
		Maximum	3 V				3 V			
• Switching speed	Turn on	Typical	0.23 msec.	0.22 msec.	0.13 msec.	0.09 msec.	0.3 msec.	0.41 msec.	0.21 msec.	0.18 msec.
		Maximum	1 msec.	1 msec.	1 msec.	1 msec.	1 msec.	1 msec.	1 msec.	1 msec.
	Turn off	Typical	0.07 msec.	0.07 msec.	0.07 msec.	0.08 msec.	0.08 msec.	0.08 msec.	0.07 msec.	0.07 msec.
		Maximum	1 msec.	1 msec.	1 msec.	1 msec.	1 msec.	1 msec.	1 msec.	1 msec.
• Total power dissipation*			210 mW				210 mW			
• I/O isolation voltage*			1,500 V AC				1,500 V AC			
• Temperature limits	Operating*		−20°C to +80°C −4°F to 176°F				−20°C to +80°C −4°F to 176°F			
	Storage*		−40°C to +100°C −40°F to 212°F				−40°C to +100°C −40°F to 212°F			
• I/O capacitance	Typical		1.3 pF				1.3 pF			
	Maximum		3 pF				3 pF			
• Initial I/O isolation resistance			1,000 MΩ (min.)				1,000 MΩ (min.)			
• Terminal layout (mm, inch grid) Tolerance: ±0.1 ±.004			Through hole terminal (Bottom view) 				Surface mount terminal Mounting pad (Top view) 			

*The values are absolute maximum ratings (25°C 77°F).

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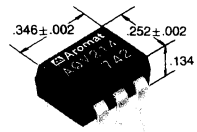
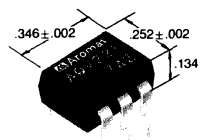
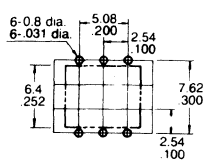


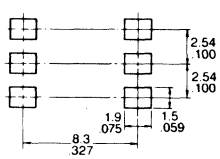


• High sensitivity (input current of 5 mA)	• For high frequency applications • Low "off state" leakage current	
400 V	40 V	80 V
400 V	40 V	80 V
0.1 A	0.08 A	0.05 A
0.3 A	0.3 A	0.3 A
500 mW	230 mW	
30 Ω 50 Ω	22 Ω 35 Ω	36 Ω 50 Ω
1 μA or less	10 nA or less	
50 mA	50 mA	
3 V	3 V	
1 A	1 A	
75 mW	75 mW	
1 mA 3 mA	0.9 mA 3 mA	
0.4 mA 0.79 mA	0.4 mA 0.85 mA	
1.25 V 1.5 V	1.14 V 1.5 V	
0.21 msec. 0.5 msec.	0.10 msec. 0.3 msec.	
0.05 msec. 0.2 msec.	0.03 msec. 0.1 msec.	
550 mW	280 mW	
1,500 V AC	1,500 V AC	
−20°C to +80°C −4°F to 176°F	−20°C to +80°C −4°F to 176°F	
−40°C to +100°C −40°F to 212°F	−40°C to +100°C −40°F to 212°F	
0.8 pF 1.5 pF	0.8 pF 1.5 pF	
1,000 MΩ (min.)	1,000 MΩ (min.)	

Through hole terminal (Bottom view)



Surface mount terminal
Mounting pad (Top view)



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Clare Division Products

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Clare·ification Chart-Relays

Product Name	Contact Form	Contact Material	Maximum Switching Power (VA)	Maximum Switching Voltage (VDC)	Maximum Switching Current (A)	Maximum Switching Max. Carry Current (A)	Nominal Input Power (mW) Reference 5V Version	Operate Time (ms) (Typical)	Life @ Signal (10 VDC, 10 ma) Level Loads (No. Operations)
CLARE RELAYS FORM A, B									
MRBS	1A	RUTHENIUM	5	75	0.15	1.00	10	1.30	20 × 10^6
MRBT	2A, 3A	RUTHENIUM	5	200	0.50	1.00	71	0.50	100 × 10^6
PRMA	1A, 2A, 1B	RUTHENIUM	10	100	0.50	1.00	50	0.25	100 × 10^6
DSS3	1A	RUTHENIUM	10	100	0.50	1.00	63	0.40	200 × 10^6
DSS4	1A	RUTHENIUM	10	100	0.50	1.00	50	0.25	200 × 10^6
CUP V	1A, 2A, 1B, 1A1B, 2A2B	RUTHENIUM	10	200	0.75	2.00	175	0.45	300 × 10^6
CUP 1	1A THRU 5A, 1B, 2B	RUTHENIUM	10	200	0.75	2.00	73	0.70	300 × 10^6
PRME	1A	RUTHENIUM	10	100	0.50	1.00	50	0.25	100 × 10^6
MRB	1A, THRU 6A, 1B, 2B	RUTHENIUM	10	200	0.50	1.00	111	1.00	100 × 10^6
951	1A THRU 5A	RUTHENIUM	10	100	0.50	1.00	132	0.50	100 × 10^6
926	1A	RUTHENIUM	10	100	0.50	1.00	35	0.50	100 × 10^6
MSS2	1A	MERCURY	30	350	0.75	2.00	178	1.20	200 × 10^6
MSS4	1A	MERCURY	30	350	0.75	2.00	178	1.20	200 × 10^6
MSS6	2A	MERCURY	30	350	0.75	2.00	312	1.20	200 × 10^6
CUP 6	1A THRU 5A, 1B	MERCURY	30	350	0.75	2.00	179	2.00	200 × 10^6
CUP 5	1A THRU 5A, 1B	MERCURY	30	350	0.75	2.00	179	1.60	200 × 10^6
MMRB	1A THRU 5A	MERCURY	30	350	0.75	2.00	125	1.60	200 × 10^6
HRM	1A, 2A	MERCURY	50	350	0.75	3.00	75	1.60	1000 × 10^6
HRB	1A THRU 5A	MERCURY	50	350	0.75	3.00	125	2.00	1000 × 10^6
851	1A THRU 5A	MERCURY	50	350	1.00	3.00	208	2.00	1000 × 10^6
CLARE RELAYS FORM C									
PRMA	1C	RHODIUM	3	28	0.25	0.50	179	1.50	20 × 10^6
922	1C THRU 4C	RHODIUM	3	28	0.25	0.50	125	2.00	20 × 10^6
HGZM	1C, 2C	MERCURY	30	150	1.00	2.00	568	2.50	100 × 10^6
LX	2C	SILVER-PD, GOLD	30	100	2.00	3.00	200	2.00	10 × 10^6
LM44	2C	SILVER-PD, GOLD	30	100	2.00	3.00	400	3.00	10 × 10^6
LA	4C	SILVER-PD, GOLD	30	100	1.00	3.00	1100	15.00	100 × 10^6
LB/LBP	6C	SILVER-PD, GOLD	30	100	1.00	3.00	1100	15.00	100 × 10^6
LC	12A, 6B6C	SILVER-PD, GOLD	30	100	1.00	3.00	1100	15.00	100 × 10^6
MHC	1C, 2C	MERCURY	50	350	1.00	3.00	161	2.00	1000 × 10^6
HGJM	1C, 2C	MERCURY	100	500	2.00	5.00	200	1.00	2000 × 10^6
HGWM	1C, 2C, 1D, 2D	MERCURY	100	500	2.00	5.00	213	1.00	2000 × 10^6
HGRM	1C, 2C, 1D, 2D	MERCURY	100	500	2.00	5.00	357	1.75	2000 × 10^6
HGSM	1C, 2C, 1D, 2D	MERCURY	100	500	2.00	5.00	290	1.75	2000 × 10^6
HGSR	1C, 1D	MERCURY	100	500	2.00	5.00	357	1.75	2000 × 10^6
HGM	1D, 2D	MERCURY	250	500	5.00	10.00	2100	3.00	2000 × 10^6
HG	1D, 2D	MERCURY	250	500	5.00	10.00	625	3.00	2000 × 10^6
CLARE REED SWITCHES									
FR 1	1A	RUTHENIUM	10	200	0.50	1.00	10-45 OP NI	0.50	100 × 10^6
FR 2	1A	RUTHENIUM	10	200	0.50	1.00	10-45 OP NI	0.50	200 × 10^6
MA 1	1A	MERCURY	30	350	0.75	2.00	30-70 OP NI	1.00	200 × 10^6
MH 1	1A	MERCURY	50	350	1.00	3.00	30-65 OP NI	1.00	1000 × 10^6
MH 2	1A	MERCURY	50	350	1.00	3.00	30-65 OP NI	1.00	1000 × 10^6
MH C	1C	MERCURY	50	350	1.00	3.00	35-70 OP NI	2.50	1000 × 10^6
HG W	1C	MERCURY	100	500	2.00	5.00	60 NI MAX	1.00	2000 × 10^6
HG 1	1D	MERCURY	250	500	5.00	10.00	120-180 OP NI	3.00	2000 × 10^6

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GENERAL INSTRUMENT

Clare·ification Chart-Relays

Product Name	Breakdown Contact to Coil (VDC)	Breakdown Across Contacts (VDC)	FCC 68	Approvals (UL, CSA, BSI, Etc.)	S= Sealed U=Unsealed S-U=Sealed Standard (Can Be Supplied 'Unsealed)	Packaged Type	
CLARE RELAYS FORM A, B							
MRBS	1400	210	YES	BSI, PTB	S	METAL	SPECIAL APPLICATION RELAYS
MRBT	1400	250	YES		U	METAL	SPECIAL APPLICATION RELAYS
PRMA	1400	250	YES	UL, VDE	S	MOLDED	14 PIN DIP RELAYS
DSS3	1000	250	NO		S	PLASTIC	SPECIAL APPLICATION RELAYS
DSS4	1400	250	YES		S	MOLDED	SINGLE IN LINE (SIP) RELAY
CUP V	2800	350	YES	BSI, PTB	S-U	PLASTIC	STAGGERED PIN LAYOUT
CUP 1	2800	350	YES		S-U	PLASTIC	STAGGERED PIN LAYOUT
PRME	1000	250	YES		S	MOLDED	14 PIN DIP RELAY
MRB	1400	250	YES	UL	U	METAL	1.0 X .01 INCH GRID
951	1400	250	NO		S	MOLDED	OTHER CLARE RELAYS
926	1400	250	YES		U	PLASTIC	OTHER CLARE RELAYS
MSS2	1400	1400	YES	VDE	S	MOLDED	14 PIN DIP RELAY
MSS4	1400	1400	YES		S	MOLDED	SINGLE IN LINE (SIP) RELAY
MSS6	1000	1400	YES		S-U	PLASTIC	16 PIN DIP RELAY
CUP 6	2800	1400	YES		S-U	PLASTIC	STAGGERED PIN LAYOUT
CUP 5	2800	1400	YES		S-U	PLASTIC	STAGGERED PIN LAYOUT
MMRB	1400	1400	YES		U	METAL	1.0 X .01 INCH GRID
HRM	700	1400	YES		S	METAL	SPECIAL APPLICATION RELAYS
HRB	1400	1400	YES		U	METAL	1.0 X .01 INCH GRID
851	1400	1400	YES		S	MOLDED	OTHER CLARE RELAYS
CLARE RELAYS FORM C							
PRMA	1400	175	NO		S	MOLDED	14 PIN DIP RELAY
922	1400	175	NO		U	METAL	1.0 X 0.1 INCH GRID
HGZM	1000	1400	YES		S-U	PLASTIC	16 PIN DIP RELAY
LX	2100	1400	YES	UL, CSA	S-U	PLASTIC	16 PIN DIP RELAY
LM44	2100	1400	YES	UL, CSA	S-U	PLASTIC	16 PIN DIP RELAY
LA	700	700	YES		U	PLASTIC	MULTI POLE RELAY
LB/LBP	700	700	YES		U	PLASTIC	MULTI POLE RELAY
LC	700	700	YES		U	PLASTIC	MULTI POLE RELAY
MHC	1400	1400	YES		S	PLASTIC	1.0 X 0.1 INCH GRID
HGJM	1400	1400	YES	UL	S	METAL	OTHER MERCURY WETTED
HGWM	1400	1400	YES		S	METAL	OTHER MERCURY WETTED
HGRM	1400	1400	YES	UL	S	METAL	OTHER CLARE RELAYS
HGSM	1400	1400	YES		S	METAL	OTHER CLARE RELAYS
HGSR	1400	1400	YES		S	METAL	OTHER CLARE RELAYS
HGM	1400	1400	YES		S	METAL	OTHER CLARE RELAYS
HG	1400	1400	YES		S	METAL	OTHER CLARE RELAYS
CLARE REED SWITCHES							
FR 1		350			S	GLASS	RUTHENIUM DRY REED SWITCH
FR 2		350			S	GLASS	BIFURCATED RUTHENIUM DRY REED SWITCH
MA 1		1400			S	GLASS	ALL POSITION MERCURY WETTED REED SWITCH
MH 1		1400			S	GLASS	STANDARD FORM A WETTED REED SWITCH
MH 2		1400			S	GLASS	SMALL DIAMETER WETTED REED SWITCH
MH C		1400			S	GLASS	MINIATURE MERCURY WETTED REED SWITCH
HG W		1400			S	GLASS	FASTEST MERCURY WETTED REED SWITCH
HG 1		1400			S	GLASS	POWER MERCURY WETTED REED SWITCH

SALES OFFICES

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FAX: 416/789-5522

CLARE DIVISION
General Instrument Corporation
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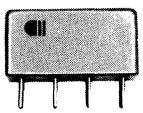
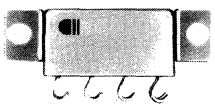
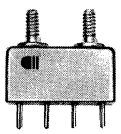
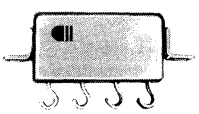
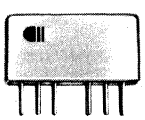
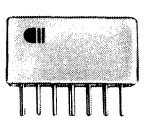
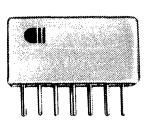
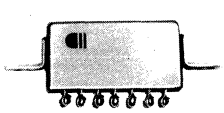
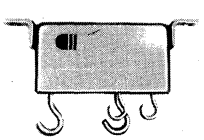
Chicago, IL 60645
(312) 262-7700 TX: 210075
FAX: 312/262-7819

Military Grade/Half Size Relays

RELAY	CONTACT RATING/ CONFIGURATION	COIL VOLTAGES	FEATURES
 **HFW** **(Standard Sensitivity)**	• Low Level to 3.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	5 to 48.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Sensitive version available • Excellent RF switching • Ambient temp rating −65°C to + 125°C • Qualified to MIL-R-39016/6 level L, M & P (Request Brochure HFW 88)
 **HFW4A** **(4 Amp Rating)**	• Low Level to 4.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	5 to 48.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Excellent RF switching • Ambient temp rating −65°C to + 125°C • Designed to MIL-R-39016 (Request Brochure HFW 88)
 **HMS** **(Sensitive Series)**	• Low Level to 2.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	5 to 36.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Energy-saving 100/125 milliwatt sensitivity • Excellent RF switching • Ambient temp rating −65°C to + 125°C • Qualified to MIL-R-39016/44 level L, M & P (Request Brochure HFW 88)
 **HMB** **(Bifilar Coil)**	• Low Level to 3.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	6 to 26.5 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Bifilar transient suppression • Excellent RF switching • Ambient temp rating −65°C to + 125°C • Qualified to MIL-R-39016/22 level L, M & P (Request Brochure HFW 88)
 **LS** **(2 Pole Latching)**	• Low Level to 2.0 Amps • 2 Form C, (DPDT)	5 to 48.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Single or dual latch version • Excellent RF switching • Qualified to MIL-R-39016/45 level L, M (Request Brochure HFW 88)
 **LR** **(4 Pole Latching)**	• Low Level to 2.0 Amps • 4 Form C (4PDT)	5 to 48.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Four pole design • Ambient temp rating −65°C to + 125°C • Designed to MIL-R-39016 (Request Brochure HFW 88)
 **SR** **(4 Pole Version)**	• Low Level to 2.0 Amps • 4 Form C (4PDT)	6 to 26.5 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Four pole design • Ambient temp rating −65°C to + 125°C • Qualified to MIL-R-39016/40 level L, M (Request Brochure HFW 88)
 **SS** **(6 Pole Version)**	• Low Level to 2.0 Amps • 6 Form C, (6PDT)	6 to 26.5 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Six pole hi-density design • Ambient temp rating −65°C to + 125°C • Designed to MIL-R-39016 (Request Brochure HFW 88)
 **C-10 AMP** **(10 Amp Series)**	• Low Level to 10 Amps • 1 Form C, (SPDT)	6 to 26.5 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Unique hi-current design package • Ambient temp rating −65°C to + 125°C • Designed to MIL-R-39016 (Request Brochure HFW 88)

SIZE (Case Size): H-.410 (10.41) D-.410 (10.41) & W-.810 (20.57)

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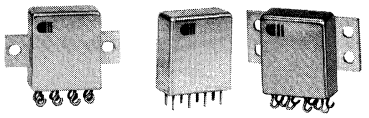
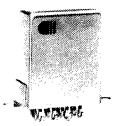
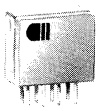
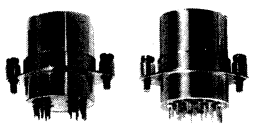
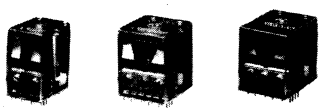
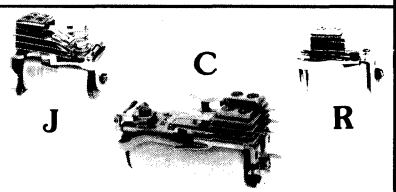
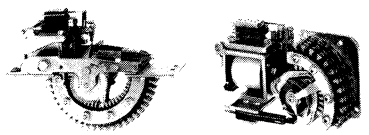
Military Grade/Full Size Relays

RELAY	SIZE (Case Size)	CONTACT RATING/ CONFIGURATION	COIL VOLTAGES	FEATURES
 **FW** (3 Amp Series) **FW5A** (5 Amp Version) **LFW** (Latching Series)	Variable	FW & LFW • Low Level to 3.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A FW5A • Low Level to 5.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	6.3 to 110.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Sensitive version available (FW only) • Excellent RF switching • Ambient temp rating -65° to +125°C • One and two coil operation (LFW only) • Qualified to 5757/10 (FW only)

Military Grade/Other Relays

PF 10 Amp Power Relay 	H- 1.300 (33.02)* D- .515 (13.08) W- 1.075 (27.31)	• Low Level to 10.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	6.0 to 115.0 VDC	• Welded, hermetically sealed enclosures • Very low contact resistance • Package volume .72 cubic inch • Excellent RF switching • Ambient temp rating -65°C to + 125°C • Designed to MIL-R-5757/23 & 28 (Request Data Sheet PF-85)
MFW 1/6th Size Relay 	H- .410 (10.41) D- .230 (5.84) W- .500 (12.70)	• Low Level to 1.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	3.5 to 53.0 VDC	• Hermetically sealed enclosures • Low contact resistance • Total volume only .046 cubic inch • Excellent RF switching • Ambient temp rating -65°C to + 125°C • Qualified to MIL-R-39016/34, L & M level (Request Data Sheet MF-84)
SF 40 MW Sensitive Relay	H- 1.281 (32.54) D- .400 (10.16) W- .800 (20.32)	• Low Level to 2.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	1.8 to 40.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • 40 milliwatt sensitivity • Excellent RF switching • Ambient temp rating -65°C to + 125°C • Designed to MIL-R-5757/13 (Request Data Sheet SF-85)
RD 4&6 Pole Relays 	H- 1.34 (34.04) D- 1.14 (28.96) W- 1.06 (26.92)	• Low Level to 2.0 Amps • 4 Form C, 6 Form C	26.5 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Optional all-welded construction • 100 G Shock • Ambient temp rating -65°C to + 125°C • Qualified to MIL-R-5757/1 & 7 (Request Data Sheet RD-83)

Telephone Relays

 **MA** (4 Pole) **MB** (6 Pole) **MC** (12 Pole)	Variable	• Low Level (microwatts) to 2.0 Amps 28 VDC • MA-4 pole MB-6 pole MC-12 pole	6 VDC 12 VDC 24 VDC 48 VDC 60 VDC	• 4, 6 & 12 poles available • Bifurcated contacts • Low cost • PCB or plug-in mounting (Request Data Sheet MA/MB-85)
 **J** **C** **R**	Variable	• Low Level to 10.0 Amps • Contact Arrangements: Long Frame: up to 8 Form C Medium Frame: up to 8 Form C Short Frame: up to 4 Form C	6 to 250.0 VDC	• Optional hermetic sealing • AC or DC operation • Fast operate and fast release times • Variety of accessories • Ambient temp rating -55°C to + 85°C • Custom designs available (Request Catalog 502)
 **20/26** **210/211**	Variable *mm	• Point Variations: 10 to 52 point operation • Contact rating: 0.1 Amp @ 115 VAC or 30 VDC resistive Carry: 3.0 Amps	6 to 110.0 VDC	• Optional sealing • Insulation resistance 10^9 Ω at 500 VDC • Fast operate and fast release times • Variety of switch mounting accessories • Operating temperature -0°C to + 85°C • Custom designs available (Request Catalog 601)

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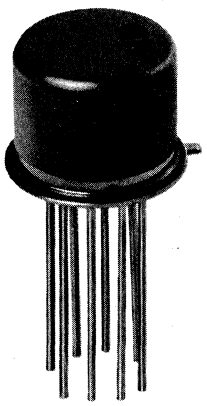
TO-5 Relays



TM & HM Relays

FEATURES:

- Built in accordance with MIL-R-39016/9: other QPL versions pending
- All welded construction, hermetically sealed
- State-of-the-art cleaning techniques and precious metal contact material with gold plating

SIZE:

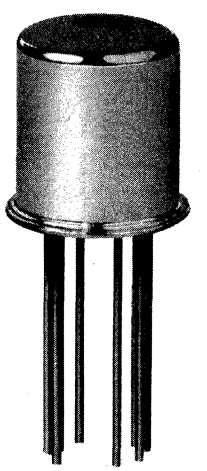
- Diameter
  - Enclosure (max) — .335 inches (8.51)
  - Base (max) — .370 inches (9.40)
- Height (max): .280 (7.11)

CONTACT RATING/ ARRANGEMENT:

- DC Rating:
  - Resistive — low level to 1 amp / 28 VDC
- Contact Resistance:
  - 0.1 ohm max before life
  - 0.2 ohm max after life
- Contact Arrangement:
  - 2 Form C (DPDT)

COIL VOLTAGES:

Coil Voltages (Nominal VDC)	Coil Resistance (ohms +/- 10% at 25°C)
5.0	50
6.0	98
9.0	220
12.0	390
18.0	880
26.5	1560
30.0	2500



TS & HS Relays

FEATURES:

- Built in accordance with MIL-R-39016/11: other QPL versions pending
- All welded construction, hermetically sealed
- State-of-the-art cleaning techniques and precious metal contact material with gold plating

SIZE:

- Diameter
  - Enclosure (max) — .335 inches (8.51)
  - Base (max) — .370 inches (9.40)
- Height (max): .375 (9.53)

CONTACT RATING/ ARRANGEMENT:

- DC Rating:
  - Resistive — low level to 1 amp / 28 VDC
- Contact Resistance:
  - 0.1 ohm max before life
  - 0.2 ohm max after life
- Contact Arrangement:
  - 2 Form C (DPDT)

COIL VOLTAGES:

Coil Voltages (Nominal VDC)	Coil Resistance (ohms +/- 10% at 25°C)
5.0	100
6.0	200
9.0	400
12.0	850
18.0	1600
26.5	3300
36.0	6500
48.0	11000

Options

- Diode Coil Suppression
- Special Coils
- Ground Pins
- Spreader Pads

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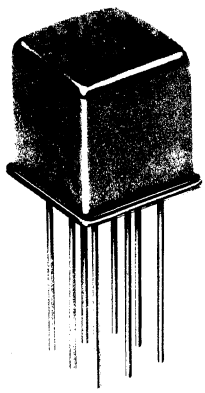
0.100 Grid Relays



TC Relay

FEATURES:

- Built in accordance with MIL-R-39016/17: other QPL versions pending
- All welded construction, hermetically sealed
- State-of-the-art cleaning techniques and precious metal contact material with gold plating

CONTACT RATING/ ARRANGEMENT:

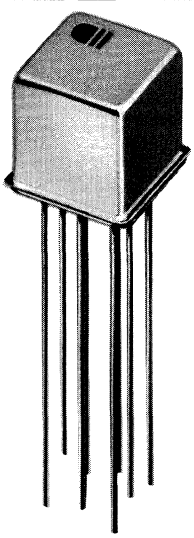
- DC Rating:
  - Resistive — low level to 1 amp / 28 VDC
- Contact Resistance:
  - 0.1 ohm max before life
  - 0.2 ohm max after life
- Contact Arrangement:
  - 2 Form C (DPDT)

SIZE:

- Width & Depth:
  - Enclosure (sq. max) — .335 inches (8.51)
  - Base (sq. max) — .370 inches (9.40)
- Height (max): .275 (6.99)

COIL VOLTAGES:

Coil Voltages (Nominal VDC)	Coil Resistance (ohms +/- 10% at 25°C)
5.0	50
6.0	98
9.0	220
12.0	390
18.0	880
26.5	1560



TCS Relay

FEATURES:

- Built in accordance with MIL-R-39016/41: other QPL versions pending
- All welded construction, hermetically sealed
- State-of-the-art cleaning techniques and precious metal contact material with gold plating

CONTACT RATING/ ARRANGEMENT:

- DC Rating:
  - Resistive — low level to 1 amp / 28 VDC
- Contact Resistance:
  - 0.1 ohm max before life
  - 0.2 ohm max after life
- Contact Arrangement:
  - 2 Form C (DPDT)

SIZE:

- Width & Depth:
  - Enclosure (sq. max) — .335 inches (8.51)
  - Base (sq. max) — .370 inches (9.40)
- Height (max): .375 (9.53)

COIL VOLTAGES:

Coil Voltages (Nominal VDC)	Coil Resistance (ohms +/- 10% at 25°C)
5.0	100
6.0	200
9.0	400
12.0	800
18.0	1600
26.5	3200
36.0	6500
48.0	11000

Options

- Diode Coil Suppression
- Special Coils
- Ground Pins
- Spreader Pads

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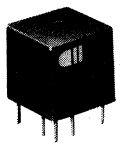
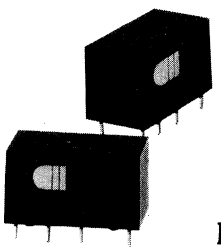
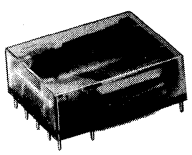
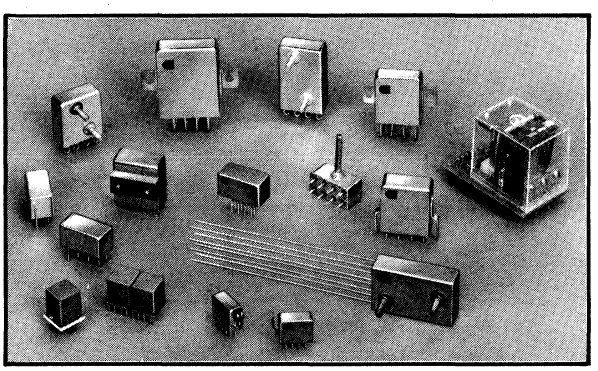
Commercial PCB Relays

RELAY	SIZE (Case Size)	CONTACT RATING/ CONFIGURATION	COIL VOLTAGES	FEATURES
 **MM** **(2 Amp Series)**	H- .428 (10.87)* D- .410 (10.41) W- .410 (10.41)	• Low Level (microwatts) up to 2.0 Amps 24 VDC • 2 Form C (DPDT) 1 Form C (SPDT) 1 Form A (SPST-NO) 2 Form A (DPST-NO)	3 VDC 4 VDC 5 VDC 6 VDC 12 VDC 24 VDC 48 VDC	• Bifurcated contacts gold clad silver-palladium. • Rated for low level to 2.0 Amp switching. • Mount six relays per square inch. • Long Life—Mechanical 100 million ops. • High shock/high vibration resistance. • .1 inch (2.54 mm) footprint. • Fast operate and release time. • Low contact resistance. • UL recognized. File #E90612 • Completely sealed • Meets FCC Part 68, 1000VAC & 1500V peak (Request Data Sheet MM-89)
 **MD** **(Dual in-line)**	H- .472 (12.0) D- .394 (10.0) W- .795 (20.2)	• Low Level (microwatts) up to 2.0 Amps 24 VDC • 2 Form C (DPDT)	5 VDC 6 VDC 9 VDC 12 VDC 24 VDC 48 VDC	• Two form C bifurcated contacts gold clad silver-palladium. • Standard and high sensitivity models. • Completely sealed. • Contact rating from low level to 2.0 Amps switching—3.0 Amps carry. • Super clean construction—inert gas filled. • Designed for low contact resistance and contact resistance stability during life. • UL recognized. File #E90612 • Conforms to FCC Part 68, 1000VAC & 1500V peak • CSA approved #LR65354-1. (Request Data Sheet MD-85)
 **MP4** **(4 Pole Flat Pack)**	H- .45 (11.5) D- 1.20 (30.5) W- .96 (24.5)	• Low Level (microwatts) up to 2.0 Amps 24 VDC •4 Form C(4PDT) 4 Form D(4PDT)** [2 Form C(DPDT) [2 Form D(DPDT)**	5 VDC 6 VDC 9 VDC 12 VDC 24 VDC 48 VDC	• Low profile. • Stands only .45 inches (11.5 mm) high. • Long life: 100,000,000 mechanical operations. 1,000,000 operations at 1.0 Amps. • Environment sealed. • Designed for low contact resistance and contact stability during life. • Contact rating: From low level to 2.0 Amps switching—3.0 Amps carry. • UL recognized. File #E90612. • Conforms to FCC Part 68, 1500V peak • CSA approved #LR65354-1. (Request Data Sheet MP-4-86)
	*mm	**make before break		

Custom Built Relays

- Build to Print
- Custom Made
- Unique Applications
- Replacement/Alternative Design
- Specialized Testing
- RF Switching
- Industrial/Commercial/Military
- High Shock & Vibration
- Extreme Temperatures
- Application Engineering Assistance



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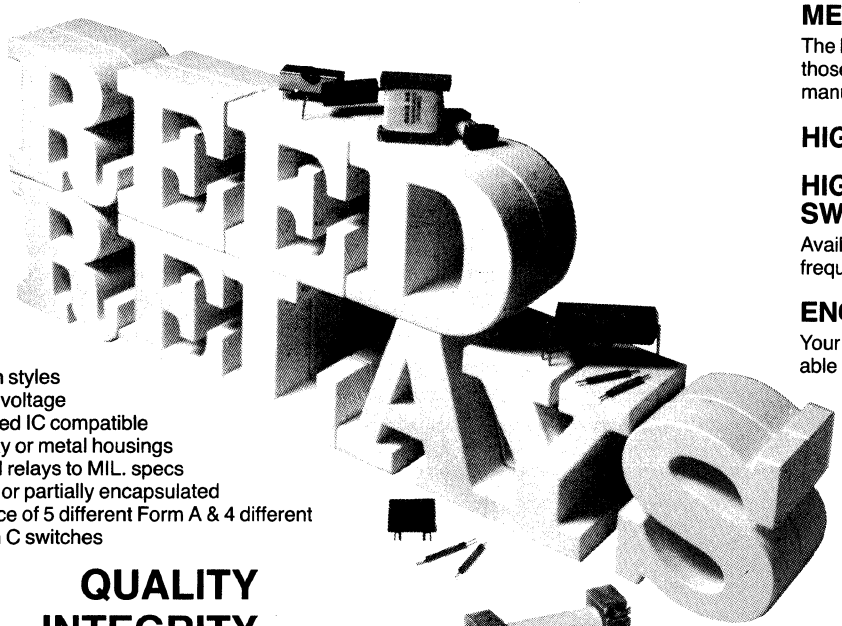
(704) 628-1711 • TELEX 577436 • FAX (704) 628-1439



MERCURY WETTED RELAYS

The largest selection available including all those discontinued by their former manufacturers.

HIGH FREQUENCY SWITCHING

HIGH FREQUENCY SWITCHING

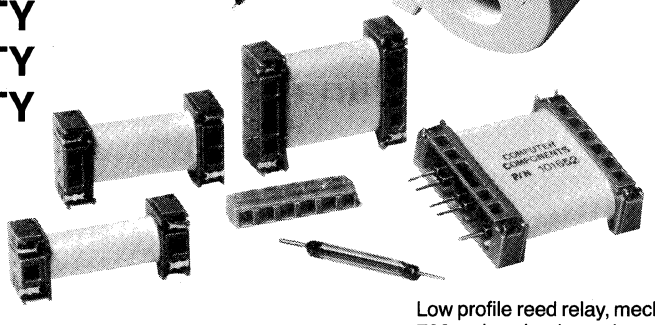
Available in Form A, B, or C contacts for frequencies to 50 MHz.

ENCAPSULATED DIP'S

Your source for the largest selection available up to 6 form or 4 form C contacts.

- Open styles
- High voltage
- Molded IC compatible
- Epoxy or metal housings
- Reed relays to MIL. specs
- Fully or partially encapsulated
- Choice of 5 different Form A & 4 different Form C switches

QUALITY INTEGRITY RELIABILITY

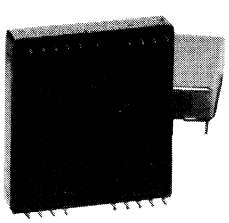


HP (Also 101, 201, 301, & 401 Series)

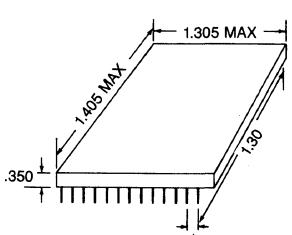
Low profile reed relay, mechanical & electrical replacement for IBM 766 series plug-in, replace reeds, no tools – no soldering

THE MULTI-POLE FLATPACK

The highest density reed relay available – Up to 10 form A or 8 form C or combinations of forms A, B & C



Better Built in the U.S.A.



Why compromise your design using several relays when one compact multi-pole relay can save valuable P.C. board space as well as cost.

SPECIAL DESIGNS

In view of the difficulty in offering a product line that is complete enough to cover every application and physical layout, Computer Components, Inc. maintains special engineering and design facilities to provide the project or design engineer with REED RELAYS specifically tailored to his particular requirements.

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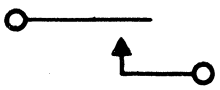
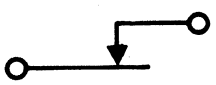
MINIGLOSSARY
RELAY CONTACT FORMS

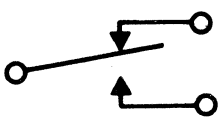
A
Make
SPST-NO



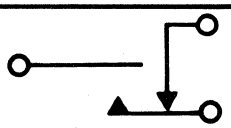
B
Break
SPST-NC



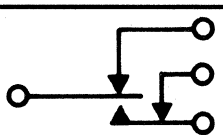
C
Break, Make
(Transfer)
SPDT



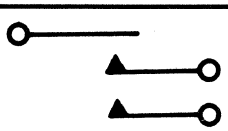
D
Make, Break
(Continuity
Transfer)



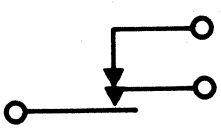
E
Break,
Make,
Break



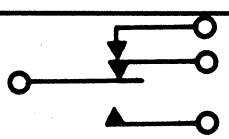
F
Make,
Make



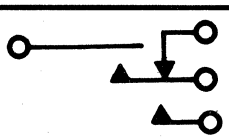
G
Break,
Make



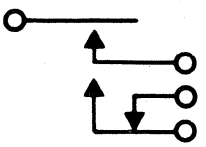
H
Break,
Break,
Make



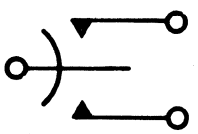
I
Make,
Break,
Make



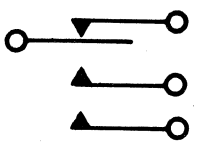
J
Make,
Make,
Break



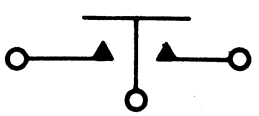
K
Center off
SPDT



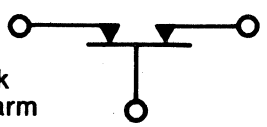
L
Break,
Make,
Make



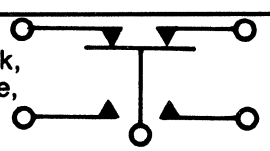
U
Double
make
Contact
on arm



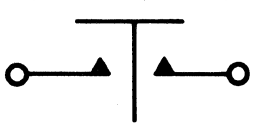
V
Double break
Contact on arm



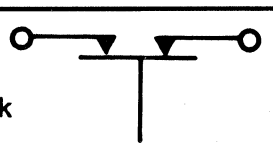
W
Double break,
Double make,
Contact
on arm



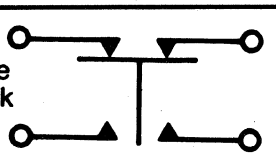
X
Double
make



Y
Double break



Z
Double make
Double break
SPDT-DB



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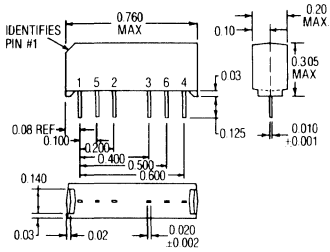
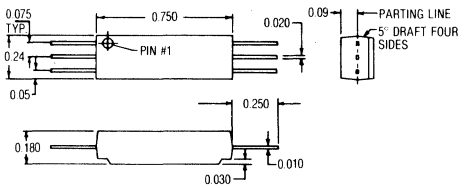
MOLDED REED RELAYS SIP (SERIES 9000) AND SURFACE MOUNT (SERIES 9200)

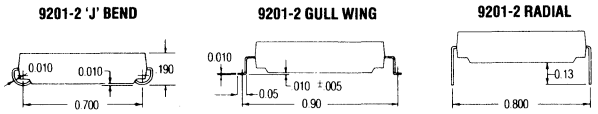
MECHANICAL SPECIFICATIONS





TERMINAL STYLE

LOCATION AND COPLANARITY TOLERANCE ±.003



ORDERING INFORMATION

To order a Coto relay, assemble a part number from the data to describe the desired parameters.

SIP

Model Number — **90XX – XX – XX**

- 01 = SPST, 4 Pin SIP
- 02 = 50Ω Coxial Shield.SPST, 6 Pin SIP
- 03 = SPST, 4 Pin SIP, Recommended For Load Switching

Coil Voltage

- 05 = 5 Volts Nominal
- 12 = 12 Volts Nominal

- 00 = No Option – Omit 0's
- 01 = Internal Diode*

SURFACE MOUNTED

Model Number — **92XX – XX – X0** — Terminal Style

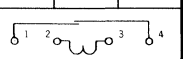
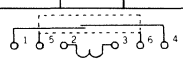
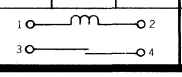
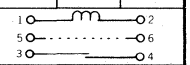
- 01 = SPST, Recommended For Low Level Switching 4 Pin
- 02 = SPST, 50Ω Coaxial Shield 6 Pin

Coil Voltage

- 05 = 5 Volts Nominal
- 12 = 12 Volts Nominal

Terminal Style

- 0 = Gull Wing
- 1 = Axial
- 2 = 'J'
- 3 = Radial

MODEL NUMBER			9001			9002			9201			9202		
PARAMETERS & TEST CONDITIONS		**UNIT**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**
COIL RESISTANCE	5 VOLT COIL	Ω	450	500	550	315	350	385	225	250	275	135	150	165
	12 VOLT COIL	Ω	900	1000	1100	675	750	825	585	650	715	585		715
COIL DRIVE VOLTAGE	5 VOLT COIL	VDC	—	5	6.5	—	5	6.5	—	5	6.5	—	5	6.5
	12 VOLT COIL	VDC	—	12	15	—	12	15	—	12	15	—	12	15
RELAY OPERATE VOLTAGE	5 VOLT COIL	VDC	—	—	3.75	—	—	3.75	—	—	3.75	—	—	3.75
	12 VOLT COIL	VDC	—	—	9.0	—	—	9.0	—	—	9.0	—	—	9.0
RELAY RELEASE VOLTAGE	5 VOLT COIL	VDC	0.4	—	—	0.4	—	—	0.4	—	—	0.4	—	—
	12 VOLT COIL	VDC	1.0	—	—	1.0	—	—	1.0	—	—	1.0	—	—
SWITCHING VOLTAGE (DC/Peak AC, Resistive)		Volts	—	—	200	—	—	200	—	—	200	—	—	200
SWITCHING CURRENT (DC/Peak AC, Resistive)		Amps	—	—	0.5	—	—	0.5	—	—	0.5	—	—	0.5
CARRY CURRENT (DC/Peak AC, Resistive)		Amps	—	—	1.0	—	—	1.0	—	—	1.0	—	—	1.0
CONTACT POWER RATING (DC/Peak AC, Resistive)		W	—	—	10	—	—	10	—	—	10	—	—	10
LIFE EXPECTANCY	(@ Signal Level <1.0 V, .010A)	$\times 10^6$	500	—	—	500	—	—	500	—	—	500	—	—
	(Switching >1.0 V, Consult Factory)	$\times 10^6$	—	—	—	—	—	—	—	—	—	—	—	—
STATIC CONTACT RESISTANCE (Max. initial, measured with .050 V, .010A)		Ω	—	—	0.150	—	—	0.150	—	—	.150	—	—	.150
DYNAMIC CONTACT (Max. initial, meas. w/.050 V, .050 A @ 100 Hz 1.5 msec after closure)		Ω	—	—	0.200	—	—	0.200	—	—	.200	—	—	.200
INSULATION RESISTANCE (Between all isolated pins)	25°C, 40% RH	Ω	10^{10}	10^{13}	—	10^{10}	10^{13}	—	10^{12}	10^{13}	—	10^{12}	10^{13}	—
MEASURED WITH 100 V @	40°C, 95% RH	Ω	10^{10}	10^{12}	—	10^{10}	10^{12}	—	10^{10}	10^{12}	—	10^{10}	10^{12}	—
DIELECTRIC STRENGTH (DC/Peak AC)	ACROSS OPEN CONTACTS:	Volts	250	—	—	250	—	—	250	—	—	250	—	—
	CONTACTS TO SHIELD:	Volts	—	—	—	500	—	—	—	—	—	500	—	—
	CONTACTS & SHIELD TO COIL:	Volts	500	—	—	500	—	—	500	—	—	500	—	—
CAPACITANCE ACROSS OPEN CONTACTS	No shield	pf	—	0.70	1.00	—	—	—	—	0.70	1.0	—	—	—
	Shield floating	pf	—	—	—	—	0.80	1.0	—	—	—	—	0.80	0.80
	Shield guarding	pf	—	—	—	—	0.10	0.30	—	—	—	—	0.10	0.30
OPEN CONTACTS TO COIL	No shield	pf	—	1.4	2.0	—	—	—	—	1.4	2.0	—	—	—
	Shield floating	pf	—	—	—	—	1.4	2.0	—	—	—	—	1.4	2.0
	Shield guarding	pf	—	—	—	—	—	1.0	—	—	—	—	0.2	0.4
CONTACT TO SHIELD Contacts open and shield floating		pf	—	—	—	—	1.4	1.6	—	—	—	—	1.4	1.6
OPERATE TIME (Incl. bounce @ Nom. voltage)		msec.	—	0.35	1.0	—	0.35	1.0	—	0.35	1.0	—	0.35	1.0
RELEASE TIME	No supression	msec.	—	0.05	0.10	—	0.05	0.10	—	0.05	0.10	—	0.05	0.10
	Diode supression	msec.	—	0.35	0.50	—	0.35	0.50	—	0.35	0.50	—	0.35	0.50
	Diode & Zener suppressed	msec.	—	0.10	0.20	—	0.10	0.20	—	0.10	0.20	—	0.10	0.20
TEMPERATURE RANGE	Operate:	°C	−20	—	70	−20	—	70	−20	—	70	−20	—	70
	Storage:	°C	−50	—	100	−50	—	100	−50	—	100	−50	—	100
	Max. allowable temp during mounting process:	°C			221			221			221			221
ALL RATINGS AT 25°C UNLESS NOTED.														
PIN DIAGRAMS (Top View) *If diode is selected, pin #2 is positive.														

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(401) 943-2686 FAX (401) 942-0920

ULTRA-LOW THERMAL EMF REED RELAYS FOR LOW-LEVEL DATA ACQUISITION SYSTEMS

THERMAL EMF

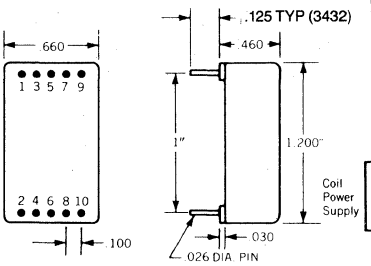
Ratings. Thermal EMF is specified differentially between the two thermal EMF switches (pins 5-6 and 7-8). It is directly proportional to coil power or the square of the applied voltage. When the relays are operated in a scanning mode, the thermal EMF is also proportional to the coil duty cycle.

Coto Series 3600 relays are available with maximum differential thermal EMF ratings of <5μV, <3μV, <1μV, or <0.5μV.

The Mercury wetted 3432 Relay is available with maximum differential thermal EMF ratings of <5μV, <10μV.

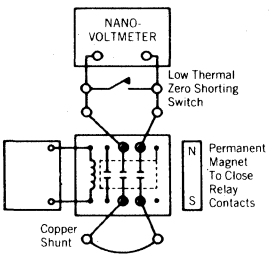
Note: The must operate and must release voltages and the coil resistance are specified at 25°C. These values vary by approximately 0.4%/°C as the ambient temperature varies.
Vibration: 20 G's to 2000Hz Shock: 50 G's

MECHANICAL SPECS



All dimensions are nominal
Pin 9 is the electrostatic shield pin.

Thermal EMF Test Circuit



ORDERING INFORMATION

To order – assemble a part number from the parameters.
Specifications subject to change without notice.

3602, 3650, 3660

Model Number (02,50,60) **36XX-XX-X X**
Coil Voltage (05 or 12)
Thermal
- <5μV – Suffix 9
- <3μV – Suffix 8
- <1μV – Suffix 7
- <0.5μV – Suffix 5

Pin Length
- Standard (0.135" ± 0.020") "2" – Suffix 2
- VME (0.110" ± 0.010) "3" – Suffix 3

Hg Wet **3432-XX-1X**
Coil Voltage
Thermal <10μV – Suffix 1
<5μV – Suffix 9
Contact Isolation (Ohms)
10^{10} – Suffix "0"
10^{12} – Suffix "1"

MODEL NUMBER			3602			3650			3660			3432[1]		
CONTACT ARRANGEMENT			2A DRY			3A DRY			3A DRY			2A HG WET		
PARAMETERS & TEST CONDITIONS		UNIT	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
COIL RESISTANCE	5 VOLT COIL	Ω	315	350	385	315	350	385	315	350	385	97.5	105	115.5
	12 VOLT COIL	Ω	1800	2000	2200	1800	2000	2200	1800	2000	2200	540	600	660
COIL DRIVE VOLTAGE	5 VOLT COIL	VDC	—	5	6.5		5	6.5	—	5	6.5	—	5	6.5
	12 VOLT COIL	VDC	—	12	15	—	12	15	—	12	15	—	12	15
RELAY OPERATE VOLTAGE	5 VOLT COIL	VDC	—	—	3.8	—	—	3.8	—	—	3.8	—	—	3.8
	12 VOLT COIL	VDC	—	—	9.0	—	—	9.0	—	—	9.0	—	—	9.0
RELAY RELEASE VOLTAGE	5 VOLT COIL	VDC	0.4	—	—	0.4	—	—	0.4	—	—	0.4	—	—
	12 VOLT COIL	VDC	1.0	—	—	1.0	—	—	1.0	—	—	1.0	—	—
SWITCHING VOLTAGE (DC/Peak AC, Resistive)		Volts	—	—	150	—	—	150	—	—	150	—	—	500
SWITCHING CURRENT (DC/Peak AC, Resistive)		mA	—	—	250	—	—	250	—	—	250	—	—	1.0
CARRY CURRENT (DC/Peak AC, Resistive)		Amps	—	—	1.5	—	—	1.5	—	—	1.5	—	—	2.0
CONTACT POWER RATING (DC/Peak AC, Resistive)		W	—	—	5.0	—	—	5.0	—	—	5.0	—	—	5.0
LIFE EXPECTANCY	(@ Signal Level <1.0 V, .010A)	$\times 10^6$	500	—	500	500	—		500	—		1000	—	—
	(Switching >1.0 V, Consult Factory)	$\times 10^6$	—	—		—	—		—	—	—	—	—	—
STATIC CONTACT RESISTANCE (Max. initial, measured with .050 V, 10mA Contact Lead)		Ω	—	—	0.100	—	—	0.100	—	—	0.100	—	—	0.050
DYNAMIC CONTACT (Max. initial, meas. w/.050 V, .050 A @ 100 Hz 1.5 msec after closure)		Ω	—	—	0.200	—	—	0.200	—	—	0.200	—	—	0.100
INSULATION RESISTANCE (Between all isolated pins)	25°C, 40% RH	Ω	10^{10}	10^{10}	—	10^{12}	10^{13}	—	10^{12}	10^{13}	—	10^{10}	10^{12}	—
MEASURED WITH 100 V @	40°C, 95% RH	Ω	—	—	—	—	—	—	—	—	—	—	—	—
DIELECTRIC STRENGTH	ACROSS OPEN CONTACTS:	VDC	250	—	—	250	—	—	250	—	—	1000	—	—
	CONTACTS TO SHIELD:	VDC	500	—	—	500	—	—	500	—	—	1000	—	—
	CONTACTS & SHIELD TO COIL:	Vrms	1500	—	—	1500	—	—	1500	—	—	1500	—	—
CAPACITANCE ACROSS OPEN CONTACTS	Shield floating	pf	—	1.2	—	—	1.2	—	—	1.2	—	—	1.2	—
	Shield guarding	pf	—	0.2	—	—	0.2	—	—	0.2	—	—	0.2	—
OPEN CONTACTS TO COIL AND SHIELD		pf	—	2.5	—	—	2.5	—	—	2.5	—	—	2.5	—
OPERATE TIME (Incl. bounce @ Nom. voltage)		msec.	—	.75	1.0	—	.75	1.0	—	.75	1.0	—	2.0	3.0
RELEASE TIME	Diode & Zener supressed:[2]	msec.	—	100	500	—	100	500	—	100	500	—	1.5	2.5
TEMPERATURE RANGE	Operate:	°C	−20	—	+70	−20	—	+70	−20	—	+70	−20	—	+70
	Storage:	°C	−50	—	+100	−50	—	+100	−50	—	+100	−30	—	+100
ALL RATINGS AT 25°C UNLESS NOTED.														
PIN DIAGRAM (Bottom View) Switches connected to pins 5-6 and 7-8 are the low thermal EMF switches.			1 3 5 7 9 / 2 4 6 8 10			1 3 5 7 9 / 2 4 6 8 10			1 3 5 7 9 / 2 4 6 8 10			1 3 5 7 9 / 2 4 6 8 10		

1. Mercury-wetted Relay 3432 must be mounted vertically with the arrow pointing up and shield pin at the top.
2. Consists of 20V Zener-diode and 1N4002 diode in series connected in parallel to coil.
3. For Series 3660, the third non-low thermal switch (9-10) is connected in common with the electrostatic shield at pin 9.

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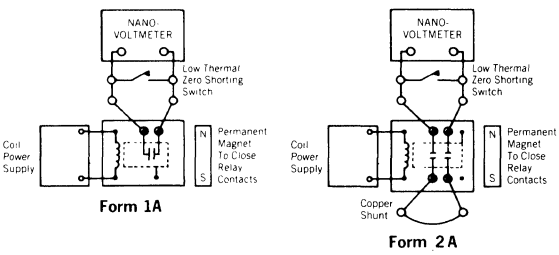
LOW THERMAL EMF REED RELAYS
SERIES 3500

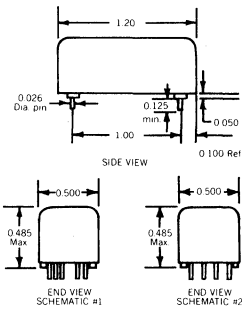
THERMAL EMF

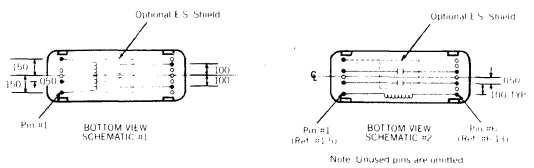
Ratings. The thermal EMF is specified individually for Form 1A relays and differentially between the switches for Form 2A relays. This measurement is made as shown in block diagram. Form 2A relays are measured by shorting pins 2 and 4 with a copper shunt and connecting a nanovolt meter across pins 8 and 10.

The 3500 relays are available with maximum differential thermal EMF ratings of either <10μV, <5μV, <3μV, <1μV or <500nV. The ratings are determined by 100% testing and sorting according to the thermal EMF's measured after the coil has been energized for 5 minutes at its nominal voltage.

Thermal EF Test Circuits:







ORDERING INFORMATION

To order – assemble a part number from the parameters. Specifications subject to change without notice.

35 XX-XX-XXX

- Model No.
- Coil Voltage 05 / 12
- Thermal
  - <10μV – Suffix "1" Hg Wet
  - <5μV – Suffix "9" Dry & Hg Wet
  - <3μV – Suffix "8" Dry Only
  - <1μV – Suffix "7" Dry Only
  - <500nV – Suffix "5" Dry Only
- Contact Isolation (Ohms)
  - 10^{10} – Suffix "0"
  - 10^{12} – Suffix "1"
- No electrostatic shield – "0"
- Electrostatic shield – "1"

Model Number			3501			3502			3520			3530			3531			3540			3541		
Features			High Sensitivity			High Sensitivity			Mercury Wetted			Intermediate High Voltage			Intermediate High Voltage			High Voltage			High Voltage		
Contact Form			1A			2A			2A Hg[1]			1A			2A			1A			2A		
Electrostatic Shield Available			Yes			Yes			Yes			No			No			Yes			Yes		
Thermal EMF Options Available 4		μV Max	Individual 5,3,1,0.5			Differential 5,3,1,0.5			Differential 10,5			Individual 5,3,1,0.5			Differential 5,3,1,0.5			Individual 5,3,1,0.5			Differential 5,3,1,0.5		
PARAMETERS & TEST CONDITIONS		UNIT	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
COIL RESISTANCE[2]	5 VOLT COIL	Ω	315	350	385	315	350	385	180	200	220	225	250	275	225	250	275	225	250	275	225	250	275
	12 VOLT COIL	Ω	1800	2000	2200	1800	2000	2200	765	850	935	1350	1500	1650	1350	1500	1650	1350	1500	1650	1350	1500	1650
COIL DRIVE VOLTAGE	5 VOLT COIL	VDC	–	5	6.5	–	5	6.5	–	5	6.5	–	5	6.5	–	5	6.5	–	5	6.5	–	5	6.5
	12 VOLT COIL	VDC	–	12	15	–	12	15	–	12	15	–	12	15	–	12	15	–	12	15	–	12	15
RELAY OPERATE VOLTAGE	5 VOLT COIL	VDC	–	–	3.8	–	–	3.8	–	–	3.8	–	–	3.8	–	–	3.8	–	–	3.8	–	–	3.8
	12 VOLT COIL	VDC	–	–	9.0	–	–	9.0	–	–	9.0	–	–	9.0	–	–	9.0	–	–	9.0	–	–	9.0
RELAY RELEASE VOLTAGE	5 VOLT COIL	VDC	0.4	–	–	0.4	–	–	0.4	–	–	0.4	–	–	0.4	–	–	0.4	–	–	0.4	–	–
	12 VOLT COIL	VDC	1.0	–	–	1.0	–	–	1.0	–	–	1.0	–	–	1.0	–	–	1.0	–	–	1.0	–	–
SWITCHING VOLTAGE (DC/Peak AC, Resistive)		Volts	–	–	200	–	–	200	–	–	500	–	–	250	–	–	250	–	–	500	–	–	500
SWITCHING CURRENT (DC/Peak Ac, Resistive)		Amps	–	–	0.5	–	–	0.5	–	–	1.0	–	–	0.5	–	–	0.5	–	–	0.5	–	–	0.5
CARRY CURRENT (DC/Peak AC, Resistive)		Amps	–	–	1.5	–	–	1.5	–	–	2.0	–	–	2.5	–	–	2.5	–	–	2.0	–	–	2.0
CONTACT POWER RATING (DC/Peak AC, Resistive)[3]		W	–	–	10	–	–	10	–	–	28	–	–	20	–	–	20	–	–	10	–	–	10
LIFE EXPECTANCY	(@ Signal Level <1.0 V, .010A)	10^6	500	–	–	500	–	–	1000	–	–	500	–	–	500	–	–	100	–	–	100	–	–
	(Switching>1.0 V, Consult Factory		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
STATIC CONTACT RESISTANCE (Max. initial, measured with .050V, 10 mA Contact Load)		Ω	–	–	0.200	–	–	0.100	–	–	0.050	–	–	0.200	–	–	0.100	–	–	0.200	–	–	0.100
DYNAMIC CONTACT (Max. initial, meas. w/.050 V, .050 A @ 100 Hz 1.5 msec after closure)		Ω	–	–	0.300	–	–	0.200	–	–	0.100	–	–	0.300	–	–	0.200	–	–	0.300	–	–	0.200
INSULATION RESISTANCE (Between all isolated pins) MEASURED WITH 100 V @ 25°C. 40% RH		Ω	10^{10}			10^{10}			10^{10}			10^{10}			10^{10}			10^{10}			10^{10}		
DIELECTRIC STRENGTH (DC/Peak AC)	ACROSS OPEN CONTACTS:	Volts	700	–	–	350	–	–	1500	–	–	1500	–	–	750	–	–	1500	–	–	1500	–	–
	CONTACTS TO SHIELD:	Volts	500	–	–	500	–	–	500	–	–	500	–	–	500	–	–	500	–	–	500	–	–
	CONTACTS & SHIELD TO COIL:	Volts	1500	–	–	1500	–	–	1500	–	–	1500	–	–	1500	–	–	1500	–	–	1500	–	–
CAPACITANCE ACROSS OPEN CONTACTS	Without shield	pf	–	3.0	–	–	1.7	–	–	1.7	–	–	3.0	–	–	1.7	–		3.0			1.7	
	Shield guarding	pf	–	1.9	–	–	0.2	–	–	0.2	–	–	1.9	–	–	0.2	–	–	1.9	–	–	0.2	–
OPEN CONTACTS TO COIL AND SHIELD		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
OPERATING TIME (Incl. bounce @ Nom. voltage)		msec	–	0.75	–	–	0.75	–	–	2.0	–	–	1.0	–	–	1.0	–	–	1.0	–	–	1.0	–
RELEASE TIME Diode & Zener suppressed:		msec	–	0.1	–	–	0.1	–	–	0.1	–	–	0.2	–	–	0.2	–	–	0.2	–	–	0.2	–
TEMPERATURE RANGE	Operate:	C°	−20	–	+70	−20	–	+70	−20	–	+70	−20	–	+70	−20	–	+70	−20	–	+70	−20	–	+70
	Storage:	C°	−35	–	+100	−35	–	+100	−35	–	+100	−35	–	+100	−35	–	+100	−35	–	+100	−35	–	+100
ALL RATINGS AT 25°C UNLESS NOTED																							
SCHEMATIC NUMBER			1			2			2			1			2			1			2		

1 Must be mounted vertically. Pin #1 is up.
2 The coil resistance & operate & release voltages are specified at 25°C. These values vary by approx. 0.39%/°C as the ambient temperature changes.
3 The life expectancy when switching intermediate voltages and currents may vary widely. Consult the factory for your exact load requirements.
4 Measured after 5 minutes at nominal coil voltage.

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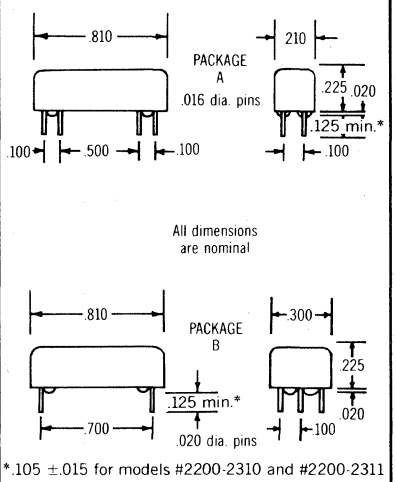
MICROMINIATURE REED RELAYS
SERIES 2200

For a complete product line catalog, technical assistance, life test data or other ordering information, please contact us directly. Our philosophy incorporates working hand-in-hand with our customers (Partners in Design) to develop custom designed reed relays that meet their special design requirements.

OPERATING PARAMETERS @ 25°C		
Nominal Volts	05	12
Coil #2 Resistance Ohms*	150	900
Coil #3 Resistance Ohms*	230	1500
Coil #4 Resistance Ohms*	370	—

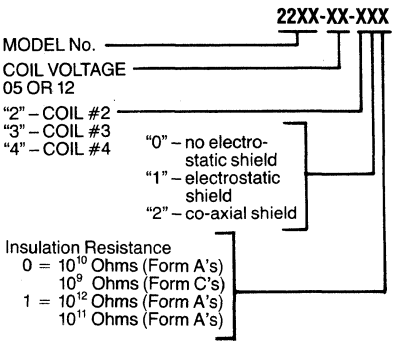
*Resistance figures are ± 10%



*.105 ±.015 for models #2200-2310 and #2200-2311

ORDERING INFORMATION

To order, assemble a part number from the data below to describe the desired parameters.



MODEL NUMBER			2200-2301			2200-2302			2200-2311			2204			2211		
Available Coil Options			150Ω			150Ω			250Ω			2, 3, 4			2, 3		
Contact Form			1A			1A			2A			1A			1C		
Package Size			A			A			B			A			A		
Available Shield Options			Electrostatic 5 pin relay			Co-Axial 6 pin relay			N/A			Optional Electrostatic or Co-Axial[1]			N/A		
PARAMETERS & TEST CONDITIONS		UNIT	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
COIL RESISTANCE	5 VOLT COIL	Ω	135	150	165	135	150	165	225	250	275	See Chart Above			See Chart Above		
	12 VOLT COIL	Ω	—	—	—	—	—	—	—	—	—						
COIL DRIVE VOLTAGE	5 VOLT COIL	VDC	—	5	6.5	—	5	6.5	—	5	6.5	—	5	6.5	—	5	6.5
	12 VOLT COIL	VDC	—	12	15	—	12	15	—	12	15	—	12	15	—	12	15
RELAY OPERATE VOLTAGE	5 VOLT COIL	VDC	—	—	3.6	—	—	3.6	—	—	4.0	—	3.75	—	—	3.75	—
	12 VOLT COIL	VDC	—	—	—	—	—	—	—	—	—	—	9.0	—	—	9.0	—
RELAY RELEASE VOLTAGE	5 VOLT COIL	VDC	0.5	—	—	0.5	—	—	1.0	—	—	0.4	—	—	0.4	—	—
	12 VOLT COIL	VDC	—	—	—	—	—	—	—	—	—	1.0	—	—	1.0	—	—
SWITCHING VOLTAGE (DC/Peak AC, Resistive)		Volts	—	—	150[1]	—	—	150	—	—	200	—	200	—	—	100	—
SWITCHING CURRENT (DC/Peak AC, Resistive)		Amps	—	—	0.5	—	—	0.5	—	—	0.5	—	0.5	—	—	0.25	—
CARRY CURRENT (DC/Peak AC, Resistive)		Amps	—	—	1.0	—	—	1.0	—	—	1.0	—	1.0	—	—	0.5	—
CONTACT POWER RATING (DC/Peak AC, Resistive)		W	—	—	10	—	—	10	—	—	10	—	10	—	—	3	—
LIFE EXPECTANCY	(@ Signal Level <1.0 V, .010A)	10^6	—	500	—	—	500	—	—	500	—	—	500	—	—	100	—
	(Switching >1.0 V, Consult Factory)		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
STATIC CONTACT RESISTANCE (Max. initial, measured with .050 V, 10mA Contact Load)		Ω	—	—	0.150	—	—	0.150	—	—	0.100	—	—	0.100	—	—	0.150
DYNAMIC CONTACT (Max. initial, meas. w/.050 V, .050 A @ 100 Hz 1.5 msec after closure)		Ω	—	—	0.200	—	—	0.200	—	—	0.200	—	—	0.200	—	—	0.200
INSULATION RESISTANCE (Between all isolated pins) MEASURED WITH 100 V @ 25°C, 40% RH		Ω	10^{10}	—	—	10^{10}	—	—	10^{10}	—	—	10^{10} Min. 10^{12} Optional			10^9 Min. 10^{11} Optional		
DIELECTRIC STRENGTH (DC/Peak AC)	ACROSS OPEN CONTACTS:	Volts															
	CONTACTS TO SHIELD:	pf	250	—	—	250	—	—	250	—	—	250	—	—	200	—	—
	CONTACTS & SHIELD TO COIL:	pf	1,000	—	—	1,000	—	—	1,000	—	—	1,000	—	—	1,000	—	—
CAPACITANCE ACROSS OPEN CONTACTS	Shield floating	pf	—	0.9	—	—	0.9	—	—	1.0	—	—	0.9	—	—	1.8	—
	Shield guarding	pf	—	0.2	—	—	0.2	—	—	N/A	—	—	0.2	—	—	N/A	—
OPERATE TIME (Incl. bounce @ Nom. voltage)		msec.	—	—	0.55	—	5	0.55	—	—	0.650	—	0.5	—	—	1.0	—
RELEASE TIME	Diode & Zener supressed[2]	msec.	—	0.1	—	—	0.1	—	—	0.020	—	—	0.1	—	—	2.0	—
TEMPERATURE RANGE	Operate:	°C	−20	—	+70	−20	—	+70	−20	—	+70	−20	—	+70	−20	—	+70
	Storage:	°C	−50	—	+100	−50	—	+100	−50	—	+100	−50	—	+100	−50	—	+100
ALL RATINGS AT 25°C UNLESS NOTED.																	
Schematics (Bottom View) Not to scale																	

Unused pins are omitted.
Pin numbers for reference only.
Black dot on top of relay denotes pin #1.

1. On model 2204 pin #7 is the optional electrostatic shield pin, pins #6 and #7 are the optional co-axial shield pins.
2. Consists of 20V Zener-diode and 1N4002 diode in series connected in parallel to coil.

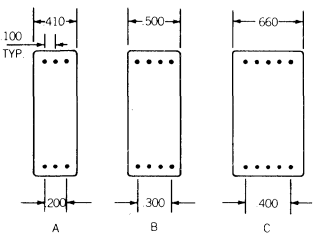
COTO CORPORATION
DuPont Drive, Providence, R.I. 02907
(401) 943-2686 FAX (401) 942-0920

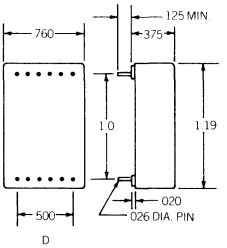
HIGH RELIABILITY REED RELAYS
SERIES 7000

Contact Type	Contact Form	Part No.	Coil V.D.C.	Res. Ohms ±10% @ 25°C	Max. Pick-up V.D.C. @ 25°C	Min. Drop-out V.D.C. @ 25°C	D W G.	Pin Diagram Bottom View • End to End	Pin Diagram Bottom View • Same End
DRY STANDARD	1A	7101	5 12 24	300 1600 4200	3.75 9 18	0.4 1.0 2.0	A		
	2A	7102	5 12 24	150 1000 3500	3.75 9 18	0.4 1.0 2.0	B		
	3A	7103	5 12 24	100 800 2400	3.75 9 18	0.4 1.0 2.0	C		
	4A	7104	5 12 24	80 550 2000	3.75 9 18	0.4 1.0 2.0	D		
	1C	7141	5 12 24	175 1100 4200	3.75 9 18	0.4 1.0 2.0	A		
	2C	7142	5 12 24	65 490 1550	3.75 9 18	0.4 1.0 2.0	C		
	1A Latch *	7150	5 12	550/550 1750/1750	3.75 9	0.4 1.0	B		
MERCURY WETTED	1A	7201	5 12 24	70 450 1785	3.75 9 18	0.4 1.0 2.0	A		
	2A	7202	5 12 24	60 340 1330	3.75 9 18	0.4 1.0 2.0	B		
HIGH VOLTAGE	1A	7301	5 12 24	175 1100 4200	3.75 9 18	0.4 1.0 2.0	A		
	2A	7302	5 12 24	100 640 2450	3.75 9 18	0.4 1.0 2.0	B		

• Black dot on top of relay denotes Pin #1.
* These relays contain bias magnets. Correct polarity must be observed. Diode coil suppression is required for proper operation of latching relays. If internal diode option is selected on 7150 Pins #1 and #8 are positive. On all other relays Pin #1 is Positive.

Package and Pin Configuration
(Bottom View)





MODEL NUMBER			7100						7200			7300		
CONTACT TYPE			DRY STANDARD						MERCURY WET			HIGH VOLTAGE		
CONTACT FORM			A's AND B's			C's			A's			A's		
PARAMETERS & TEST CONDITIONS		UNIT	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
SWITCHING VOLTAGE (DC/Peak AC, Resistive)		Volts	—	—	200	—	—	150	—	—	500	—	—	500
SWITCHING CURRENT (DC/Peak AC, Resistive)		Amps	—	—	0.5	—	—	0.250	—	—	1.0	—	—	0.5
CARRY CURRENT (DC/Peak AC, Resistive)		Amps	—	—	2.0	—	—	1.0	—	—	2.0	—	—	2.0
CONTACT POWER RATING (DC/Peak AC, Resistive)[3]		W	—	—	10	—	—	3	—	—	50	—	—	10
LIFE EXPECTANCY	(@ Signal Level <1.0 V, .010A) ‡	CYC	—	10^8	—	—	10^8	—	—	10^8	—	—	10^8	—
	(Switching>1.0V, Consult Factory)	CYC	—	*	—	—	*	—	—	10^6	—	—	*	—
STATIC CONTACT RESISTANCE (Max. initial, measured with .050 V, 10 mA Contact Load)		Ω	—	—	.100	—	—	.150	—	—	.050	—	—	.100
DYNAMIC CONTACT (Max. initial, meas. w/.050 V, .050 A @ 100 Hz 1.5 msec after closure)		Ω	—	—	.150	—	—	.200	—	—	.100	—	—	.150
INSULATION RESISTANCE (Between all isolated pins) MEASURED WITH 100 V @ 25°C, 40% RH		Ω	10^{10}	10^{12}	—	10^9	10^{11}	—	10^{10}	10^{12}	—	10^{10}	10^{12}	—
DIELECTRIC STRENGTH	ACROSS OPEN CONTACTS:	Volts	250	—	—	200	—	—	1000	—	—	1200	—	—
(DC/Peak AC)	CONTACTS TO SHIELD	Volts	500	—	—	500	—	—	500	—	—	500	—	—
GS	CONTACTS & SHIELD TO COIL:	VRMs	1500	—	—	1500	—	—	1500	—	—	1500	—	—
CAPACITANCE ACROSS OPEN CONTACTS	WITHOUT SHIELD	pf	—	1.0	—	—	2.0	—	—	1.0	—	—	1.0	—
	SHIELD GROUNDED	pf	—	0.2	—	—	1.0	—	—	0.2	—	—	0.2	—
OPERATE TIME (Incl. bounce @ Nom. voltage)		msec	—	1.0	—	—	2.0	—	—	2.0	—	—	1.0	—
RELEASE TIME	Diode & Zener suppressed:	msec	—	0.100	—	—	2.5	—	—	1.0	—	—	0.100	—
TEMPERATURE RANGE (C°)	Operate:	C°	−20	—	+70	−20	—	+70	−20	—	+70	−20	—	+70
	Storage:	C°	−50	—	+100	−50	—	+100	−50	—	+100	−50	—	+100
ALL RATINGS AT 25°C UNLESS NOTED.														

ORDERING INFORMATION
To order a Coto relay, assemble a part number from the data to describe the desired parameters.

7XXX – XX – XXXX

Contact Type:
Dry Standard = 1
Mercury Wet = 2
High Voltage = 3

Contact Form

Coil Voltage

Options:

Insulation Resistance
0 = 10^{10} Ohms (Form A's)
10^9 Ohms (Form C's)
1 = 10^{12} Ohms (Form A's)
10^{11} Ohms (Form C's)

Coil Termination
0 = End to End
1 = Same End

Electrostatic Shield*
0 = Omit
1 = Include

Diode
0 = Omit
1 = Include

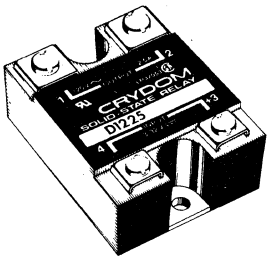
*E-pin indicates electrostatic shield pin.

* Life expectancy at full rated load is dependent upon the combination current/voltage switched. While typical life expectancy is >5 × 10^6. Consult factory for life data at your load levels.
‡ Consists of 20V Zener-Diode and IN4002 Diode in series, connected in parallel to coil.

CRYDOM COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES 1



2.5 TO 90 AMP, 120, 240 AND 480 VAC SCR AC OUTPUT, PANEL MOUNT SOLID-STATE RELAYS

These Crydom SSRs make it possible to switch AC power loads up to 47 kw. Output circuit consists of inverse-parallel (back-to-back) dual SCRs to meet the most demanding requirements. Features include zero voltage switching, phase control and normally closed models available.

AC Control Models — SCR Output

Crydom Model No.	Line VAC (47-63 Hz)	Max. Load Current, Amps (RMS)	One-Cycle Surge, Amps (PK)
A1202	24-140	2.5	22.5
A1210	24-140	10	120
A1225	24-140	25	250
A1240	24-140	40	625
A2402	48-280	2.5	22.5
A2410	48-280	10	120
A2425	48-280	25	250
A2440	48-280	40	625
A2450	48-280	50	625
A2475	48-280	75	1000
A4808	80-530	8	72
A4812	80-530	12	140
A4825	80-530	25	250
A4840	80-530	40	400
A4875	80-530	75	1000
A4890	80-530	90	1200

General Specifications
Isolation Voltage: 4000 VAC Std. (Input to Output)
Operating Temperature Range: – 30°C to 80°C. UL and CSA

DC Input Control Models
Control Signal Range . . . . . .3-32 VDC
Must Operate Voltage . . . . . .3 VDC Max
Must Release Voltage . . . . . .1 VDC Min
Input Current . . . . . .4 mA max @ 5 VDC

AC Input Control Models
Control Signal Range . . . . . .90-280 VAC
Must Operate Voltage . . . . . .90 VAC Max
Must Release Voltage . . . . . .10 VAC Min
Input Current . . . . . .2 mA max @ 120 VAC

DC Control Models — SCR Output

Crydom Model No.	Line VAC (47-63 Hz)	Max. Load Current, Amps (RMS)	One-Cycle Surge, Amps (PK)
D1202	24-140	2.5	22.5
D1210	24-140	10	120
D1225	24-140	25	250
D1240	24-140	40	625
D2402	48-280	2.5	22.5
D2410	48-280	10	120
D2425	48-280	25	250
D2440	48-280	40	625
D2450	48-280	50	625
D2475	48-280	75	1000
D4808	80-530	8	72
D4812	80-530	12	140
D4825	80-530	25	250
D4840	80-530	40	400
D4850	80-530	50	625
D4875	80-530	75	1000
D4890	80-530	90	1200

ADDITIONAL DC INPUT MODELS AVAILABLE:
"NORMALLY CLOSED" . . . . . — B SUFFIX
"NON-ZERO SWITCH" . . . . . — 10 SUFFIX
"400 Hz" . . . . . — 4 PREFIX

8 TO 90 AMP, 48-530 AND 48-660 VAC AC OUTPUT SOLID-STATE RELAYS 1000-1200V BLOCKING

The highest power rated SSRs, up to 59 kw, 4000V of isolation with the highest available blocking voltages (1.2 KV) below which the SSRs will not mistrigger. The wide margin between operating and blocking voltages permits the proper use of transient suppression (MOV) devices on the 480V line. Features include high dv/dt and zero voltage switching.

General Specifications
Control Signal Range "C", "WD" 4 to 32 VDC
"CD" . . . . .4 to 8 VDC
"CA" . . .90 to 140 VAC
Input Current @ 5 VDC . . . . . .15 mA max.
Isolation Voltage 50/60 Hz . . . .4000 VRMS
Operating Temperature Range.0°C to 80°C

Crydom Model No.	Line VAC (47-63 Hz)	Max. Load Current Amps (RMS)	One Cycle Surge Amps (pk)
D4808C	48-530	8	72
D4812C	48-530	12	140
D4825C	48-530	25	250
D4850C	48-530	50	625
D4875C	48-530	75	1000
D4890C	48-530	90	1200
H10CD4850	48-660	50	625
H10CD4890	48-660	90	1200
H10CA4850	48-660	50	625
H10CA4890	48-660	90	1200
H12CD4850	48-660	50	625
H12CD4890	48-660	90	1200
H12CA4850	48-660	50	625
H12CA4890	48-660	90	1200
H10WD4850	48-660	50	625
H10WD4890	48-660	90	1200
H12WD4850	48-660	50	625
H12WD4890	48-660	90	1200

7.0 TO 40 AMP, 100 TO 500 VDC CMOS DC INPUT SOLID STATE RELAYS

This new Crydom series of DC power SSRs incorporates a power MOSFET as the output device in the classic Crydom package. The input can be driven from most logic circuits, requiring less than 1.6 mA at 5 VDC.

General Specifications
Control Signal Range . . . . . .3.5 to 32 VDC
Input Current @ 5 VDC . . . . . .1.6 mA max.
Isolation Voltage 50/60 Hz . . . .2500 VRMS
Operating Temperature Range.0°C to 80°C

Crydom Model No.	Line VDC	Max. Load Current @ 40°C Amps	10MS Surge Amps
D1D07	0-100	7.0	15
D1D12	0-100	12	28
D1D20	0-100	20	42
D1D40	0-100	40	106
D2D07	0-200	7.0	22
D2D12	0-200	12	27
D4D07	0-400	7.0	17
D4D12	0-400	12	36
D5D07	0-500	7.0	19
D5D10	0-500	10	29

10 TO 75 AMP, 120-240V DC CONTROLLED, AC OUTPUT SSRs FEATURE IC FIRING CIRCUITS TO BOOST RELIABILITY AND PERFORMANCE

Combining integrated circuit technology and the proven Crydom series 1 high power dissipation output system results in superior SSRs. The reduction of control circuit components from 22 to 3 greatly increases life and reliability.

SCR OUTPUT

Crydom Model No.	Input Control Voltage	Output Load Current	Ratings Volts (RMS)
CSD2410	3.5-15 VDC	10A	120/240
CSD2425	3.5-15 VDC	25A	120/240
CSD2440	3.5-15 VDC	40A	120/240
CSD2450	3.5-15 VDC	50A	120/240
CSD2475	3.5-15 VDC	75A	120/240
CSE2410	15-32 VDC	10A	120/240
CSE2425	15-32 VDC	25A	120/240
CSE2450	15-32 VDC	50A	120/240

TRIAC OUTPUT

CTD2410	3.5-15 VDC	10A	120/240
CTD2425	3.5-15 VDC	25A	120/240

SERIES 1 — HEATSINK SELECTION GUIDE

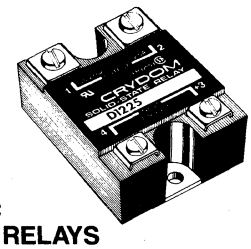
Maximum Operating Current (SSR Rating)	Crydom Heatsink Type	Maximum Ambient Temperature (@ Max. Current)
10A	HS-1	25°C
10A	HS-2	40°C
25A	HS-2	25°C
50A	HE-54	40°C

CRYDOM COMPANY: 17215 Studebaker Rd., Cerritos, CA 90701 • Phone: (213) 865-3536 • Fax: (213) 865-3318

CRYDOM COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES 1



5 THRU 25 AMP/120 AND 240 VAC TRIAC AC OUTPUT SOLID-STATE RELAYS

Crydom Triac SSRs are quality-made devices designed for general purpose switching applications where performance requirements are less demanding than those offered by SCR output types.

General Specifications	DC Input	AC Input
Control Signal Range	3 to 32 VDC	90 to 280 VAC
Input Current	4 mA @ 5 VDC	2 mA @ 120 VAC
Isolation Voltage	4000 VRMS	4000 VRMS
Oper. Temp. Range	–30°C to 80°C	–30°C to 80°C

DC Control Models—Triac Output

Crydom Model No.	Line VAC (47-63 Hz)	Max. Load Current, Amps (RMS)	One-Cycle Surge, Amps (PK)
TD1210	24-140	10	100
TD1225*	24-140	25	250
TD2410*	48-280	10	100
TD2425	48-280	25	250
TD4825	80-530	25	250

AC Control Models—Triac Output

TA1210	24-140	10	100
TA1225	24-140	25	250
TA2410	48-280	10	100
TA2425	48-280	25	250
TA4825	80-530	25	250

TIME DELAY RELAYS 48 TO 280 VAC, 10, 25 OR 50 AMP 2 TIMING RANGES

Standard series 1 relay with built-in Time Delay. (External resistor for 0 to 10 Megohm.)

General Specifications

Control Voltage Range . . . . . 3.5 to 15 VDC
Timing Range "DSD" . . . . . 0.1 to 83 sec
Timing Range "DLD" . . . . . 1.6 to 1330 sec

Crydom Model No.	Max Load Current, Amps (pk)	One-Cycle Surge Amps (pk)
DSD2410	10	120
DSD2425	25	250
DSD2450	50	625
DLD2410	10	120
DLD2425	25	250
DLD2450	50	625

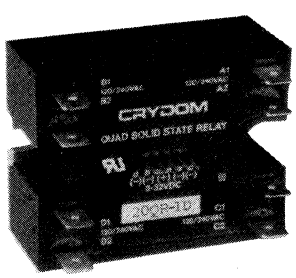
SOFT-START POWER MODULES/RELAYS 90-140 AND 180-280 VAC 10 TO 75 AMPS

A control module is used in combination with a Crydom phase control relay to provide gradual applicaton of power to the load.

General Specifications: All models.

Input Operate Voltage Range . . . . . 3.5 to 10 VDC
Minimum Release Voltage . . . . . 1 VDC
Input Current @ 5 VDC . . . . . 1.6 mA

Crydom Model No.	Output Voltage Range VAC	Max Load Current Amps
10SST120	90-140	10
25SST120	90-140	25
40SST120	90-140	40
10SST240	180-280	10
25SST240	180-280	25
40SST240	180-280	40
75SST240	180-280	75



These space saving and cost saving "dual" and "quad" series provide two (2) or four (4) totally independent AC output solid state relays in a single Series 1 package. The "dual" types employ inverse parallel SCR outputs and are available in 25 AMP and 40 AMP models. The "quad" types have triac outputs. Protection is provided by an internal dv/dt snubber network across the output switch which restricts the rate of rise of most voltage transients to within acceptable limits. Features include 2500 VRMS optical isolation, zero voltage turn-on and zero current turn-off of the the load. Random voltage turn-on units (–10 suffix) are also available for phase control applications.

These series are ideal when multiple SSR's are required for interfacing between the logic output of TTL, HTL, MOS or microprocessor circuits and AC loads such as motors, heaters, lamps, solenoids and transformers.

25, 40 AMP Dual-SCR Output 20 AMP Quad-Triac Output

General Specifications

Isolation Voltage: . . . . . 2500 VAC
Temperature Range:
  Storage . . . . . –40°C to 120°C
  Operating: . . . . . –30°C to 80°C
Weight: . . . . . 3.5 oz. (98G) Max.
Control Signal Range . . . . . 4-15 VDC
Must Operate Voltage . . . . . 4 VDC Max.
Must Release Voltage . . . . . 1 VDC Min.
Input Current . . . . . .34 mADC Max.
Off-State dv/dt . . . . . 200V/usec Min.

DUAL—SCR OUTPUT **UL Recognized, CSA Certified**

Crydom Model No.	Line VAC (47-70 Hz)	Max. Load Current Amps (RMS) (Per Section)	One-Cycle Surge Amps (PK) (Per Section)	Switching Mode
D2425D	24-280	25	350	Zero
D2425D-10	24-280	25	350	Non-Zero
D2440D	24-280	40	500	Zero
D2440D-10	24-280	40	500	Non-Zero

QUAD—TRIAC OUTPUT **UL Recognized, CSA Certified**

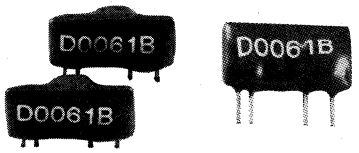
TD2420Q	24-280	20	250	Zero
TD2420Q-10	24-280	20	250	Non-Zero

CRYDOM COMPANY: 17215 Studebaker Rd., Cerritos, CA 90701 • Phone: (213) 865-3536 • Fax: (213) 865-3318

CRYDOM COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES DO 061



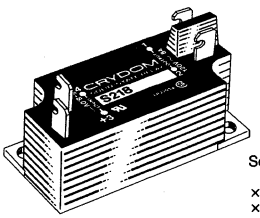
Crydom Model No.	Line Voltage VDC	Max. I @ 60°C A (RMS)	Control Voltage Range	Must Operate Voltage, Max.	Must Release Voltage, Min.	Surge Current 1 Sec.
DO 061A	3-60	1.0	3.0-9.0 VDC	3.0 VDC	1.0 VDC	5A
DO 061B	3-60	1.0	1.7-9.0 VDC	1.7 VDC	0.8 VDC	5A

The DO 061 are miniature DC output modules in a conformally coated SIP package, measuring only 0.46 × 0.9 × 0.4 in. with pinouts on the popular 100-mil grid. The input-to-output isolation is 4000 VRMS with an isolation resistance of 1×10^9 ohms. The units are derated 10mA per degree C above 60°C ambient temperature. Operating temperature range is – 30°C to + 80°C. When used for inductive loads, diode suppression across the load is recommended.

SERIES 2

8 AMPS, 120 AND 240 VAC AC OUTPUT, PANEL MOUNT SOLID-STATE RELAYS

The Crydom Series 2 solid-state relays combine small size, zero voltage switching and high current rating in a package designed for heat sink or panel mounting. Standard 0.187″ push-on terminals allow quick connection and are positioned to provide maximum isolation between control and power circuits.



Series 2
0.85″ (21.59 mm)
× 1.75″ (44.5 mm)
× 0.83″ (21.08mm)

Must Operate Current . . . . . .12 mA max
Isolation Voltage . . . . . .2500 VAC
Operating Temperature Range . . . . . – 30°C to 80°C
Snubber . . . . . .Internal

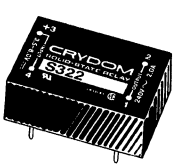
General Specifications
Control Signal Range. . . . . .3.5 to 8 VDC
Control Signal Range"221C" 3.5 to 7 VDC
Must Operate Voltage . . . . . .3.5 VDC max
Must Release Voltage . . . . . .1 VDC min

Crydom Model No.	Line VAC (47-63 Hz)	Max. Load Current @ 40°C Amps (RMS)	One-Cycle Surge Amps (PK)
S218	20-140	8	120
S228	40-280	8	120
S228C	24-280	8	120

SERIES 3

AC OUTPUT, PC BOARD MOUNT SOLID-STATE RELAYS 0.3 TO 3 AMPS 120 AND 240 VAC

Case Style 30A



Case Style 3

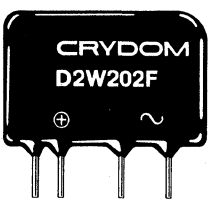
Designed for PCB applications. Units require only 1 sq. in. space on boards. Overall height of 0.45″ on case 3 allows spacing on 0.5″ centers. High current rating. Zero voltage switching.

General Specifications
Control Signal Range. . . . . .3.5 to 8 VDC
(Models S3013A/S3023A . . .3.5 to 18 VDC)
Must Operate Voltage . . . . . .3.5 VDC max
Must Release Voltage . . . . . .1 VDC min.
Isolation Voltage . . . . . .2500 VAC
(Models S3013A/S3023A. . . . . .4000 VAC)
Operating Temperature Range. . . – 30°C to 80°C

Crydom Model No.	Line VAC (47-63 Hz)	Max. I @ 40°C A (RMS)	One-Cycle Surge Amps (PK)	Internal Snubbers	Case Style
S310	20-140	0.3	2	No	3
S3010A	20-140	0.3	2	Yes	30A
S320	40-280	0.3	2	No	3
S3020A	40-280	0.3	2	Yes	30A
S312	20-140	2	55	No	3
S3012A	20-140	2	55	Yes	30A
S3013A	24-140	3	55	Yes	30A
S322	40-280	2	55	No	3
S3022A	40-280	2	55	Yes	30A
S3023A	48-280	3	55	Yes	30A

SERIES D2W

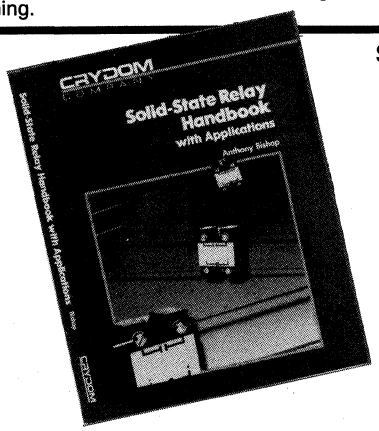
LOW COST AC OUTPUT 60 TO 280 VAC, 2 AMPS SOLID-STATE RELAYS



The D2W202F is designed to achieve optimum performance at a record low cost by means of completely automated assembly using labor saving robotics. The package has a hard, skin-tight epoxy coating which provides excellent environmental protection and a pinout that matches the Series 6.

General Specifications
Control Signal Range . . . . . .3 to 28 VDC
Must Operate Voltage, max. . . . . .3 VDC
Must Release Voltage, min. . . . . .1 VDC
Input Current @ 5 VDC max. . . . . .4 mA
Input Impedance, min. . . . . .1500 OHMS
Dielectric Strength: 50/60 Hz . .2500 VRMS
Operating Temperature Range. . . – 20°C to 80°C

Crydom Model No.	Control Voltage Range	Output Ratings	Surge One Cycle
D2W202F	3-32 VDC	2A @ 60-280 VAC	28A pk
D2W203F	3-32 VDC	3A @ 60-280 VAC	—
D2W203F-11	3-32 VDC	3A @ 60-280 VAC	80A pk



SOLID-STATE RELAY HANDBOOK
WITH APPLICATIONS BY ANTHONY BISHOP

This comprehensive 223 page reference to the use and applications of Solid-State Relays (SSRs) incorporates a detailed tutorial on what SSRs are and why they are used in various industrial applications. In its pages you will find:

- A thorough introduction to solid-state relays
- Descriptions of various coupling methods
- SSR operation and parameters
- Coverage of different drive methods
- Thermal considerations
- Applications of SSRs in microprocessor-based equipment for industrial machine control
- A cross reference of types and manufacturers
- A handy glossary of terms

ORDER: HDBK-899

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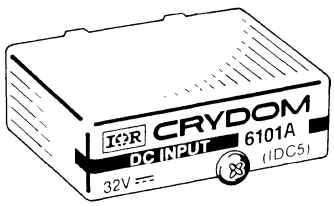
CRYDOM COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES 6

AC AND DC MICROPROCESSOR INPUT/OUTPUT MODULES



For electrically clean, photo-isolated, noise-free interfacing between logic level programmable controllers, microprocessors and computerized machine controls and power level loads.
Input modules accept power level signals and convert them to logic level signals. Output modules accept logic level signals to switch AC or DC loads to 3.5 Amps.

General Specifications — All Models
Dielectric (Input/Output) . . . . . .4000 VRMS
Isolation Resistance (Input/Output @ 500 V) . . . .10^{10} Ohms
Capacitance (Input/Output) . . . . . .8.0 pF
Operating Temperature Range. . . . . – 40°C to 80°C

3.5 AMPS, 60 VDC, 120 and 240 VAC
Standard Input/Output Modules (and Equivalents)
*IN COMPLIANCE WITH NEMA 2-230 (NOISE IMMUNITY)

5 Volt Models		15 Volt Models					
P–N	Equivalent	P–N	Equivalent	Type	Input Current vs. Voltage	Maximum Load Voltage	Maximum Load Current
6101/6101A*	IDC5	6131	IDC15	DC/IN	7 mA @ 32 VDC	30 VDC	25 mA @ 80°C
6201A*	IAC5	6231	IAC15	AC/IN	6 mA @ 120 VAC	30 VDC	25 mA @ 80°C
6202A*	IAC5-A	6232	IAC15-A	AC/IN	6 mA @ 240 VAC	30 VDC	25 mA @ 80°C
6301A*	ODC5			DC/OUT	15 mA @ 5 VDC	60 VDC	3 ADC @ 45°C
6401A*	OAC5			AC/OUT	15 mA @ 5 VDC	140 VAC	3A RMS @ 45°C
6402A*	OAC5-A			AC/OUT	15 mA @ 5 VDC	280 VAC	3A RMS @ 45°C
6102	—	—	—	DC/IN	6 mA @ 180 VDC	30 VDC	25 mA @ 80°C
6200	—	—	—	AC/IN	6 mA @ 24 VAC	30 VDC	25 mA @ 80°C
6302	ODC5-A	—	—	DC/OUT	12 mA @ 5 VDC	200 VDC	1.5A @ 45°C

Buffered Output Modules
*SINK CURRENT (NON-INVERTING) **SOURCE CURRENT (INVERTING)

Crydom Part No.						
5V Models	15V Models	Type	Input Current vs. Voltage 5 Volt Models	Input Current vs. Voltage 15 Volt Models	Maximum Load Voltage	Maximum Load Current
6311	6341	DC/OUT	75 μA @ 0.8 VDC*	175 μA @ 2.0 VDC*	60 VDC	3.5 ADC @ 45°C
6321	6351	DC/OUT	75 μA @ 2.4 VDC**	75 μA @ 8.0 VDC**	60 VDC	3.5 ADC @ 45°C
6411	6441	AC/OUT	75 μA @ 0.8 VDC*	175 μA @ 2.0 VDC*	140 VAC	3.5A RMS @ 45°C
6412	6442	AC/OUT	75 μA @ 0.8 VDC*	175 μA @ 2.0 VDC*	280 VAC	3.5A RMS @ 45°C
6421	6451	AC/OUT	75 μA @ 2.4 VDC**	75 μA @ 8.0 VDC**	140 VDC	3.5A RMS @ 45°C
6422	6452	AC/OUT	75 μA @ 2.4 VDC**	75 μA @ 8.0 VDC**	280 VAC	3.5A RMS @ 45°C

SERIES DMP

AC AND DC INPUT/OUTPUT MODULES
3 AMPS, 30, 60 VDC AND 280 VAC

Electrically identical to Series 6 models. Packaged in a hard, skin-tight epoxy conformal coating for excellent environment protection and fast heat-transfer. Pin-out matches Series 6.

Crydom Model Number	Module Type	Input Current vs. Voltage	Max. Load Voltage
DMP6101A	DC/IN	32 mA @ 32 VDC	30 VDC
DMP6201A	AC/IN	6 mA @ 120 VAC	30 VDC
DMP6202A	AC/IN	6 mA @ 240 VAC	30 VDC
DMP6301A	DC/OUT	15 mA @ 5 VDC	60 VDC
DMP6402A	AC/OUT	15 mA @ 5 VDC	280 VDC

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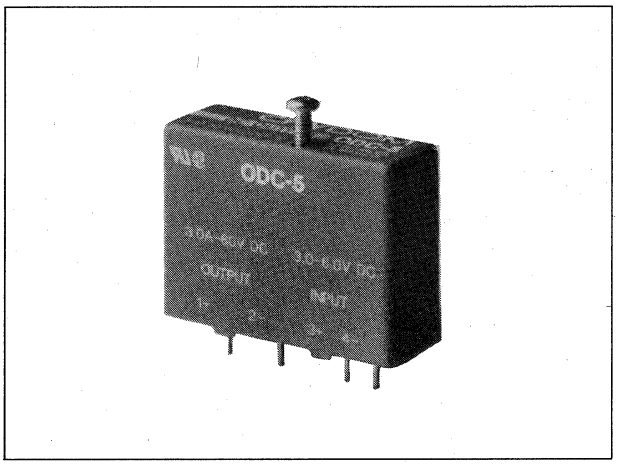
CRYDOM COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

IAC/IDC/OAC/ODC SERIES

Industrial environments can subject sensitive microelectronic circuits to undesirable stresses in the form of voltage transients, electrical noise, shock, vibration, etc. These can result in permanent damage, spurious operations or false indications. Crydom's I/O modules are designed to provide an electrically clean, photo-isolated, noise-free "output" interface from logic level control systems to external loads such as motors, valves, solenoids, etc., or, an "input" interface from the load or sensors to microprocessor or computer-based logic level systems. Used with Crydom's I/O mounting boards, these solid-state modules exhibit long, reliable life in industrial environments.

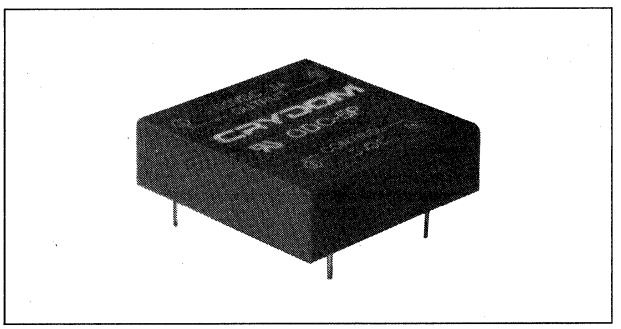


FEATURES

- Color-coded by Function
- 4000 Vrms Optical Isolation
- Industry Standard Package and Pin-out
- High Transient Noise Immunity
- Series Operation Compatibility
- UL Recognized, CSA Certified, SEV Approved Types Available

IACP/IDCP/OACP/ODCP SERIES

These flat pack modules offer reliable input-output interfacing in a low profile package outline that permits PC board spacing on half-inch centers.

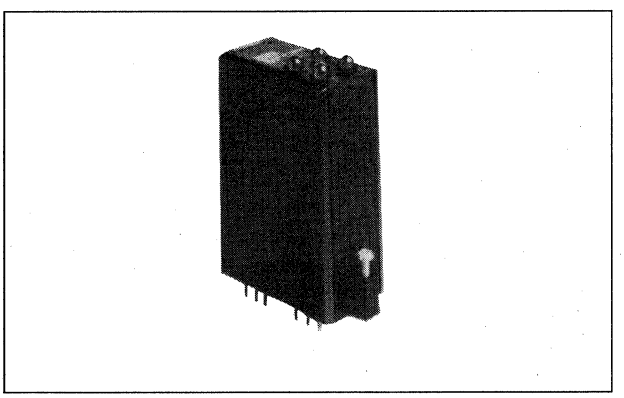


FEATURES

- Low Profile Permits 0.50 inch (12.70mm) PC Board Spacing
- Industry Standard Footprint
- Color-Coded by Function
- 4,000 Vrms Optical Isolation
- High Transient Noise Immunity
- Series Operation Compatibility
- UL Recognized, CSA Certified

IACQ/IDCQ/OACQ/ODCQ SERIES

Each quad module has four I/O channels of the same type. They provide a high packaging density means of reliably interfacing logic level control systems with external loads such as motors, valves, solenoids, etc., or as an interface from the load or sensors to microprocessor or computer-based logic level control systems.

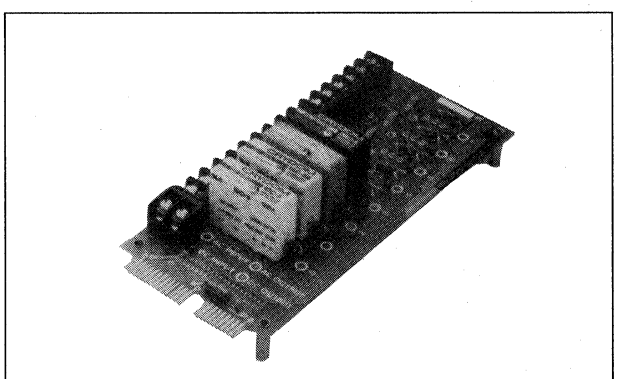


FEATURES

- Industry Standard Plug-in Package
- Input Modules Have Reverse Voltage Feedback Protection
- Output Modules Can Be Controlled By Sinking Logic
- Color Coded By Function
- 4,000 Vrms Optical Isolation
- High Transient Noise Immunity
- Series Operation Compatibility
- UL Recognized, CSA Certified Types Available

PB SERIES

These mounting boards will accept input/output modules in any combination of input or output types of the same style (single or quad channel). Modules can be easily and quickly inserted, without disturbing field wiring. The single channel models provide an LED status indicator, plug-in 5 amp fuse and 3.3 Kohm pull-up resistor for each module.



FEATURES

- LED Status Indicators
- Plug-in Fuses
- Pull-up Resistors
- Barrier Strip Screw Terminals for Field Wiring
- Card Edge Logic Connections Available
- Screw Terminal Logic Connections Available
- UL Recognized Types
- CSA Certified Types

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MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES
TECHNICAL INFORMATION

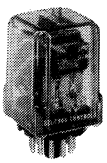
WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1404, **B**•1090, **C**•1119 **D**•1156
AC Power Supplies, Product Selection Guide ..... **D**•2156
ASCII Code ..... **D**•1080
Batteries, Product Selection Guide .... **D**•1447
Batteries & Fuel Cells, Characteristics ..... **D**•1450
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide . **A**•1002
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1197
Conductors, Maximum Current Capacity of Copper & Aluminum ... **A**•2272, **C**•1316
Connectors, Miniglossary ..... **C**•1271
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1339
DC Power Supplies, Product Selection Guide ..... **D**•1537
Delay Lines, Product Selection Guide ..... **A**•1503
Dielectrics, Thermal Conductivity ..... **B**•1916
Discrete Semiconductors, Product Selection Guide ..... **A**•2154
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1041
EBCDIC Code ..... **D**•1086
Encapsulation, Miniglossary ..... **C**•1124
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide ..... **C**•1631
Fiber Optics, Miniglossary ..... **B**•1185
Fiber Optics, Product Selection Guide ..... B•1204
Filters, Power, Product Selection Guide ..... **A**•1642
Filters, Signal, Product Selection Guide ..... **A**•1683
IC Master ..... **A**•1740
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1210
Interconnection Systems, Product Selection Guide ..... **C**•1702
Keyboards & Keypads, Product Selection Guide ..... **B**•1854
Lamps, Lights, & Indicators, Product Selection Guide ..... **B**•1126
Logofinder & Trademark Directories ... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1776
Military Qualified Products List ..... **B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1221
Opto Semiconductors, Miniglossary ..... **A**•2169
Oscilloscopes, Product Selection Guide ..... **D**•1426
Panel Hardware, Product Selection Guide ..... **C**•1583
Panel Meters, Analog & Digital, Product Selection Guide ..... **D**•1376
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **A**•2078
Power Supplies, Miniglossary ..... A•2276, **D**•1541
Power Supplies, AC, Product Selection Guide ..... **D**•2156
Power Supplies, DC, Product Selection Guide ..... **D**•1537
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1351
Relay Contact Forms ..... **B**•1450
Relays, Electromechanical, Miniglossary ..... **B**•1414
Relays, Product Selection Guide ..... **B**•1411
Resistor Color Codes ..... **A**•1952
Resistors, Product Selection Guide ... **A**•1867
Servo Components, Miniglossary ..... **B**•1266
SI Units, Basic Guide To, ... **A**•1434, **B**•1472, **C**•1692, **D**•1386
Solenoids, Product Selection Guide ... **B**•1655
Switches, Product Selection Guide .... **B**•1673
Symbols—International Authorities ..... **A**•1454, **B**•1064, **C**•1104, **D**•1166
Thermal Components, Product Selection Guide ..... **B**•1886
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1916
Thyristors/High Power Diodes, Miniglossary ..... **A**•2211
Timers, Miniglossary ..... **B**•1492, **D**•1140
Trademark & Logofinder Directories ... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1928
Transformers, Product Selection Guide ..... **A**•2215
Voltage Drop Nomograph ..... **A**•2262, **C**•1469, **C**•1960 **D**•1718
Wire & Cable, Product Selection Guide ..... **C**•1755
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1343, **C**•1759

DELTROL RELAYS

MADE IN U.S.A.

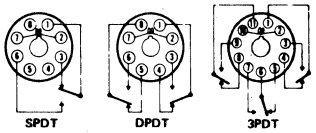
SEE SECTION 4550 FOR SOLENOIDS



105 Series

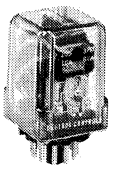
L = 1-3/8
W = 1-3/8
H = 2

General purpose plug-in relay for continuous duty operation. Plastic cover. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).



BASE DIAGRAMS FOR 105 SERIES

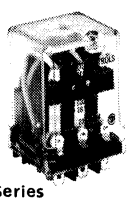
B-3 HOLD DOWN SPRING S/N 20171-00



105A Series

L = 1-3/8
W = 1-3/8
H = 2

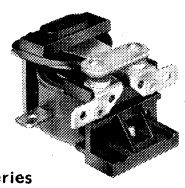
General purpose plug-in relay with a lamp connected across relay coil; indicates voltage applied to coil. Recognized under the components Program of Underwriters Laboratories, Inc. (File No. E37066).



165/166 Series

L = 1-13/32
W = 1-1/2
H = 2-3/16

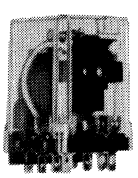
Plastic covered general purpose plug-in relay. Molded nylon coil. Continuous duty operation. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). Also CSA Recognized.



170 Series

L = 1-7/8
W = 1-5/8
H = 1-1/4

High current relays for industrial control applications. Molded nylon encapsulated coil is resistant to fungus and moisture. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).



268 Series

W = 1-1/2
D = 1-7/16
H = 2-1/2

Plastic covered general purpose plug-in relay. Molded nylon coil. Continuous duty operation. .187 quick connect terminals. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). Also CSA recognized.

105 SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20106-82	105	SPDT	10A	24VAC	82	2.0VA
20106-84	105	SPDT	10A	120VAC	2,250	2.0VA
20107-84	105	DPDT	5A	120VAC	1,800	2.2VA
20108-81	105	DPDT	10A	12VAC	19	2.0VA
20108-82	105	DPDT	10A	24VAC	74	2.0VA
20108-84	105	DPDT	10A	120VAC	1,800	2.0VA
20108-85	105	DPDT	10A	240VAC	6,800	2.0VA
20110-82	105	3PDT	10A	24VAC	74	2.2VA
20110-84	105	3PDT	10A	120VAC	1,800	2.2VA
20110-85	105	3PDT	10A	240VAC	6,800	2.2VA
20114-80	105	DPDT	10A	6VDC	30	1.2W
20114-81	105	DPDT	10A	12VDC	120	1.2W
20114-82	105	DPDT	10A	24VDC	472	1.2W
20114-83	105	DPDT	10A	48VDC	1,800	1.2W
20114-84	105	DPDT	10A	110VDC	10,000	1.2W
20116-81	105	3PDT	10A	12VDC	120	1.2W
20116-82	105	3PDT	10A	24VDC	472	1.2W

105A SERIES (w/Indicator Lamp)

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20117-82	105A	DPDT	10A	24VAC	74	2.2VA
20117-84	105A	DPDT	10A	120VAC	1,800	2.2VA
20117-85	105A	DPDT	10A	240VAC	6,800	2.2VA
20118-84	105A	3PDT	10A	120VAC	1,800	2.2VA

165/166 SERIES

Flange-Mount Versions are Also Available.

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20307-82	166	DPDT	10A	24VAC	74	2.2VA
20307-84	166	DPDT	10A	120VAC	1,800	2.2VA
20307-85	166	DPDT	10A	240VAC	6,800	2.2VA
20308-82	166	3PDT	10A	24VAC	74	2.2VA
20308-84	166	3PDT	10A	120VAC	1,800	2.2VA
20308-85	166	3PDT	10A	240VAC	6,800	2.2VA
20310-80	166	DPDT	10A	6VDC	30	1.2W
20310-81	166	DPDT	10A	12VDC	120	1.2W
20310-82	166	DPDT	10A	24VDC	472	1.2W
20325-84	165	3PDT	5A	120VAC	1,800	2.2VA
20311-81	166	3PDT	10A	12VDC	120	1.2W
20311-82	166	3PDT	10A	24VDC	472	1.2W
20311-84	166	3PDT	10A	110VDC	9,500	1.2W
20381-82	166A	3PDT	10A	24VAC	74	2.2VA
20381-83	166A	3PDT	10A	120VAC	1,800	2.2VA

170 SERIES

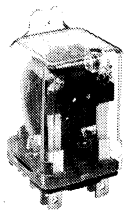
		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20392-82	170	SPST-	30A	24VAC	44	4.7VA
20392-83	170	NO-DM	30A	120VAC	1,100	4.7VA
20394-81	170	SPST-	30A	12VDC	72	2W
20394-82	170	NO-DM	30A	24VDC	288	2W

268 SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20684-82	268	DPDT	15A	24VAC	74	2.2VA
20684-84	268	DPDT	15A	120VAC	1,800	2.2VA
20686-82	268	DPDT	15A	24VDC	472	1.2W

DELTROL RELAYS MADE IN U.S.A.

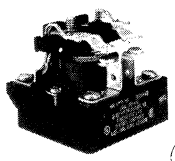
SEE SECTION 4550 FOR SOLENOIDS



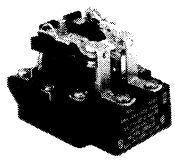
General purpose relays with plastic dust cover with flange mounting, barrier-type .250" quick-connect terminals and molded-nylon coil. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA Recognized.

275F SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20844-82	275F	DPDT	25A	24VAC	55	2.4VA
20844-84	275F	DPDT	25A	120VAC	1,500	2.4VA
20848-82	275F	SPST-NO-DM	35A	24VDC	320	1.8W
20852-82	275F	DPDT	25A	24VDC	320	1.8W

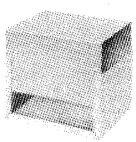


Single Pole
L = 2-1/2
W = 2-1/2
H = 2-3/16



Double Pole
L = 3-11/32
W = 2-1/2
H = 2-3/8

Heavy duty power relay for industrial control applications. Particularly suited for motor controls, heater loads, welder loads, and other power switching applications. Molded nylon coil resists fungus and moisture. Long life, rugged construction. Rating: 30 amps, 1-1/2 hp, 120/240 VAC. Heavy duty screw-type terminals. Mounting: two 3/16" holes on 1-7/8" centers. Listed under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA listed (File No. 20690).



B-5 DUST COVER

L = 5
W = 4
H = 3

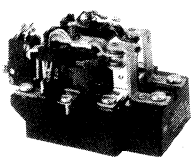
S/N 20257-80

Sealed knock-out holes for standard conduit fittings. Relay mounts on pre-drilled base. Constructed of Aluminum. Snap action cover release. Accommodates relay series 900.

900 SERIES

Auxiliary Switch Models are Also Available.

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20237-82	900	SPST-NO	30A	24VAC	12	9.5VA
20237-83	900	SPST-NO	30A	120VAC	290	9.5VA
20238-82	900	SPST	30A	24VAC	12	9.5VA
20238-83	900	NO-DM	30A	120VAC	290	9.5VA
20239-82	900	SPDT	30A	24VAC	12	9.5VA
20239-83	900	SPDT	30A	120VAC	290	9.5VA
20240-82	900	DPST-NO	30A	24VAC	12	9.5VA
20240-83	900	DPST-NO	30A	120VAC	290	9.5VA
20240-84	900	DPST-NO	30A	240VAC	1,200	9.5VA
20241-82	900	DPDT	30A	24VAC	12	9.5VA
20241-83	900	DPDT	30A	120VAC	290	9.5VA
20241-84	900	DPDT	30A	240VAC	1,200	9.5VA
20243-81	900	SPDT	30A	12VDC	72	2W
20243-82	900	SPDT	30A	24VDC	290	2W
20244-81	900	DPST-NO	30A	12VDC	72	2W
20244-82	900	DPST-NO	30A	24VDC	290	2W
20245-81	900	DPDT	30A	12VDC	72	2W
20245-82	900	DPDT	30A	24VDC	290	2W
20245-84	900	DPDT	30A	110VDC	6,050	2W

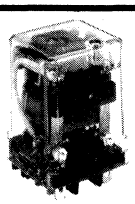


L = 4-1/4
W = 2-1/2
H = 2-3/8

900 Series heavy duty power relay with snap-action, 10 amp, 1/4" hp, SPDT auxiliary switch. Molded nylon coil resists fungus and moisture. Listed under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA File No. 20690.

900-1C SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20246-83	900-1C	DPDT	30A	120VAC	290	9.5VA
20249-82	900-1C	DPST-NO	30A	24VDC	290	2W

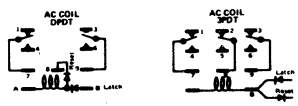


L = 1-13/32
W = 1-1/2
H = 2-3/16

Latching relays especially suited for AC power supplies. Units have moisture and fungus-resistant nylon encapsulated coil. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).

166ML SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20525-84	166ML	DPDT	10A	120VAC	1,800	4VA



WIRING DIAGRAMS
FOR 166ML SERIES

Diodes are Externally Wired and Supplied by customer. Type IN4005 or equivalent recommended. 3PDT ONLY

All Dimensions are Nominal.

DELTROL controls / DIVISION OF DELTROL CORP
2745 S. 19th St., Milwaukee, WI 53215, Phone (414) 671-6800, Telex 2-6871, Fax (414) 671-6809

DOUGLAS RANDALL

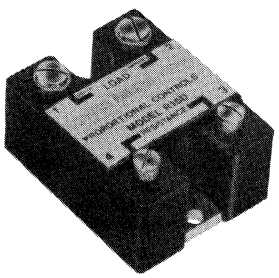
Division of Kidde Industries, Inc.

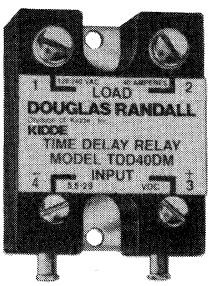
KIDDE

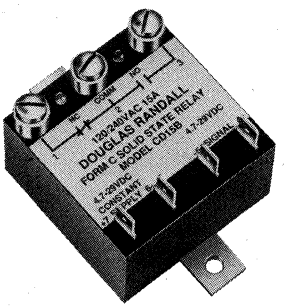
RELAYS & COIL PRODUCTS

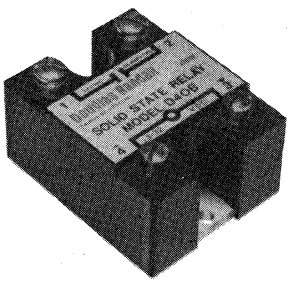
6 Pawcatuck Avenue, P.O. Box 506, Pawcatuck, CT 06379 (203) 599-2075, FAX (203) 599-1754

RELAYS









PROPORTIONAL CONTROL

- R series for variable AC control with variable resistor input
- An additional module to provide variable AC control with 0-10 VDC input
- RD series for variable AC control with 0-10 VDC input in one module

See EEM page **B•1467**

TIME DELAY

- Up to 40 amp operation
- Total solid state unit
- Timing set by external resistor from 300 ms to 23 min. duration on standard units
- Full opto-isolation, zero crossover, integral heat sink features

See EEM page **B•1467**

FORM C RELAY

- True Form C Function
- Full Solid State Design Incorporates Opto Isolation, 0-Voltage Switching, Integral Heat Sink
- LED Indicators of Switching Status
- Models Available for Both AC and DC Loads

See EEM page **B•1466**

SOLID STATE RELAY

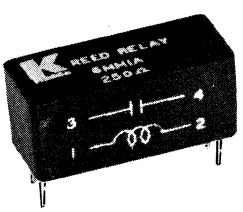
- Full line of standard AC output relays UL recognized
- DC output relays to 8 amp and 500V
- Opto isolation, zero voltage switching

See EEM page **B•1466**

REED RELAY and COIL PRODUCTS

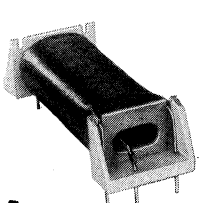
REED RELAYS

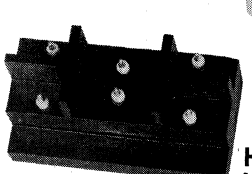
- One week turnaround on special samples



MINIATURE MOLDED

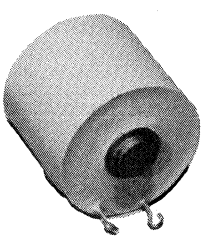
OPEN TYPES

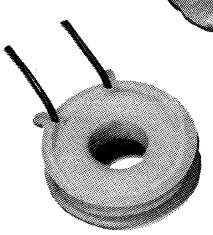




HIGH VOLTAGE

COILS

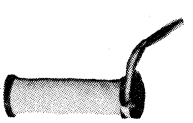




Tape wound
Bobbin wound
Molded
Interleave
Interweave
Encapsulated

TRANSFORMERS

- Up to 500 VA split bobbin types available
- Specialty transformers of all types



DOUGLAS RANDALL

Division of Kidde Industries, Inc.

KIDDE

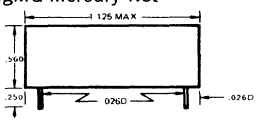
6 Pawcatuck Avenue, P.O. Box 506, Pawcatuck, CT 06379 (203) 599-2075, FAX (203) 599-1754

REED RELAYS

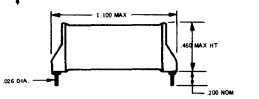
MINIATURE REED RELAYS

MOLDED—Series MM Dry, HgM Mercury Wet*
OPEN—Series MG Dry Reed, HgMG Mercury Wet*

MINIATURE MOLDED, M



MINIATURE OPEN, MG



Form	Nominal Voltage	DCR Ohms ± 10%	MM Series Part Number	MG Series Part Number
1A	6	250	6MM1A	6MG1A
	12	1000	12MM1A	12MG1A
	24	4000	24MM1A	24MG1A
2A	6	170	6MM2A	6MG2A
	12	675	12MM2A	12MG2A
	24	2700	24MM2A	24MG2A
3A	6	110	6MM3A	6MG3A
	12	450	12MM3A	12MG3A
	24	1800	24MM3A	24MG3A
4A	6	60	—	6MG4A
	12	250	—	12MG4A
	24	1000	—	24MG4A
5A	6	50	—	6MG5A
	12	200	—	12MG5A
	24	800	—	24MG5A
6A	6	50	—	6MG6A
	12	200	—	12MG6A
	24	800	—	24MG6A
1B	6	170	6MM1B	6MG1B
	12	675	12MM1B	12MG1B
	24	2700	24MM1B	24MG1B
2B	6	110	6MM2B	6MG2B
	12	450	12MM2B	12MG2B
	24	1800	24MM2B	24MG2B
1A1B	6	110	6MM1A1B	6MG1A1B
	12	450	12MM1A1B	12MG1A1B
	24	1800	24MM1A1B	24MG1A1B
2A2B	6	50	6MM2A2B	6MG2A2B
	12	200	12MM2A2B	12MG2A2B
	24	800	24MM2A2B	24MG2A2B
1C	6	250	6MM1C	6MG1C
	12	1000	12MM1C	12MG1C
	24	4000	24MM1C	24MG1C
2C	6	170	6MM2C	6MG2C
	12	675	12MM2C	12MG2C
	24	2700	24MM2C	24MG2C
3C	6	60	—	6MG3C
	12	250	—	12MG3C
	24	1000	—	24MG3C
4C	6	50	—	6MG4C
	12	200	—	12MG4C
	24	800	—	24MG4C
1A Latch	6	85/85	6MML1A	6MGL1A
	12	340/340	12MML1A	12MGL1A
	24	1350/1350	24MML1A	24MGL1A

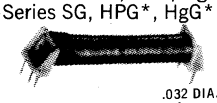
1. E/M shields std. all Series MM and all Form B and Form L.
2. E/S shields optional.
3. 1000VDC switches available all Form A and B relays.
4. Premium run-in switches available all models.
5. Ultra sensitive relays available.
6. Series MML/1A, have internal diodes.

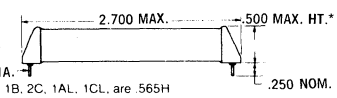
Contact factory for informtion on contact data and pin layouts for Miniature and Standard Series plus additional models available.

STANDARD SIZE REED RELAYS

MOLDED—Series SM, HP*, Hg*
OPEN—Series SG, HPG*, HgG*

STANDARD OPEN, SG, HPG*, HgG*



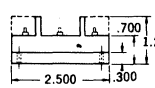


*2A, 1B, 2C, 1AL, 1CL, are .565H

Form	Nominal Voltage	SM Series Molded Part Number	SM Series Molded DCR Ohms ± 10%	SG Series Open Part Number	SG Series Open DCR Ohms ± 10%
1A	6	6SM1A	180	6SG1A	180
	12	12SM1A	725	6SG1A	720
	24	24SM1A	2900	24SG1A	2880
2A	6	6SM2A	175	6SG2A	110
	12	12SM2A	700	12SG2A	440
	24	24SM2A	2750	24SG2A	1760
1B	6	6SM1B	175	6SG1B	110
	12	12SM1B	700	12SG1B	440
	24	24SM1B	2750	24SG1B	1760
2B	6	6SM2B	140		
	12	12SM2B	550		
	24	24SM2B	2200		
1C	6	6SM1C	180	6SG1C	180
	12	12SM1C	725	6SG1C	720
	24	24SM1C	2900	24SG1C	2880
2C	6	6SM2C	175	6SG2C	110
	12	12SM2C	700	12SG2C	440
	24	24SM2C	2750	24SG2C	1760
1A Latch	6	6SML1A	85/85	6SGL1A	85/85
	12	12SML1A	340/340	12SGL1A	340/340
	24	24SML1A	1350/1350	24SGL1A	1350/1350

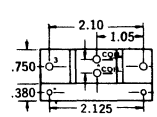
*For part numbers and DCR values contact factory. See specification table for contact ratings.

HIGH VOLTAGE RELAYS
HV SERIES

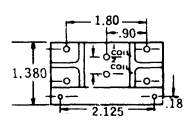


Form	Nom. Volt.	Part Number	DCR Ohms ± 10%
1A (1B*)	6	6HV1A	25
	12	12HV1A	100
	24	24HV1A	400
2A	6	6HV2A	20
	12	12HV2A	80
	24	24HV2A	320

1A or 1B Top View



2A Top View



OPTION:
*Relays available in Form B up to 7,500V.

Note: To order, specify as follows: 6HV1A 35 is a 6HV1A relay with 3,500VDC switch.

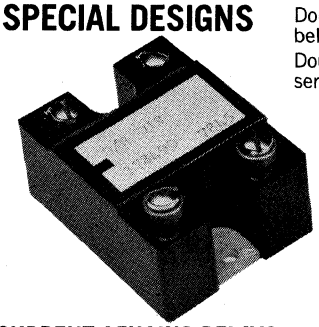
CONTACT DATA

Series	Maximum Resistive Rating			Breakdown Voltage (min.)	Initial Resistance
35	3,500VDC	3.0A	50W	5,000VDC	.100 Ohms
75	7,500VDC	3.0A	50W	10,000VDC	.100 Ohms
100	10,000VDC	3.0A	50W	12,500VDC	.100 Ohms

SPECIAL DESIGNS

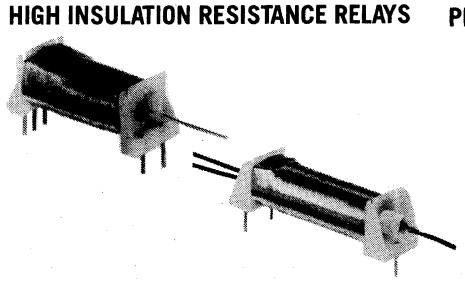
Douglas Randall makes custom designed relays to solve difficult problems. A few models are shown below to illustrate the variety available.

Douglas Randall will gladly review your applications and offer rapid engineering and prototype service.

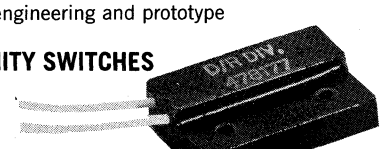


CURRENT SENSING RELAYS

HIGH INSULATION RESISTANCE RELAYS

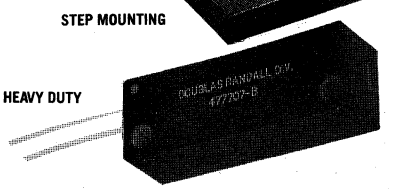


PROXIMITY SWITCHES



STEP MOUNTING

HEAVY DUTY



DOUGLAS RANDALL SOLID STATE COMPONENTS

Division of Kidde Industries, Inc.
KIDDE

STOCKED FOR IMMEDIATE DELIVERY

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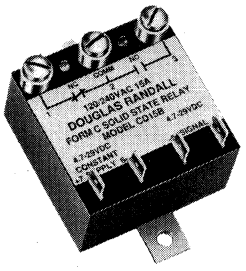
FORM C AC SWITCHING RELAYS



MODEL	CONSTANT SUPPLY	INPUT SIGNAL	OUTPUT
CD15B	4.7-29 VDC Continuous	4.7-29 VDC	15 Amp 120-240 VAC
CD40B	4.7-29 VDC Continuous	4.7-29 VDC	40 Amp 120-240 VAC
CA15B	90-140 VAC Continuous	Dry Switch	15 Amp 120-240 VAC
CA40B	90-140 VAC Continuous	Dry Switch	40 Amp 120-240 VAC

- True Form C Function
- Full Solid State Design Incorporates Opto Isolation, O-Voltage Switching, Integral Heat Sink
- LED Indicators of Switching Status
- Models Available for Both AC and DC Loads

OPERATION

DC INPUT

The relay requires a constant supply of DC voltage independent of the switching signal or output load function. In order for the relay to operate, both DC constant supply and AC load must be connected to the appropriate terminals (see schematic). At this point, the NC load will conduct while the NO load will remain open. In order to switch the relay, the signal terminals are activated by a DC signal of 4.7-29 VDC. At this time the normally closed contacts will open and the normally open contacts will close. LED on indication shows the conducting side at all times. Removal of the DC signal voltage switches the relay to its initial conducting position. If the constant supply is not applied, both sides will be open and both LEDs will be off. Constant supply can be used as an on-off switch on the normally closed side.

INPUT DATA-AC LOAD RELAYS

	DC SIGNAL	CONSTANT SUPPLY	AC SIGNAL	CONSTANT SUPPLY
Range	4.7-29 VDC	4.7-29 VDC	Dry Closure	90-140 VAC
Must Operate	4.7 VDC	4.7-29 VDC		90 VAC
Must Release	1.0 VDC	1.0 VDC		10 VAC
Input Impedance	2.7K	2.7K		5.5K
Isolation Signal to Load Signal to Base	 4000 V 2500 V	 4000 V 2500 V	 4000 V 2500 V	 4000 V 2500 V
Temperature Range	−20+80C		−20+80C	

AC OUTPUT DATA

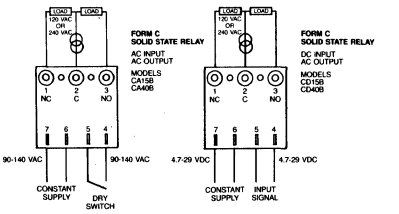
	CD15B	CA15B	CD40B	CA40B
AC Line Voltage	90-300 VAC	90-300 VAC	90-300 VAC	90-300 VAC
AC Load Current	15A	15A	40A	40A
Frequency	47-63Hz	47-63Hz	47-63Hz	47-63Hz
Voltage Drop at Rated Current	1.6	1.6	1.6	1.6
Minimum Holding Current	100MA	100MA	200MA	200MA
Typ. Turn On Voltage	6V	6V	6V	6V
Off-State Leakage Current	5MA	5MA	10MA	10MA
Isolation Output to Base	2500V	2500V	2500V	2500V

AC INPUT

The Form C relay with AC input requires a 90-140 VAC constant supply and a dry closure for the switch signal. The operation of the relay and indication of the LEDs are the same as for the DC input models.

O-CROSSING AND TRANSFER TIME

The Form C relay incorporates a O-crossing feature to minimize switching transients. To assure break-before-make between output terminals, a 10ms. minimum transfer time is designed into the unit. Due to O-crossing variations, the maximum transfer time could be as much as 18ms.



The relay is a seven terminal device. Terminals 1, 2, and 3 are output terminals. Terminals 4 and 5 are signal terminals, and 6 and 7 are constant supply terminals.

FORM C DC SWITCHING RELAYS

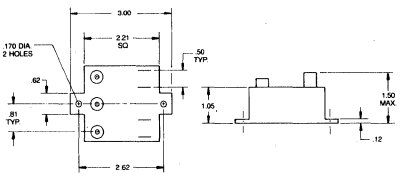
The Douglas Randall Form C DC solid state relay is a true break-before-make device. LEDs indicate the conducting side of the relay. Opto isolation and integral heat sink are standard in a fully epoxy encapsulated unit.

MODEL	CONSTANT SUPPLY	DC SIGNAL	OUTPUT
CK06E	4.7-29 VDC Continuous	4.7-29 VDC	6 Amp-300 VDC
CK15E	4.7-29 VDC Continuous	4.7-29 VDC	15 Amp-300 VDC
CK15B	4.7-29 VDC Continuous	4.7-29 VDC	15 Amp-80 VDC

DC OUTPUT DATA

	CK06E	CK15B	CK15E
DC Line Voltage	2-300 VDC	2-80 VDC	2-300 VDC
Continuous Current	6ADC	15ADC	15ADC
Off State Leakage	2MA	15MA	5MA
Voltage Drop At Rated Current	1.5VDC	1.5VDC	1.5VDC
Isolation Load to Base Signal Load	 2500V 4000V	 2500V 4000V	 2500V 4000V
Minimum Holding Current	30MA	50MA	50MA

MECHANICAL ARRANGEMENT– ALL MODELS



SOLID STATE RELAYS/RATINGS TO 40 AMPS

AC Output/DC or AC Control
UL Recognized/File No. E60556/C.C.
NMFT2
CSA Certified File LR34149

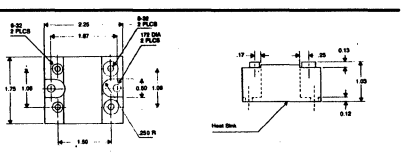
Douglas Randall's line of solid state AC output relays are UL recognized for resistive, lamp and motor loads. Featuring opto-isolation and zero-voltage switching models are available to handle up to 40 Amp. DC or AC control signals can be specified and Form A or B output. Call For Competitive Pricing on The New "J" Series.

AC Line Voltage: 90/140V or 200/280V[1] @ 47-63 Hz[2]
Voltage Drop @ Rated Current: 1.6V Max.
Typical Turn-on Voltage: 5V
Response Time (DC Signal): 1/2 Cycle Max.
dv/dt[6] Off State: 100V/µsec.
Commuting: 5V/µsec.

Off State Leakage Current:
90/140 VAC—4.5mA Typ.
200/280VAC—5.5mA Typ.
400/480VAC—1.5mA Typ.
Isolation Output to Base: 1500V, $10^{10}\Omega$ DC[3]
Contact Form:: SPST (NO)[4]

INPUT SIGNAL DATA (AC OR DC)

	DC	AC
Range	3-32V[5]	90-240VAC (80-140VDC)
Must Operate	3VDC	90VAC (80VDC)
Must Release	1VDC	10VAC (10VDC)
Input Impedance	1000Ω Min., 40KΩ Min.	
Isolation		
Signal to Load	1500V, $10^{10}\Omega$ DC	
Signal to Base	1500V, $10^{10}\Omega$ DC	
Capacitance	15 pF Signal to Load	
Temperature Range	−30°C to +80°C	



MODEL NUMBERS

Output Rating	Current	DC Signal	AC Signal
90-140VAC	4A	D04A	A04A
	8A	D08A	A08A
	12A	D12A	A12A
	25A	D25A	A25A
	40A	D40A	A40A
200-280VAC	4A	D04B	A04B
	8A	D08B	A08B
	12A	D12B	A12B
	25A	D25B	A25B
	40A	D40B	A40B
400-480VAC*	12A	D12D	A12D
	25A	D25D	A25D
	40A	D40D	A40D

OUTPUT DATA (AC OUTPUT)

Maximum Current	4A	8A	12A	25A
One Cycle Surge Current	75A	100A	150A	250A
Overload (1 sec., RMS)	20A	30A	50A	40A
Minimum Holding Current	50mA Typ.	50mA Typ.	50mA Typ.	50mA Typ.

DOUGLAS RANDALL

Division of Kidde Industries, Inc.
KIDDE

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SOLID STATE COMPONENTS
STOCKED FOR IMMEDIATE DELIVERY

PROPORTIONAL CONTROLS/40 AMP @ 480 VAC

Douglas Randall Proportional Control vary loads up to 40 Amp @ 480 VAC from 0 to 99%.

Mechanical Specifications on SSR AC output

SERIES R— RESISTOR CONTROLS

These controls operate by connecting a variable resistor to the input terminals. See Figs. 1 & 2.

INPUT*
Variable Resistor (150,000Ω, 1 watt)—For 120VAC
Variable Resistor (1 Megohm, 1/2 watt)—For 240VAC, 277VAC or 480VAC

Output Voltage		CURRENT				
		5A	10A	15A	25A	40A
90-130 VAC	Models	R05A	R10A	R15A	R25A	R40A
200-240 VAC	Models	R05B	R10B	R15B	R25B	R40B
400-480 VAC	Models*	R05D	R10D	R15D	R25D	R40D

OUTPUT DATA

Maximum Current	5A	10A	15A	25A	40A
One Cycle Surge Current	75A	100A	150A	225A	400A
Overload (1 Sec., RMS)	20A	30A	50A	70A	150A
Minimum Holding Current	.05A	.05A	.07A	.08A	.09A
AC Line: 90/130 VAC, 200/240 VAC, 250/300 VAC or 400/480 VAC					
Typical Leakage: 90/130 VAC—10 mA; 200-240 VAC—7 mA; 250-300 VAC—6mA; 400-480 VAC—3 mA*.					

*Models R05D, R10D, R15D, R25D and R40D have no snubbers.

INPUT MODULES RDA, RDB & RDD

These modules accept 0-10 VDC signals. Their output is connected to the input terminals of Series R—Resistor Modules, which in turn controls loads up to 40 Amp @ 480 VAC. See Fig. 3.

SERIES RD/LOGIC INPUT CONTROL

Series RD provide full control from 0% to 99% when energized by 0-10 VDC or 0-15m ADC signals.

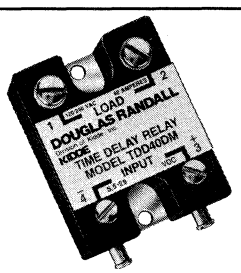
MODEL RD04A AND MODEL RD04B UL Listed File Number E103645

INPUT SIGNAL	0-10 VDC or 0-15 ma DC(2)	
OUTPUT SIGNAL	RD04A	RD04B
Maximum Current	4A	4A
One Cycle Surge Current	100A	100A
One Second Overload Current	40A	40A
Minimum Holding Current	.05A	.05A
AC Line Voltage	90-130 VAC @ 47-63 Hz	200-240 VAC
Off State Leakage	.01A (typical)	.01A (typical)
Response Time	150 m sec @ 10 VDC (typical)	300 m sec @ 10 VDC
Isolation (Input to Output)	500 VRMS	500 VRMS

Notes: 1. All data is measured at 25°C.
2. The input is not polarity sensitive, but must be protected against voltages above 10 VDC.

TIME DELAY RELAY SWITCHING

Series TD relays are available in delayed make or delayed break models, with DC or AC input, and switching capability up to 40 amps at 120/240 VAC. They incorporate leading edge R/C micro circuit technology and retain the desirable characteristics of our standard solid-state relays, such as opto-isolation, zero cross-over, and integral heat sink. Time delay is set by applying an external resistor to the terminals provided.



MODEL*	INPUT	OUTPUT AC	MODEL*	INPUT	OUTPUT AC
TDD25DM	5.5-29 VDC	120/240-25A	5TDD25DB	5.0 VDC**	120/240-25A
TDD40DM	5.5-29 VDC	120/240-40A	5TDD40DB	5.0 VDC**	120/240-40A
TDD25DB	5.5-29 VDC	120/240-25A	TDA25DM	90/140 VAC	120/240-25A
TDD40DB	5.5-29 VDC	120/240-40A	TDA40DM	90/140 VAC	120/240-40A
5TDD25DM	5.0 VDC**	120/240-25A	TDA25DB	90/140 VAC	120/240-25A
5TDD40DM	5.0 VDC**	120/240-40A	TDA40DB	90/140 VAC	120/240-40A

*DM—Delayed Make DB—Delayed Break **+10%, −5%

GENERAL SPECIFICATIONS —ALL UNITS

- 7500V opto-isolation
- Back-to-back SCR operation
- Timing: 15K ohm/second nominal; 22 megohms maximum.
- Minimum operation with resistor terminal shorted: 300 milliseconds nominal.
- All units have snubbers

NOMINAL PERCENTAGES OUTPUT VS INPUT RESISTANCE @ 25°C

Models R05 to R40A

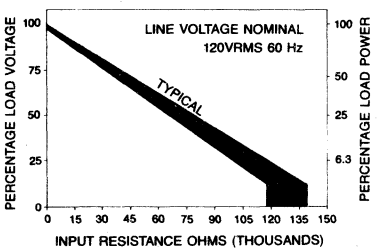


Fig. 1

Models R05 to R40B, R05 to R40D

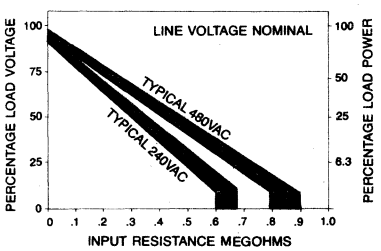


Fig. 2

PERCENT OUTPUT VOLTAGE VS INPUT VOLTAGE

Models RDA, RDB, RDD, RD04A, RD04B

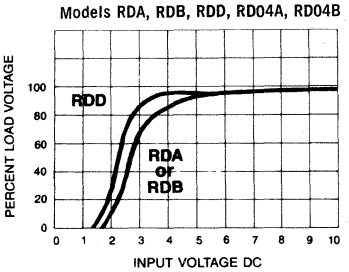
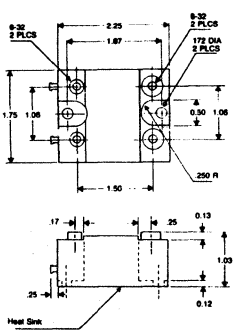


Fig. 3



DOUGLAS RANDALL

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SOLID STATE COMPONENTS
STOCKED FOR IMMEDIATE DELIVERY

SOLID STATE RELAYS SERIES K

DC OUTPUT/DC CONTROL SIGNAL

NEW OUTPUT TO 300 VDC

Douglas Randall Series K are SPST (NO) or (NC) relays which will switch loads of 4, 8 or 12 Amps to 250 VDC. They provide rapid switching and opto-isolation between input and output. The sensitive inputs are compatible with DTL or TTL logic. Arc-free switching makes these relays suitable for hazardous atmospheres.

MECHANICAL ARRANGEMENT

See AC output relays on page **B•1466**

MODEL NUMBERS

Output Voltage	Current	Model
2-32 VDC	4 Amp	K04A
	8 Amp	K08A
	12 Amp	K12A
2-55 VDC	4 Amp	K04B
	8 Amp	K08B
	12 Amp	K12B
2-250 VDC	6 Amp	K06D

*Inductive loads must be diode suppressed.
†Normally closed add—(NC) K04A-NC.

INPUT SIGNAL DATA

Range	3-32VDC
Must Operate	3VDC
Must Release	1VDC
Input Impedance	1000Ω Min.
Isolation	
Signal to Load	1500V
Signal to Base	1500V
Temperature	−30°C to +80°C

OUTPUT DATA

Continuous Current	4A, 8A, or 12A
DC Line Voltage	2-32VDC or 2-55VDC
Off State Leakage	2mA DC
Turn On Time	50 Micro Sec.
Turn Off Time	500 Micro Sec.
Voltage Drop @ Rate Current	1.5VDC Max.
Isolation Load to Base	1500V

SIZE:
2¼L x 1¾W x 1⅛H Max.

WEIGHT:
4 Ounces Max.

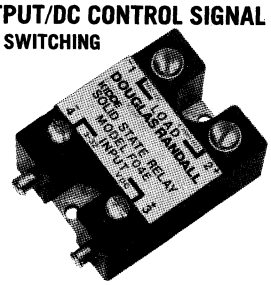
TERMINATION:
Standard Models—
Control Signal:
6-32 Screws
Output:
8-32 Screws

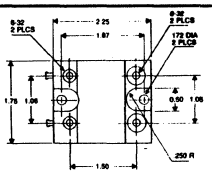
Special Models can be provided with lead wires or other types of termination in OEM quantities. Consult the factory.

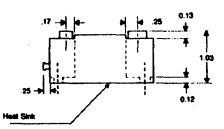
SOLID STATE RELAYS SERIES F

DC OUTPUT/DC CONTROL SIGNAL

500 VDC SWITCHING







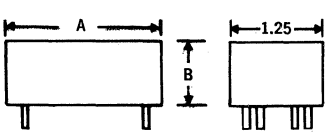
Series F Relays are available SPST (NO) or SPST (NC). They provide rapid switching of loads up to 8 amperes DC. Inputs are opto-isolated and compatible with DTL or TTL logic signals. Arc-free switching makes them suitable for hazardous atmospheres as well as machine tool process control equipment.

MODEL	CURRENT	OUTPUT VOLTAGE	SURGE CURRENT (MAX.) 100µs @ 2% DUTY CYCLE
F04E	4 Amp	25-500 VDC	30 Amp
F08E	8 Amp	25-500 VDC	60 Amp

Note: To designate normally closed relays, add suffix "NC"; e.g., F04E-NC.

SOLID STATE RELAYS—SERIES CV

PC MOUNTED



INPUT DATA			OUTPUT DATA	
	CV1	CV2		CV1 & CV2
Nominal Voltage	5.5VDC	28VDC	Current	3A RMS
Voltage Range	4-10VDC	10-32VDC	Surge Current	80A Peak
Must Operate	4VDC	10VDC	Minimum Current	50mA
Must Release	.4VDC	.4VDC	Off State Leakage	8mA
Impedance	1000Ω	4000Ω	Voltage	24 to 240VAC @ 47 to 63 Hz
Isolation	1500V	1500V		
(Input to Output)	15pF	15pF	Voltage Drop	2.0Vac
			Offstate dv/dt	100V/µsec.
			Turn On Time	8.3msec.
			Turn Off Time	16 msec.

INPUT DATA			OUTPUT DATA	
	CV3	CV6		CV3 & CV6
Nominal Voltage	5.5VDC	28VDC	Maximum Current	3A DC
Voltage Range	4-10VDC	10-32VDC	Voltage Range	4-55VDC
Must Operate	4VDC	10VDC	Voltage Drop	1.6VVDC
Must Release	.4VDC	.4VDC	Off State Leakage	10mA DC
Impedance	1000Ω	4000Ω	Turn On Time	550µsec.
			Turn Off Time	1.5msec.

INPUT DATA			OUTPUT DATA	
	CV4	CV5		CV4 & CV5
Voltage Range	10-55VDC	90-130VAC	Voltage	30VDC
Current	10mA	10mA	Current	16mA Max.
Must Not Operate	3mADC	.8mA RMS	Leakage	100µA
Isolation	1500V	1500V	Voltage Drop	.4VDC
Capacitance	10pF	10pF	Logic Supply Volt.	4-5-6VDC
Impedance	—	40KΩ	Logic Supply Cur.	10mA @ 6VDC

MODELS CV-1 & CV-2

3 Amp output @ 120/240 VAC
Zero crossover, Opto-isolation
Dim. A—2.00" Max, B—.650" Max.

MODELS CV-3 & CV-6

3 Amp output @ 4 to 55 Volts DC
Opto-isolation
Dim. A—2.00", B—.75"

MODELS CV-4 & CV-5

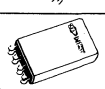
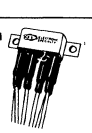
Convert 10-55 VDC (CV-4)
Convert 90-130 VAC (CV-5)
to Logic Level outputs
Opto-isolation
Dim. A—1.25", B—.50"

AC Output CV-1 & CV-2 U/L Recognized, File E60556, C.C.N.MFT2
CSA Certified File LR34149

Electronic Specialty Corporation

P.O. BOX 3501 VANCOUVER, WASHINGTON 98668-3501
PHONE 206/574/5000 FAX 206-573-4635

STANDARD HERMETIC SEALED RELAYS

SERIES	General Information	Contact Form	Contact Rating	D×W×H Size	Sensitivity	Coil Voltages
30	Digital time relay. Operate or release delay. Note: 4DPT available in delay on operate only.	1PDT 2PDT 3PDT 4PDT	2 Amp 28 VDC or 10 Amp 28 VDC	Various	N/A	12 to 48 VDC
35	Voltage Sensor	1.4PDT	10 Amp	Various	N/A	6 VDC to 115AC
50	Qualified to M39016/6. Non Latch	2PDT	D/C to 2A 28 VDC Resistive	.4×.800 ×.41	250 mw Pick Up	6 VDC to 115AC
55	Latching ½ size sensitive latching relay qualified to MIL-R-39016/45M.	2PDT	D/C to 2A 28 VDC Resistive	.4×.800 ×.41	90 mw Latch/Reset	6 VDC to 115AC
61	Qualified to MS27401	2PDT	DC to 12A	.525× 1.025×1.010		6 VDC to 115AC
68	Crystal can "Lazy S" header.	2PDT	D/C to 2A 28 VDC Resistive	.359×.797 ×.875	300 mw Pick Up	6 VDC to 115AC
71 	Sensitive crystal can relay.	2PDT	D/C to 2A 28 VDC Resistive	4×.8 ×1.280	40 mw Pick Up	6 VDC to 115AC
77	Crystal can. Sensitive latching relay.	2PDT	Dry Circuit to 3 Amps 28 VDC Resistive	4×.8 ×.875	90 mw Latch/Reset	6 VDC to 115AC
79	Non Latch Crystal can. Non-latching relay.	2PDT	Dry Circuit to 3 Amps 28 VDC Resistive	.4×.8 ×.875	250 mw Pick Up	6 VDC to 115AC
90 **92**	Sensitive—non-latching. Sensitive—Latching.	4PDT	Dry Circuit to 3 Amps 28 VDC Resistive	.601×1.032 ×1.278	80 mw Pick Up 80 mw Latch/Reset	6 VDC to 115AC
93 **94**	Non-latching Welded or solder sealed. Latching. Welded or solder sealed.	2PDT	10 Amps 28 VDC Resistive	.515×1.032 ×1.300	500 mw Pick Up 150 mw Latch/Reset	6 VDC to 115AC
100 **102**	Sensitive—non-latching. Sensitive—Latching.	6DPT	Dry Circuit to 3 Amps 28 VDC Resistive	.852×1.032 ×1.278	150 mw Pick Up 150 mw Latch/Reset	6 VDC to 115AC
103 **104**	Non-latching. Latching.	4PDT	10 Amps 28 VDC Resistive	.852×1.032 ×1.3	1000 mw Pick Up 300 mw Latch/Reset	6 VDC to 115AC
FHT 	Full or Half size crystal can coaxial relays with 8″ min. RG 178 B/U cables attached. T Series sensitive. Welded sealing.	1PDT with Auxiliary Contacts or 2 PDT Coax	RF to 1.5 Amps 50 Watt Max.	Frequency Range to 500 MHz VSWR–1:1.1 Typical. Characteristic Impedance–50 Ohm Typical. Cross Talk–50 dB Typical.		6 to 32 VDC
300	The ultimate in high current DC load switching. The load is switched with power semiconductors short term, and carried by the relay hard contacts long term, preventing the semiconductors from overheating. The Arcless™ uses a SPST heavy duty mechanical relay. In addition to switching 70 AMP loads, the Arcless will withstand a 180 AMP inrush current from motor or lamp load. Applications for arcless relays should include all high current DC switching where reliability and long life are important design criteria. **No** arc between contact points–**No** electro-magnetic interference. This non-arcing feature is useful for switching where EMI or RFI might cause damage to equipment, software, or quality of radio signals.					

EICHHOFF

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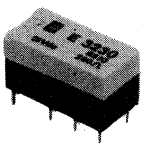
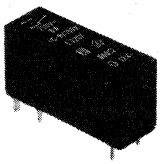
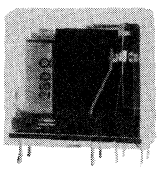
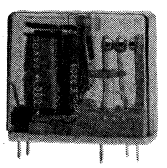
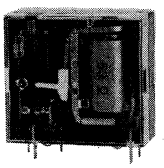
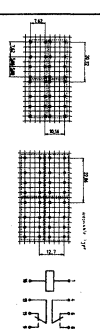
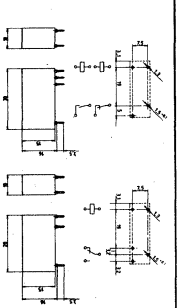
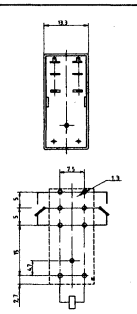
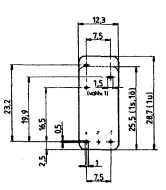
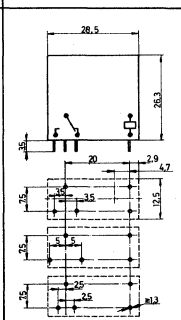
GENERAL PURPOSE PC BOARD RELAYS POWER RELAYS AND CONTACTORS

		E3230	E3207	E3208	E3201	E3206S
FEATURES		DIP-construction, flux resistant, Ag-Pd-contacts, Au-plated washable types available	Large capacity—high sensitivity—small size/wide insulation distance—air and creepage distance >8 mm slim line type	Large capacity, compact size, wide insulation distance—flux resistant, washable, air and creepage distance >8 mm Latching types available slim line type	Porcelain base, low/high temperature peaks, large capacity, flux resistant	Large capacity, compact size, wide insulation distance, air and creepage distance >8 mm Latching types available washable types available slim line type
DIMENSIONS (inch)		.8(W)×.45(H)×.39(D)	1.1(W)×.63(H)×.4(D)	1.13(W)×1.04(H)×.52(D)	1.13(W)×1.0(H)×.48(D)	1.12(W)×1.04(H)×.5(D)
(mm)		20.32(W)×11.4(H)×9.8(D)	28(W)×16(H)×10(D)	28.8(W)×26.5(H)×13.3(D)	28.7(W)×25.5(H)×12.3(D)	28.5(W)×26.3(H)×12.7(D)
CONTACT ARRANGEMENT		2C	1A, 1B, 1C(1C:W=30mm)	2A, 2B, 2C	1A, 1B, 1C	1A, 1B, 1C
CONTACT RATING RESISTIVE		1.25A 125V AC	8A 220V AC	8A 220V AC	8A 240V AC 10A 120V AC 7A 30V DC	10A 220V AC
CONTACT MATERIAL		AgPd 40/60-Au (10μ)	AgCd O	AgCd O AgCuAu-plated	AgCd O, AgCu AgCuAu-plated	AgCd O AgCuAu-plated
LIFE	mechanical operations	15×10^6	10^7	10^7	3×10^7	10^7
	electrical at load	5×10^6	2×10^5(1A);10^5(1B,1C) 8A 220V AC	1.5×10^5 8A 220V AC	3×10^5 6A 220V AC	2×10^5 10A 220V AC
BREAKDOWN VOLTAGE BETWEEN COIL DATA	open contacts		1000V	1000V	1000V	1000V
	contacts and coil		4000V	4000V	2500V	4000V
	voltage (V)	6 12 24 48 5	6 9 12 24 48	6 12 24 48 60	5 6 12 24 48 60	6 12 24 48 60
	resistance (Ω)	66 280 1050 4000 36	160 360 660 2200 8000	53 280 1100 3500 6000	53 75 280 1100 3500 6000	75 280 1100 3500 6000
	power (W)	0.5	0.25	0.5	0.5	0.5
	pull-in voltage	75%	75%	75%	75%	75%
	drop-out voltage	10%	10%	10%	10%	10%
SPECS.	release time	10 ms	12 ms	5 ms	6 ms	4 ms
	operate time	10 ms	18 ms	11 ms	14 ms	10 ms (1B:14 ms)
	dielectric Str	500V AC	2500V AC	2500V AC	2500V AC	2500V AC
	insulation res.	1000 MΩ/500 V	>50 MΩ/500V	>50 MΩ/500V	100MΩ/500V	50MΩ/500V
TEMPERATURE RANGE		−25°C to +65°C	−40°C to +70°C	−40°C to +70°C	−40°C to +70°C	−40°C to +70°C
APPROVALS *PENDING			UL*-CSA*-VDE	VDE-UL-CSA-SEMKO-SEV	UL-CSA	VDE-UL-CSA-SEMKO-SEV
BOTTOM VIEW (mm)						

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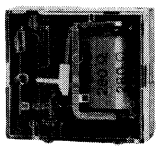
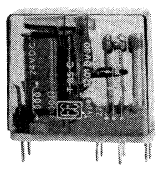
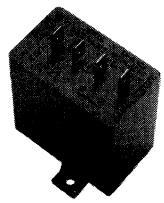
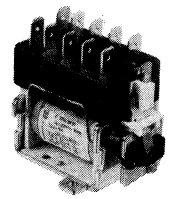
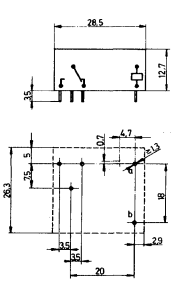
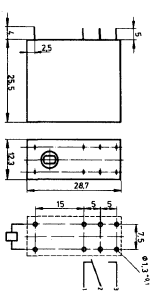
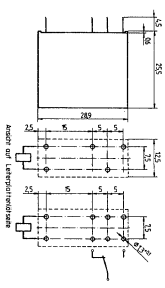
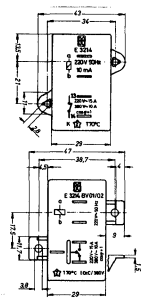
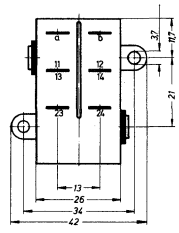
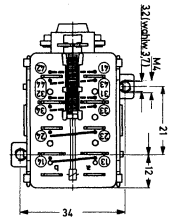
Pioneer in EMI/RFI suppression.
Resin sealed, high performance, high reliability power line filters.
Precise performance within product specifications.
Complete engineering capability for application assistance.

					
E3206L	**E3201 BV30**	**E3209**	**E3214**	**E3252**	**E3250**
Large capacity— compact size, wide insulation distance, air and creepage distance >8 mm latching types available low profile type	Porcelain base, low/high temperature peaks, large capacity, flux resistant slim line type	Low/high temperature peaks, large capacity, flux resistant, washable, high inrush current capability	Fastons High switching capacity Universal mount	Fastons High switching capacity Universal mount	VDE 0660 Miniature Contactor, fastons High switching capacity Universal mount
1.12(W)×.5(H)×1.04(D)	1.13(W)×1.0(H)×.48(D)	1.13(W)×1.00(H)×.49(D)	1.75(W)×1.87(H)×1.02(D)	1.9(W)×1.97(H)×1.14(D)	2.13(W)×2.05(H)×1.61(D)
28.5(W)×12.7(H)×26.3(D)	28.7(W)×25.5(H)×12.3(D)	28.9(W)×25.5(H)×12.5(D)	44.5(W)×47.5(H)×26(D)	48(W)×50(H)×29(D)	54(W)×52(H)×41(D)
1A, 1B, 1C	1A, 1B, 1C	1A, 1B, 1C	1A, 1B, 1C	2A/1A, 1B/1A	4A/3A, 1B/2A-2B/3A 4A/3A, 1B/2A-2B/1B
10A 220V AC	16A	20A	10A 380V AC 15A 220V AC	16A 380V AC	16A 380V AC
AgCd O AgCuAu-plated	AgCd O	AgCd O	AgCd O	AgCd O	AgCd O
10^7 2×10^5 10A 220V AC	2×10^7 1.5×10^5 16A 220V AC	3×10^7 1.5×10^5 16A 220V AC	10^5 16A 220V AC	10^5 16A 250V AC	10^5 16A 220V AC
1000V 4000V	1000V 2500V	1000V 4000V	1500V 2000V	1000V 2500V	1000V 2000V
6 12 24 48 60	5 6 12 24 48 60	6 12 24 48 60	220V AC, 120V AC	380/220V AC, 120V AC	220/380V AC, 120V AC
75 280 1100 3500 6000	53 75 205 740 3500 6000	75 280 1100 3500 6000	2.2VA	3VA(1W)	6VA(3.6W)
0.5 75% 10%	0.5 75% 10%	0.35 75% 10%	80% 10%	80% 10%	80% 10%
4 ms 10 ms (1B:14 ms)	6 ms 14 ms	3 ms 7 ms	15 ms 25 ms	15 ms 25 ms	35 ms 50 ms
2500V AC 50MΩ/500V	2500V AC 100MΩ/500V	2500V AC 100MΩ/500V	2000V	2500V	2000V
−40°C to +70°C	−40°C to +70°C	−30°C to +70°C	−40°C to +70°C	−40°C to +70°C	−30°C to +60°C
VDE-UL-CSA-SEMKO-SEV	UL-CSA (1A)	UL-CSA-VDE	VDE-DEMKO-SEMKO-SEV-UL-CSA	VDE-SEV-SEMKO-UL-CSA	ÖVE-SEV-DEMKO-KEMA-SEMKO-UL*
					

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eem SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
$\ll$	much smaller than
$>$	larger than
$\geq$	larger than or equal to
$\gg$	much larger than
$\equiv$	identical to or equivalent
$\uparrow$	increases
$\downarrow$	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

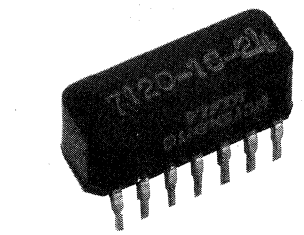
Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

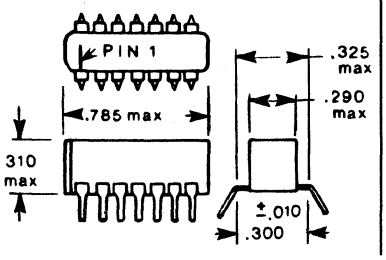
FIFTH DIMENSION INC.

Mercury Relays That Operate in any Position

DIP Relays

- Position-insensitive, bounce-free LCI sealed capsule
- 100% run-in @ 10 VDC-100 mA for 2.5 x 10^6 operations
- 5, 12 and 24 VDC-700 Mw coil drives
- Life expectancy over 50 x 10^6 operations
- Latching or non-latching operation
- Molded diallyl phthalate case





- Operate Time (max.) — 2.5 ms
- Release Time (max.) — 3.0 ms
- Contact Resistance — 75 milliohms

7000 Series (DC to 10 MHz)

- Rated Contact Load — 1.0 amp 4 VDC to 0.3 amp @ 200 VDC

2000 Series (DC to 100 MHz)

(Specifications at 100 MHz)

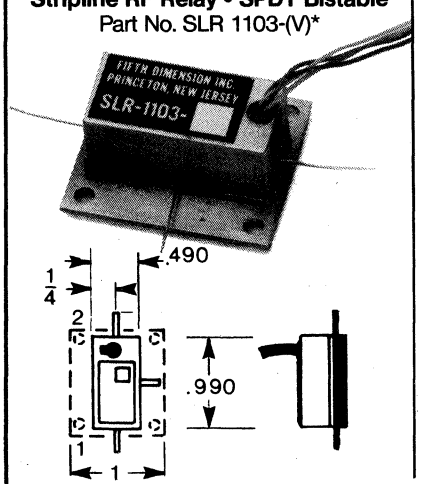
- Rated Contact Load — 10 watts CW
- Insertion Loss (Typical) — 0.2 dB
- Isolation (Typical) — 40 dB
- VSWR (Typical) — 1.5

Bistable (Latching Relays)			Monostable (Non-Latching Relays)		
Part No.	Form	Diode Protection	Part No.	Form	Diode Protection
7120-1A-V*	A	No	7210-1A-V*	A	No
7120-1C-V	C	No	7210-1C-V	C	No
7121-1A-V	A	Yes	7211-1A-V	A	Yes
7121-1C-V	C	Yes	7211-1C-V	C	Yes
2122-1A-V	A	No	2212-1A-V	A	No
2122-1C-V	C	No	2212-1C-V	C	No

*Specify Coil Voltage

50 Ohm Stripline and Coaxial Relays

Stripline RF Relay • SPDT Bistable
Part No. SLR 1103-(V)*

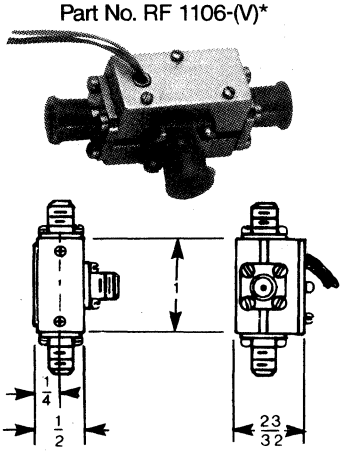


- Position-insensitive, bounce-free LCI sealed capsule
- Bistable operation
- 5, 12 and 24 VDC-700 Mw coil drives
- Operate Time (max.) — 4.0 ms
- Cycling rate — to 40 Hz
- Frequency Range — DC to 1 GHz
- Dielectric strength — 300 VDC
- Rated Load — 10 watts CW

	100 MHz	1.0 GHz
Typ. Insertion Loss (dB)	.07	.30
Typ. Isolation (dB)	56	36
Typ. VSWR	1.03	1.20

*Specify Coil Voltage

Coaxial RF Relay • SPDT Bistable
Part No. RF 1106-(V)*



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Mercury Relays That Operate in any Position

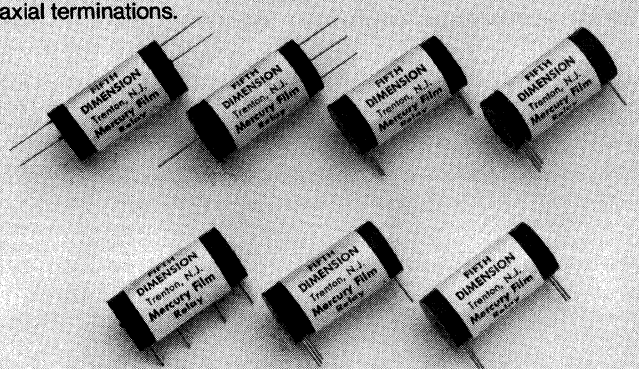
- **No Contact Bounce** — Produce clean square-wave pulses
- **Position Insensitive** — No pool of mercury
- **Self-Healing Contacts** — Always wetted with fresh mercury
- **Rugged Construction** — Welded steel switching capsule
- **Sealed Package** — High density polyethylene (WK Series)

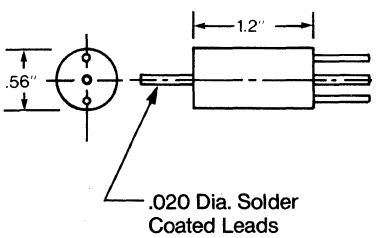
Specifications

Meet Lightning Surge Standards — 2500 volts coil-to-contact breakdown meets FCC standards (WK Series only)
Contact Type: Form A (SPST) mercury film
Contact Bounce: None at 80% of rated voltage or higher
Load Current to 52 VDC: 0.24 amps
Load Current to 200 VDC: 0.10 amps
Contact Resistance: 150 milliohms (max.)
Contact Resistance Stability: ±15 milliohms
Contact Breakdown Voltage: 800 volts DC or AC (rms)
Coil-to-Contact Breakdown: 2500 VAC
Operate Time: 4.0 milliseconds (max.)
Release Time: 4.0 milliseconds (max.)

Molded Case Series WK. Relay can be submerged in appropriate cleaning solvents during board assembly.

Series WK Mercury Relays are available in a wide variety of footprints including 0.1, 0.15 and 0.2-inch PCB spacing as well as with in-line and axial terminations.

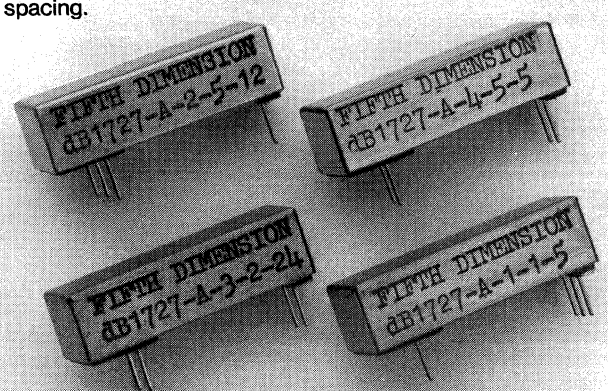


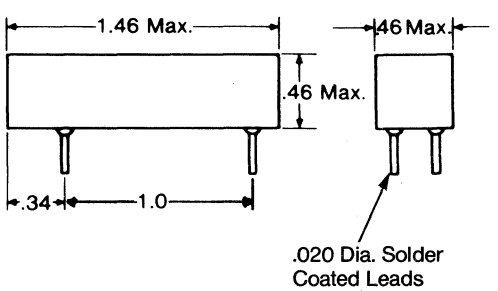


Nominal Coil Volts	Coil Resistance (± 10%) Ohms			Must Operate Volts	Must Release Volts
	250 MW	375 MW	500 MW		
5	100	67	50	4.0	0.5
12	575	384	288	9.6	1.2
24	2300	1536	1150	19.2	2.4

Shielded Series dB. Open-frame magnetically shielded.

Series dB Mercury Relays are available with 0.1, 0.15 or 0.2-inch PCB spacing.





Nominal Coil Voltage	Coil Resistance (± 10%) Ohms			Must Operate Volts	Must Release Volts
	125 MW	250 MW	500 MW		
5	200	100	50	4.0	0.5
12	1150	575	288	9.6	1.2
24	4608	2300	1150	19.2	2.4

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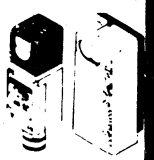
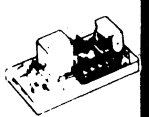
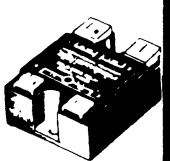
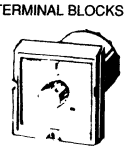

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS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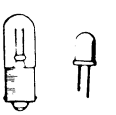
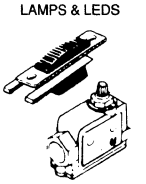
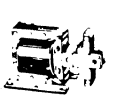

LAMPS & LEDS


SWITCHES

RELAYS

INDICATOR LIGHTS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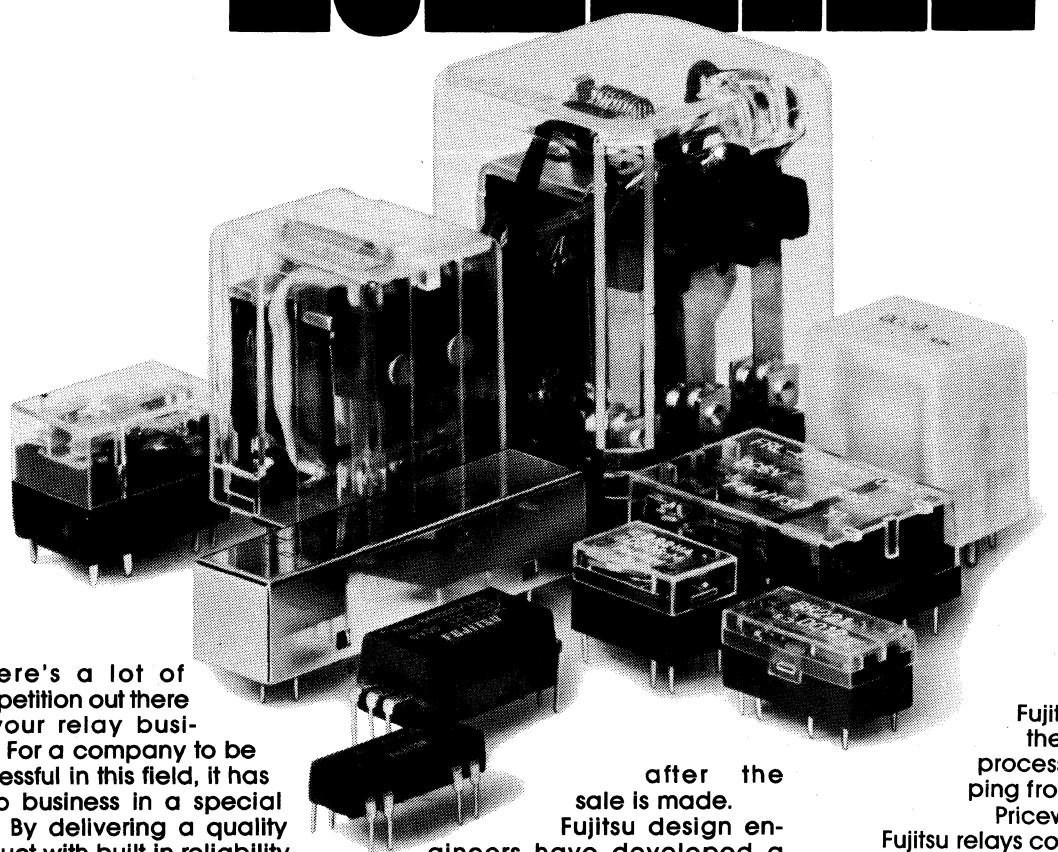
FUJITSU: RELAYS



There's a lot of competition out there for your relay business. For a company to be successful in this field, it has to do business in a special way. By delivering a quality product with built-in reliability, price and service.

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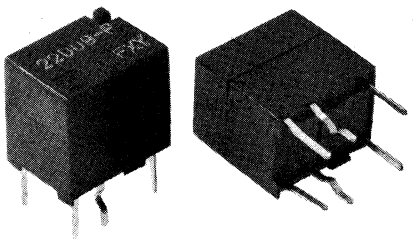
RELAYS

MICROMINIATURE RELAYS FOR P.C. BOARDS

FBR20 SERIES

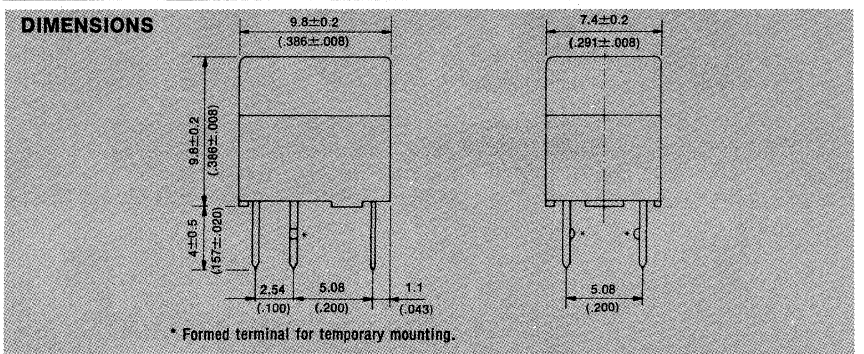


Fujitsu FBR20 series relays are designed for PC board mounting with 1A contact ratings — perfect for microminiature applications.

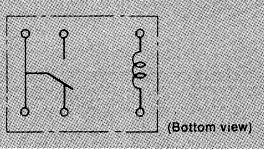
FEATURES

- **Microminiature size**
  Two FBR20 series relays can be mounted in the space now required for a single FBR210 series relay.
- **1A contact rating**
  Despite their microminiature size, FBR20 series relays have contact rating of 1A at 24 VDC for convenient installation.
- **Gold overlay single or bifurcated contact**
  Contact reliability is assured in low level applications by contact shapes and materials especially designed for signal switching applications.
- **Low power consumption**
  With a rated power consumption of only 0.3W, today's expensive energy costs can be reduced significantly.
- **Wide range of drive voltages**
  Drive voltages from 1.5 VDC to 24 VDC are available for a wide range of applications.
- **Strong shock resistance**
  Even with a 50G shock, FBR20 series relays never miss a switch.
- **Easy to pattern-design**
  Separate terminal connection with drive and output sections allow easy pattern design.
- **Formed terminal available for temporary lock**
  The unique design of the forming terminal allows FBR20 series relays to be temporary mounted for greater design flexibility.
- **Automatic soldering provision**
  The terminal is sealed to prevent flux from entering during automatic soldering.
- **Immersion cleaning**
  A sealed type is available for immersion cleaning.

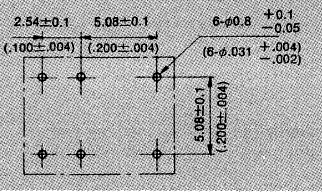
DIMENSIONS



SCHEMATIC



MOUNTING HOLE LAYOUT



ENGINEERING DATA

Item	Specifications
Contact Arrangement	SPDT (1 Form C)
Contact Shape	Single contact (FBR21), Bifurcated contact (FBR22)
Contact Material	Gold overlay silver, Gold overlay silver-palladium alloy (—P)
Contact Rating	24 VDC-1A, 120 VAC-0.5A (resistive load)
Maximum Carrying Current	2A
Maximum Switching Voltage	125 VDC, 125 VAC
Maximum Switching Power	24 WDC, 60 VA AC (resistive load)
Initial Contact Resistance	100mΩ max. (measured at 6V DC-0.1A)
Coil Power	0.3W (at rated voltage, 20°C)
Coil Temperature Rise	45°C (at rated voltage, 20°C)
Insulation Resistance	1,000MΩ min. (at 500 VDC)
Withstanding Voltage	Between contacts: 500 VAC for 1 minute Between contact and coil: 750 VAC for 1 minute
Vibration	20G, 10 ~ 300 Hz (dual amplitude, maximum 3.0 mm). No contact chatter longer than 1.0 ms.
Shock	Operation error: 50G (sine half-wave of 11 ms). No contact chatter longer than 1.0 ms.
Operate Time	5 ms max. (at rated voltage)
Release Time	3 ms max. (after rated operation)
Life Expectancy	Mechanical: 5 x 10^6 cps. min. Electrical: Gold-overlay silver contacts: 100 x 10^3 ops. min. Gold-overlay silver-palladium alloy contacts: 200 x 10^3 ops. min. (at rated contact load)
Maximum Switching Frequency	Mechanical: 18,000 operations/hour Electrical: 1,800 operations/hour (at contact rated load)
Ambient Temperature	−30°C ~ +65°C (at rated operation)
Ambient Humidity	45 ~ 85% RH
Weight	1.7 g (approx.)

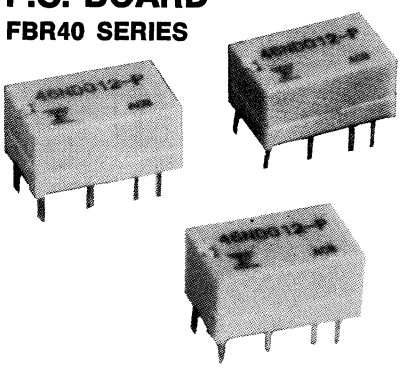
SELECTION TABLE

Type	Voltage Specifications	Coil Rated Voltage	Coil resistance (±10%)	Coil Current (at Rated Voltage)	Pick-Up Voltage	Drop-Out Voltage	Maximum Voltage Allowance	Rated Power Consumption	Coil Temperature Rise	FBR21D01		RFBR21D01P	
										Designation	Price	Designation	Price
Standard Type	D01	DC 1.5V	7.5Ω	approx. 200 mA	Less than 80% of rated voltage	More than 5% of rated voltage	160% of rated voltage	Approx. 300 mW (at rated voltage)	Approx. 45°C (at rated voltage)	FBR21D01	$1.89	FBR21D01P	$2.07
	D03	DC 3 V	30 Ω	approx. 100 mA						FBR21D03	1.89	FBR21D03P	2.07
	D05	DC 5 V	83 Ω	approx. 60 mA						FBR21D05	1.89	FBR21D05P	2.07
	D06	DC 6 V	120 Ω	approx. 50 mA						FBR21D06	1.89	FBR21D06P	2.07
	D09	DC 9 V	270 Ω	approx. 33 mA						FBR21D09	1.89	FBR21D09P	2.07
	D12	DC 12 V	480 Ω	approx. 25 mA						FBR21D12	1.89	FBR21D12P	2.07
	D18	DC 18 V	1,080 Ω	approx. 17 mA						FBR21D18	2.03	FBR21D18P	2.21
	D24	DC 24 V	1,920 Ω	approx. 13 mA						FBR21D24	2.24	FBR21D24P	2.42

Note: Measured at 20°C.

ULTRA-MINIATURE RELAYS FOR P.C. BOARD

FBR40 SERIES

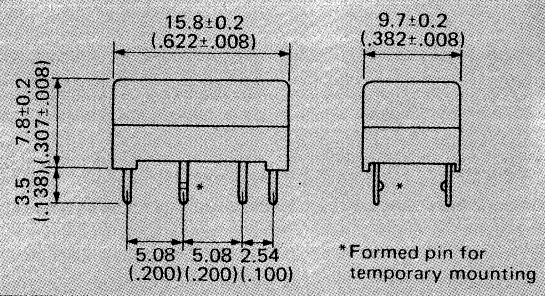


The Fujitsu FBR40 Series relay with a pick-up power consumption reduced to 85 mW is an extremely small DPDT CONTACT relay designed for PC board mounting.

FEATURES

- **Ultra-miniature low-profile design**
  At half the size of the conventional FBR240 relay and requiring only three quarters of the board area, a drastic reduction is size has been achieved in the design of the FBR40.
  15.8 (L) x 9.7 (W) x 7.8 (H) mm.
- **High dielectric strength**
  Dielectric withstanding voltage between contacts and coil is over 1,000 VAC and with the ability to withstand a surge voltage of over 1,500 V, it conforms to FCC 68.302 standard.
- **High-shockproof type**
  Even a shock force of 30 G will not result in a malfunction.
- **Low power consumption**
  With a high efficiency built-in permanent magnet, operating power consumption is only 85 mW. (Rated power consumption is 150 mW.)
- **Formed terminal for temporary lock**
  The terminals of the FBR40 are specially formed so that they can be temporarily attached to the PC board.
- **Pattern design is easy**
  The terminal connections are designed so that the drive portion (coil) and the output portion (contacts) are isolated, which simplifies pattern design.
- **Immersion cleaning**
  A sealed type is available for immersion cleaning.

DIMENSIONS Unit: mm (inch)



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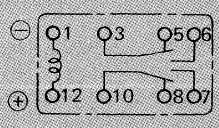
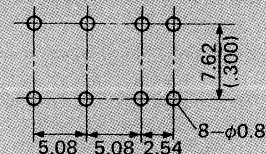


MOUNTING HOLE LAYOUT



tolerance ±0.1 (.004)
(bottom view)

Note 1. This relay is polarized. Please refer to the schematic when designing a circuit.
Note 2. An abbreviated designation is marked on the top surface of the dust cover as follows:
(Ex.) Designation: FBR46D012-P
Marking: 46D012-P
Note 3. Terminal numbers are not shown on the relay.

ENGINEERING DATA

Item	Specifications
Contact Arrangement	DPDT (2 Form C) bifurcated contact
Contact Material	Gold overlay silver-palladium alloy
Initial Contact Resistance	100 mΩ max. measured at 6V DC, 0.1A
Insulation Resistance	100 mΩ min. at 500V DC
Dielectric Withstanding Voltage	Between open contacts 500V AC for 1 min. Between contact and coil and between adjacent contacts 1,000V AC for 1 min.
Surge Voltage (FCC 68.302)	1,500V/10μsec/700μsec 1,500V 750V Between coil and contact Between adjacent contacts 10μsec 700μsec
Electrostatic Capacitance Between Contacts (Reference)	Between open contacts approx. 1 pF Between coil and contact approx. 2 pF
Vibration	Operation malfunction 10-55 Hz (Dual amplitude 1.5 mm) Durability 10-55 Hz (Dual amplitude 1.5 mm)
Shock	Operation malfunction 30 G (11 msec) Durability 100 G (11 msec)
Operate Time	5 msec max. (bounce time not included)
Release Time	5 msec max. (bounce time not included)
Life Expectancy	Mechanical: 10 x 10^6 ops. min. Electrical: 100 x 10^3 ops. min. (At contact rated load)
Maximum Switching Frequency	Mechanical: 18 x 10^3 times/hour Electrical: 1,800 times/hour (At contact rated load)
Operating Temperature Range	−30°C-+70°C (See Figure 2)
Operating Humidity Range	45-85% RH
Weight	3 g approx.

SELECTION TABLE

Type	Rated Coil Voltage	Coil Resistance (±10%)	Rated Current (for rated operation, approx.)	Pick-up Voltage	Drop-out Voltage	Rated Power Consumption	Pick-up Power Consumption	Coil Temperature Rise	Designation	Price
Standard Type	DC 3V	60Ω	50 mA	Less than 75% of rated voltage	More than 5% of rated voltage	150 mW approx. (When rated voltage is applied.)	Less than 85 mW	25 deg. approx.	FBR46D003P	$3.05
	DC 5V	167Ω	30 mA						FBR46D005P	3.05
	DC 6V	240Ω	25 mA						FBR46D006P	3.05
	DC 9V	540Ω	17 mA						FBR46D009P	3.05
	DC 12V	960Ω	13 mA						FBR46D012P	3.05
	DC 24V	2,880Ω	8 mA			200 mW approx.	Approx. 112 mW max.	30 deg. approx.	FBR46D024P	3.22

Note: Measured at 20°C

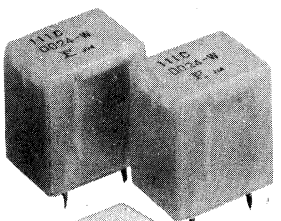
FUJITSU

RELAYS

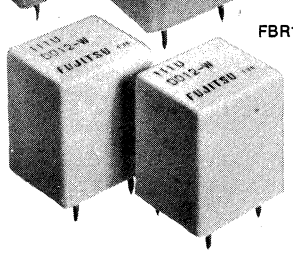
MINIATURE RELAYS FOR P.C. BOARDS

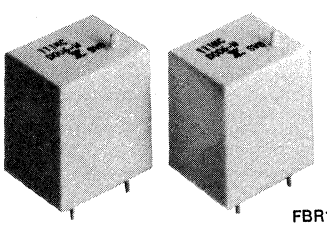
FBR100 SERIES

SPDT 3A-28V DC/120V AC, 6A-28V DC/120V AC



FBR111





FBR111N

The Fujitsu FBR111 and FBR111N Series are low cost SPDT relays with a versatile switching capability. The contact is rated 3A, 28V DC; 3A 120V AC for standard contact, or up to 6A, 28V DC; 6A, 120V AC for special heavy duty contact.

These small size, sensitive relays, designed to be mounted on printed circuit boards, feature simplified construction and a low power dissipation.

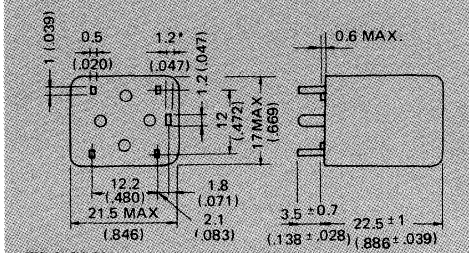
It is ideal for use in audio equipment, business machines, vending machines, security systems, game machines and automotive applications.

The FBR111N Series is the immersion cleanable version where printed circuit board cleaning is required.

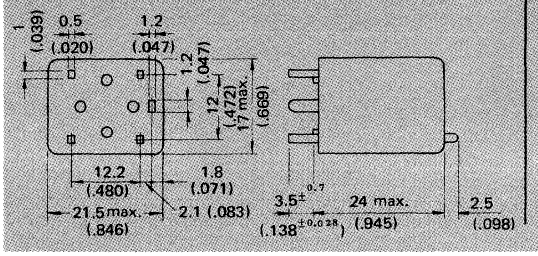
The relay specified FBR111U is UL recognized for office equipment and business machines. (File No. E63615.) CSA certified.

DIMENSIONS Unit: mm (inch)

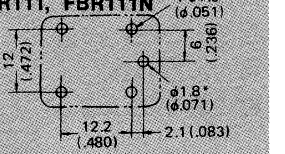
FBR111



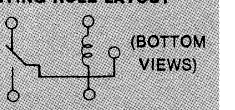
FBR111N



FBR111, FBR111N



MOUNTING HOLE LAYOUT



1 FORM C

SCHEMATICS

Notes:
1. Cut-off nib must be removed after relay soldering and board cleaning.
2. Although the plastic cover is bonded to the relay base, it is not hermetically sealed. Therefore, when the board on which the relay is soldered is cleaned by immersion, cleaning time must not exceed 2 minutes. Please use alcohol, freon or water for cleaning (water temperature is less than 50°C).

ENGINEERING DATA

Item	Specifications		
Contact Arrangement	SPDT		
Contact Ratings		Rating	UL Rating
Contact Materials	Contact Materials	28V DC or 120V AC (Resistive)	28V DC or 120V AC (Resistive)
	No suffix Silver	3A	3A
	–K Silver-Cadmium Oxide	3A	3A
	–M Gold-Plated Silver	3A	1A
	–W Special Alloy	6A	8.5A (0.8 pF @ 120V AC)
Initial Contact Resistance	100mΩ max. (at 6V DC 0.5A for No mark or -M, 6V DC 1A for -K or -W)		
Rated Coil Voltage	5, 6, 9, 12, 24V DC		
Coil Power Dissipation	Standard: 0.36W approx. at rated voltage UL Type: 0.50W approx. at rated voltage		
Coil Temperature Rise	Standard: 30°C max. at rated voltage UL Type: 40°C max. at rated voltage		
Insulation Resistance	100MΩ min. at 500V DC		
Dielectric Withstanding Voltage	500V AC for 1 minute		
Operate Time	20 ms max. at rated voltage		
Release Time	10 ms max.		
Life Expectancy — Mechanical	10×10^6 ops. min.		
Electrical	100×10^3 ops. min. at rated load		
Vibration	10 to 50Hz (Dual amplitude: 1.5mm)		
Shock	10G (11 ms)		
Temperature Range	Standard, −30°C ~ +65°C — UL Type, −30°C ~ +55°C		
Weight	15 gr. approx.		

SELECTION TABLES

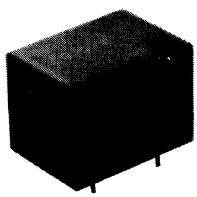
FBR111 Type	Contacts Arrangement	Contacts Materials*	Rated Voltage in V DC	Coil Resistance in Ω ±10% at 20°C	Pick-up Voltage at 20°C	Designation	Price
Standard	SPDT	No Suffix	5	70	Less Than 80% of Rated Voltage	FBR111CD005	$2.10
		–K	6	100		FBR111CD006	2.10
		–M	9	225		FBR111CD009	2.10
		–W	12	400		FBR111CD012	2.10
			24	1600		FBR111CD024	2.24
UL Type	SPDT	No Suffix	5	50	Less Than 75% of Rated Voltage	FBR111UD005	2.24
		–K	6	72		FBR111UD006	2.24
		–M	9	160		FBR111UD009	2.24
		–W	12	290		FBR111UD012	2.24
			24	1150		FBR111UD024	2.38

FBR111N Type	Contacts Arrangement	Contacts Materials*	Rated Voltage in V DC	Coil Resistance in Ω ±10% at 20°C	Pick-up Voltage at 20°C	Designation	Price
Standard	SPDT	No Suffix	5	70	Less Than 80% of Rated Voltage	FBR111NCD005	$2.45
		–K	6	100		FBR111NCD006	2.45
		–M	9	225		FBR111NCD009	2.45
		–W	12	400		FBR111NCD012	2.45
			24	1600		FBR111NCD024	2.59
UL Type	SPDT	No Suffix	5	50	Less Than 80% or Rated Voltage	FBR111NUD005	2.59
		–K	6	72		FBR111NUD006	2.59
		–M	9	160		FBR111NUD009	2.59
		–W	12	290		FBR111NUD012	2.59
			24	1150		FBR111NUD024	2.73

Note 1. 48V rated voltage relays are available on special order.
2. Each product bears its own designation on the top of the cover, but initial code 'FBR' is omitted.
* Add $0.07 to price for –K, $0.28 for –M, $0.14 for –W.
For CSA certified relays, –CSA suffix must be added to part number of UL type. Price is same as UL type.

SMALL CONTROL RELAYS FOR P.C. BOARDS

FBR160 SERIES

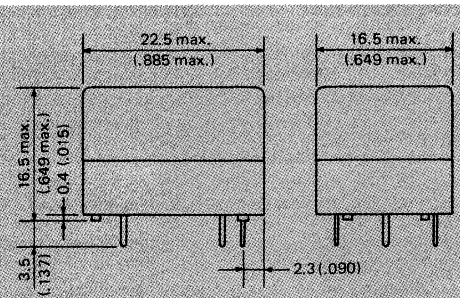


Fujitsu FBR160 series small control relays are PC board mounted and have excellent cost performance.

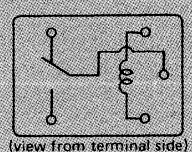
FEATURES

- **Same terminal array as FBR100**
  These relays have the same foot print as Fujitsu's conventional FBR100 series.
- **Lower profile**
  Since their profile is 7 mm lower than that of the FBR100 series relays, they can be used in smaller equipment.
- **Flux-prevention structure**
  The contacts are located on the top of the relay to protect them from solder flux from the terminals.
- **Meets major safety standards**
  The relays structure is designed to meet the Japan Electric Appliance Control Law (150V or less) and UL standards (114).
- **Choices of contact materials**
  Two different kinds of contact materials can be specified according to the load.
- **Immersion cleaning**
  A sealed type is available for immersion cleaning.
- **Contact Ratings**
  • Standard (Silver)
  3A 28V DC 120V AC
  • –K (Silver-Cadmium Oxide)
  3A 28V DC 120V AC
  • –H (Silver-Cadmium Oxide)
  5A 28V DC 120V AC

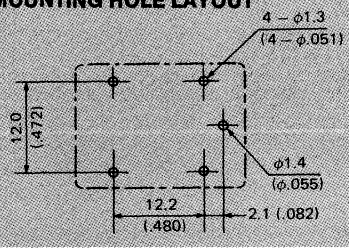
DIMENSIONS



SCHEMATICS



MOUNTING HOLE LAYOUT



ENGINEERING DATA

Item	Specifications
Contact Arrangement	SPDT or SPST – NO (Form A)
Contact Material	See Selection Table
Initial Contact Resistance	100 mΩ max. Silver contacts: Measured at 6 VDC, 0.5A Other contacts: Measured at 6 VDC, 1.0A
Insulation Resistance	100 mΩ min. (at 500 VDC)
Withstanding Voltage	Between open contacts: 500 VAC for 1 minute Between contact and coil: 1,500 VAC for 1 minute
Vibration	10 to 55 Hz (dual amplitude: 1.5 mm)
Shock	Operation malfunction: Less than 0.1 ms at 10G (11 ms) Durability: 100G (11 ms)
Operate Time	10 ms max. (at rated voltage, bounce time not included)
Release Time	5 ms max. (after operation at rated voltage, bounce time not included)
Life Expectancy	Mechanical: 10 x 10^6 ops. min. (maximum switching frequency: 18 x 10^3/hour) Electrical: 100 x 10^3 ops. min. (at rated contact load, maximum switching frequency: 18 x 10^2/hour)
Ambient Temperature	–30°C to +60°C
Ambient Humidity	45% to 85% RH
Weight	11 gr. (approx.)

SELECTION TABLE

FBR161 Type	Contacts		Rated Voltage in VDC	Coil Resistance in Ω ±10% at 20°C	Pick-Up Voltage at 20°C	Designation	Price
	Arrangement	Materials*					
Standard	SPDT	No Suffix: Silver –H, –K: Silver Cad Oxide	5	70	Less than 80% of rated voltage	FBR161SED005	$1.75
			6	100		FBR161SED006	1.75
			9	225		FBR161SED009	1.75
			12	400		FBR161SED012	1.75
			24	1,600		FBR161SED024	1.89

*Add $0.11 to price for –H contacts.
*Add $0.07 to price for –K contacts.

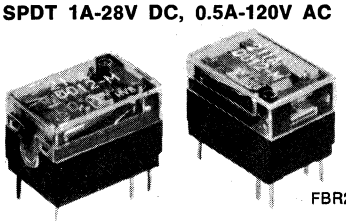
FUJITSU

RELAYS

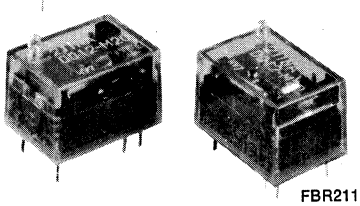
ULTRA-MINIATURE RELAYS FOR P.C. BOARDS

FBR210 SERIES

SPDT 1A-28V DC, 0.5A-120V AC



FBR211



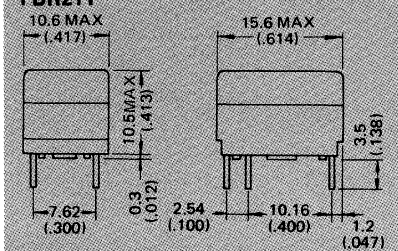
FBR211N

The FBR211 and FBR211N Series of ultra-miniature relays allow high component densities for savings in both equipment size and cost for the printed circuit board. The FBR-211N Series is suitable for immersion cleaning in freon and aqueous systems.

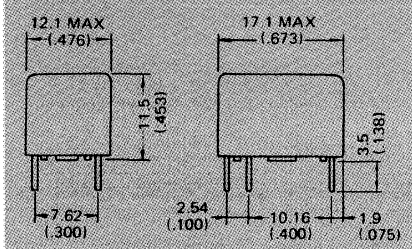
These highly sensitive relays with gold-clad SPDT contact arrangements are ingeniously designed so as to offer flux-contamination-immunity and load handling capabilities of 1A at 28V DC or 0.5A at 120V AC under a resistive load. The 0.1″ grid spacing of terminals makes these relays ideally suited for printed circuit board applications requiring high density mounting and for use in audio and wireless communications, office and vending machines, automobiles and various control applications.

DIMENSIONS Unit: mm (inch)

FBR211

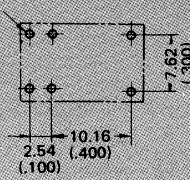


FBR211N

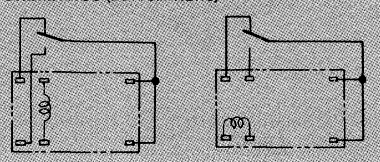


FBR211, FBR211N

MOUNTING HOLE LAYOUT



SCHEMATICS (BOTTOM VIEWS)



Notes:
1. For low level or dry circuit switching, use of gold-thick-overlay silver-palladium alloy contact relays are recommended.
2. *Cut off nib must be removed after relay soldering and board cleaning.
3. Although the plastic cover is bonded to the relay board, it is not hermetically-sealed. Therefore when the board on which the relay is soldered is cleaned by immersion, cleaning time must not exceed 2 minutes. Please use alcohol, freon or water for cleaning.

ENGINEERING DATA

Item	Specifications	
	Standard Model	High Sensitivity Model
Contact Arrangement Contact Ratings Initial Contact Resistance Contact Materials	SPDT 1A at 28V DC, 0.5A at 120V AC (resistive) 100mΩ max. at 6V DC, 0.5A Standard: Gold overlay silver (—M) — Low Level: Gold overlay silver-palladium alloy (—P)	
Rated Coil Voltage Coil Power Dissipation Coil Temperature Rise	1.5, 3, 5, 6, 9, 12, 24V DC 0.45W at rated voltage 45°C approx. at rated voltage	 0.20W at rated voltage 25°C approx. at rated voltage
Insulation Resistance Dielectric Withstanding Voltage	100MΩ min. at 500V DC (at 20°C 65% RH) 500V AC for 1 minute	
Operate Time Release Time	5 ms approx. (at rated voltage, 20°C) 5 ms approx.	
Life Expectancy — Mechanical Electrical	5 x 10^6 ops. min. 300 x 10^3 ops. min. at 1A 28V DC, resistive 100 x 10^3 ops. min. at 0.5A 120V AC, resistive	
Vibration	10 to 40Hz (Dual amplitude: 1.5mm)	
Shock	10G (11 ms)	6G (11 ms)
Temperature Range	—25°C to +55°C	—25°C to +75°C
Weight	4 gr. approx.	

SELECTION TABLE

Type	Contact: Arrangement	Contact: Materials	Schematics	Rated Voltage in V DC	Coil Resistance in Ω ±10% at 20°C	Pick-up Voltage at 20°C	FBR211: Designation	FBR211: Price* —M Type	FBR211N: Designation	FBR211N: Price* —M Type
Standard	SPDT	Gold Overlay Silver (M) or Gold Overlay Silver-Palladium Alloy (P)*	A	1.5	5	Less Than 70% of Rated Voltage	FBR211AD001—M or P	$1.89	FBR211NAD001—M or P	$2.21
				3	20		FBR211AD003—M or P	1.89	FBR211NAD003—M or P	2.21
				5	56		FBR211AD005—M or P	1.89	FBR211NAD005—M or P	2.21
				6	80		FBR211AD006—M or P	1.89	FBR211NAD006—M or P	2.21
				9	180		FBR211AD009—M or P	1.89	FBR211NAD009—M or P	2.21
				12	320		FBR211AD012—M or P	1.89	FBR211NAD012—M or P	2.21
				24	1280		FBR211AD024—M or P	2.03	FBR211NAD024—M or P	2.35
Standard	SPDT	Gold Overlay Silver (M) or Gold Overlay Silver-Palladium Alloy (P)*	B	1.5	5	Less Than 70% of Rated Voltage	FBR211BD001—M or P	1.89	FBR211NBD001—M or P	$2.21
				3	20		FBR211BD003—M or P	1.89	FBR211NBD003—M or P	2.21
				5	56		FBR211BD005—M or P	1.89	FBR211NBD005—M or P	2.21
				6	80		FBR211BD006—M or P	1.89	FBR211NBD006—M or P	2.21
				9	180		FBR211BD009—M or P	1.89	FBR211NBD009—M or P	2.21
				12	320		FBR211BD012—M or P	1.89	FBR211NBD012—M or P	2.21
				24	1280		FBR211BD024—M or P	2.03	FBR211NBD024—M or P	2.35
High Sensitivity	SPDT	Gold Overlay Silver (M) or Gold Overlay Silver-Palladium Alloy (P)*	C	1.5	12	Less Than 70% of Rated Voltage	FBR211CD001—M or P	$1.96	FBR211NCD001—M or P	$2.28
				3	45		FBR211CD003—M or P	1.96	FBR211NCD003—M or P	2.28
				5	120		FBR211CD005—M or P	1.96	FBR211NCD005—M or P	2.28
				6	180		FBR211CD006—M or P	1.96	FBR211NCD006—M or P	2.28
				9	400		FBR211CD009—M or P	1.96	FBR211NCD009—M or P	2.28
				12	700		FBR211CD012—M or P	1.96	FBR211NCD012—M or P	2.28
				24	2800		FBR211CD024—M or P	2.14	FBR211NCD024—M or P	2.45
High Sensitivity	SPDT	Gold Overlay Silver (M) or Gold Overlay Silver-Palladium Alloy (P)*	E	1.5	12	Less Than 70% of Rated Voltage	FBR211ED001—M or P	$1.96	FBR211NED001—M or P	$2.28
				3	45		FBR211ED003—M or P	1.96	FBR211NED003—M or P	2.28
				5	120		FBR211ED005—M or P	1.96	FBR211NED005—M or P	2.28
				6	180		FBR211ED006—M or P	1.96	FBR211NED006—M or P	2.28
				9	400		FBR211ED009—M or P	1.96	FBR211NED009—M or P	2.28
				12	700		FBR211ED012—M or P	1.96	FBR211NED012—M or P	2.28
				24	2800		FBR211ED024—M or P	2.14	FBR211NED024—M or P	2.45

Note: Each product bears its own designation on the top of the cover, but initial code 'FBR' is omitted.

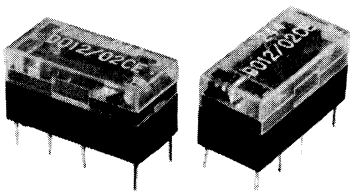
* To get price to —P type add $0.44.

FUJITSU

RELAYS

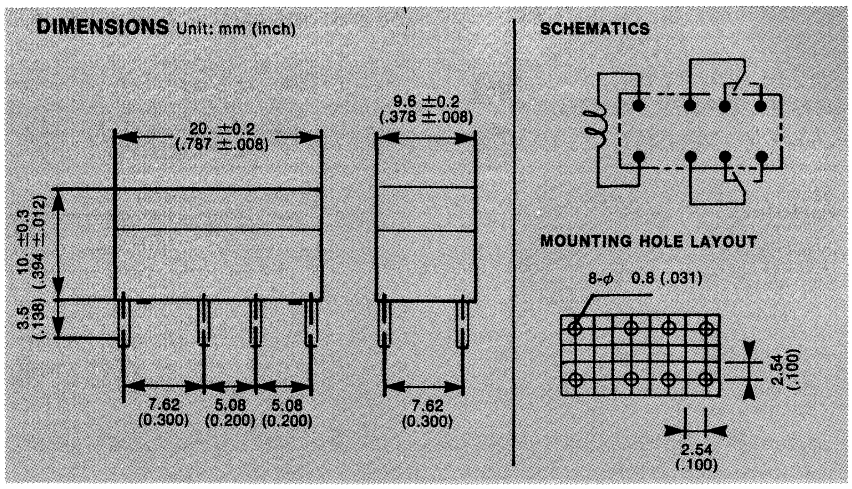
LOW PROFILE RELAYS FOR P.C. BOARDS

FBR240 SERIES



FBR244 and FBR244N Series Relays are low profile, P.C. board relays with 2 Form C (DPDT) contact arrangements in D.I.P.-compatible plastic housing and have a 2.54mm pinout grid spacing to provide 16-pin-DIP-socket compatibility. Watertight terminal sealing prevents relay from contamination by soldering flux and N type allows automatic wave soldering and board washing without relay damage. Single or bifurcated contacts switch 1A at 28V DC or 0.5A at 120V AC and have a rated-load life-time of 5×10^5 operations. These relays are suitable for telecommunication equipment, audio equipment and business machines.

- High sensitivity versions are available in 200 mw



ENGINEERING DATA

Item	Specifications
Contact Arrangement	2 Form C
Contact Material	Gold overlay silver Gold overlay silver-palladium alloy
Contact Rating	1A at 28V DC (resistive) 0.5A at 120V AC (resistive)
Initial Contact Resistance	100mΩ max. at 6V DC 0.1A
Coil Power Dissipation	Typical 0.5W at rated coil voltage
Coil Temperature Rise	50°C approx. at rated voltage 20°C
Insulation Resistance	100MΩ min. at 500V DC
Dielectric Withstanding Voltage	500V AC for 1 minute
Vibration	10 to 55 Hz (Dual amplitude: 1.5mm)
Shock	10G (11 ms)
Operate Time	10 ms max. at rated coil voltage
Release Time	5 ms max.
Life Expectancy — Mechanical	10^7 ops. min.
Electrical	5×10^5 ops. min. at 1A 28V DC (resistive) — 0.3A 120V AC (resistive) 10^5 ops. min. at 0.5A 120V AC (resistive)
Ambient Temperature Range	−30°C to +50°C
Weight	4.5 gr approx.

SELECTION TABLE

Contact Materials*	Rated Voltage in V CD	Coil Resistance in Ω ±10% at 20°C	Pick-Up Voltage at 20°C	FBR244 Designation	FBR244 Price	FBR244N Designation	FBR244N Price
S: Single Gold overlay silver P: Single Gold overlay silver-palladium alloy T: Bifurcated Gold overlay silver E: Bifurcated Gold overlay silver-palladium alloy	3	18	Less Than 75% of Rated Voltage	FBR244D003/02CS	$2.52	FBR244ND003/02CS	$2.80
	5	50		FBR244D005/02CS	2.52	FBR244ND005/02CS	2.80
	6	72		FBR244D006/02CS	2.52	FBR244ND006/02CS	2.80
	9	162		FBR244D009/02CS	2.52	FBR244ND009/02CS	2.80
	12	290		FBR244D012/02CS	2.52	FBR244ND012/02CS	2.80
	24	1150		FBR244D024/02CS	2.63	FBR244ND024/02CS	2.91

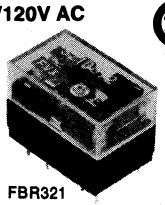
* Substitute S with P, T or E for alternate contact materials and add $0.21 to price for P or T or $0.56 for E.
For 48V relays add $0.45 to the prices of the 24V relays.

MINIATURE RELAYS FOR P.C. BOARDS

FBR310 (SPDT) AND FBR320 (DPDT) SERIES

3-5A/28V DC, 3-5A/120V AC

FBR311



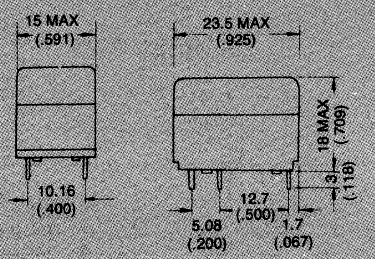
FBR321

The FBR311 (SPDT) and FBR321 (DPDT) Series miniature relays were designed to provide 3 amps ratings contacts, accommodated in truly compact packages for P.C. boards.

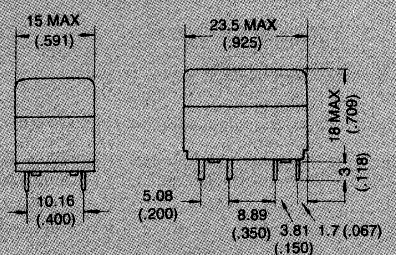
These sensitive miniature relays, featuring high density mounting, flux-contamination immunity, versatile switching performance from signal level to handling 3 amps, are ideally suited for such applications as audio equipment, office machines, vending machines and automotive or other control application. These relays are UL Recognized (E63615) and CSA Certified (add —CSA suffix to P/N).

DIMENSIONS Unit: mm (inch)

FBR311

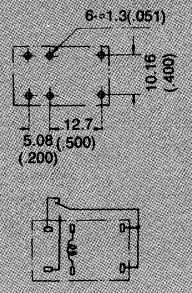


FBR321

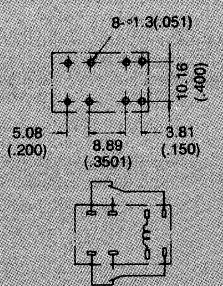


SCHEMATICS

FBR311 (SPDT)



FBR321 (DPDT)



ENGINEERING DATA FBR311, 321

Item	Specifications	
Contact Arrangement	SPDT (FBR311) DPDT (FBR321)	-K (Silver-Cadmium Oxide)
Contact Rating	3A at 28V DC, 120V AC	Contacts:
Initial Contact Resistance	100mΩ max. at 6V DC, 0.5A	SPDT (FBR311) 5A 28V DC, 120V AC
Contact Material	Gold overlay silver	DPDT (FBR321) 4A 28V DC, 120V AC
Rated Coil Voltage	5, 6, 9, 12, 24V DC	
Coil Power Dissipation	0.45W approx. at rated voltage	
Coil Temperature Rise	35°C approx. at rated voltage	
Insulation Resistance	100MΩ min. at 500V DC (initial)	
Dielectric Withstanding Voltage	500V AC for 1 minute	
Operate Time	20 ms max. at rated voltage	
Release Time	10 ms max.	
Life Expectancy — Mechanical	10×10^6 ops. min.	
Electrical	100×10^3 ops. min. at rated load	
Vibration	10 to 55Hz (Dual amplitude: 1.5mm)	
Shock	10G (11ms)	
Temperature Range	−30°C to +50°C	
Weight	12 gr. approx.	

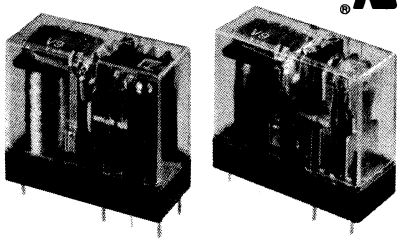
SELECTION TABLE

Contact Arrangement	Rated Voltage in V DC	Coil Resistance in Ω ±15% at 20°C	Pick-Up Voltage at 20°C	Designation	Price
SPDT	5	58	Less Than 80% of Rated Voltage	FBR311D005	$2.28
	6	85		FBR311D006	2.28
	9	180		FBR311D009	2.28
	12	300		FBR311D012	2.28
	24	1250		FBR311D024	2.42
DPDT	5	42	Less Than 80% of Rated Voltage	FBR321D005	$3.68
	6	60		FBR321D006	3.68
	9	135		FBR321D009	3.68
	12	230		FBR321D012	3.68
	24	960		FBR321D024	3.82

Note: Each product bears its own designation on the top of the cover, but initial 'FBR' is omitted.
For 48V relays add $0.28 to prices of 24V relays. -K contacts, add $0.07 to prices.

MINIATURE HIGH-POWER RELAYS

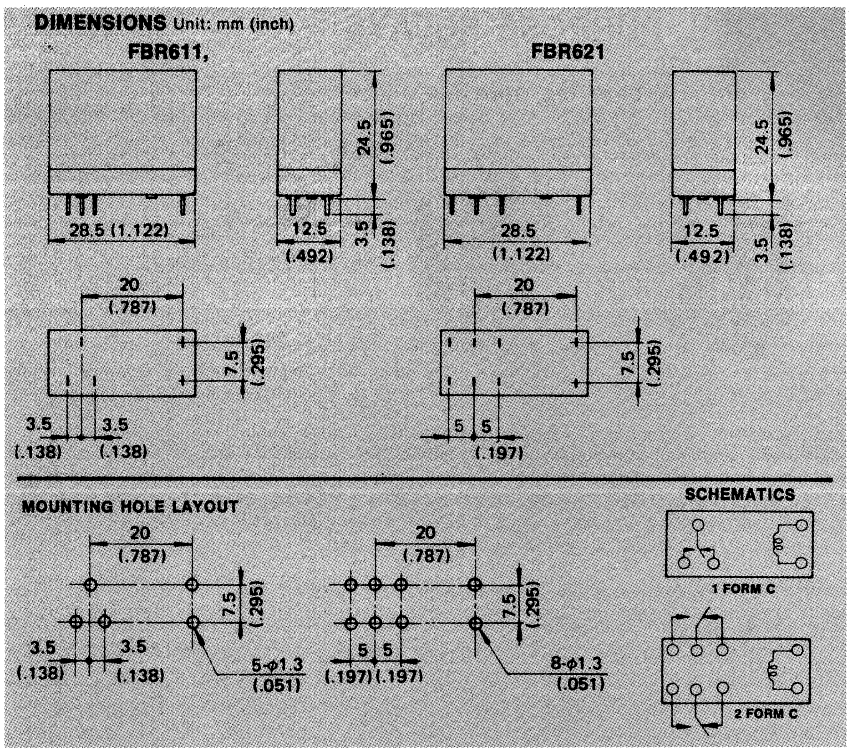
FBR600 SERIES



The FBR600 Series are miniature high-power relays with a switching capability of 10A, 30V DC or 240V AC for 1 Form C contact; and 5A, 30V DC or 240V AC for 2 Form C contacts. These relays, conforming to VDE, UL and CSA standards, are designed for mounting on printed circuit boards. Dielectric withstanding voltage is 500V AC for 1 minute and creeping distance is 8mm. These FBR600 Series relays are ideal for use in audio equipment, TV, vending machines, control machines, etc.

UL recognized (E63615) for industrial control equipment per UL508.

- **Immersion cleaning**
  A sealed type is available for immersion cleaning.



ENGINEERING DATA

Item	Specifications
Contact Arrangement	FBR611, 1 Form C — FBR621, 2 Form C
Contact Ratings	FBR611, 10A at 30V DC or 240V AC — FBR621, 5A at 30V DC or 240V AC
Carrying Current	FBR611, 10A — FBR621, 5A
Contact Material	Silver-alloy
Initial Contact Resistance	100mΩ max. at 6V DC, 1A
Rated Coil Voltage	5, 6, 9, 12, 18, 24, 48, 60V DC
Coil Power Dissipation	FBR611/621, 0.5W at 20°C
Coil Temperature Rise	FBR611/621, 35°C at rated voltage at 20°C
Insulation Resistance	1000Ω min. at 500V DC (initial) at 20°C, 65% RH
Dielectric Withstanding Voltage	
Between Coil and Contact	5000V AC for 1 minute at 20°C, 65% RH
Between Open Contacts	1000V AC for 1 minute at 20°C, 65% RH
Between Adjacent Contacts	FBR621, 3000V AC for 1 minute at 20°C, 65% RH
Lightening (1 x 40μ sec)	
Between Coil and Contact	10,000V min
Between Adjacent Contacts	FBR621, 6000V min.
Operate Time	8 ms approx. at rated voltage at 20°C
Release Time	2.5 ms approx. at 20°C
Life Expectancy — Mechanical	20 x 10^6 ops. min.
Electrical	100 x 10^3 ops. min. at rated voltage
Vibration	10~55 Hz (Dual amplitude: 1.5mm)
Shock	10G (11 ms)
Temperature Range	FBR611/621, −40°C~+70°C
Weight	16 gr. approx.

SELECTION TABLE

Contact Material	Rated Voltage in V DC	Coil Resistance in Ω at 20°C	Pick-Up Voltage at 20°C	Open Voltage at 20°C	FBR611 Designation	FBR611 Price	FBR621 Designation	FBR621 Price
Silver-Alloy	5	50	Less Than 70% of Rated Voltage	More Than 10% of Rated Voltage (reference)	FBR611D005	$3.19	FBR621D005	$3.50
	6	72			FBR611D006	3.19	FBR621D006	3.50
	9	160			FBR611D009	3.19	FBR621D009	3.50
	12	285			FBR611D012	3.19	FBR621D012	3.50
	18	640			FBR611D018	3.19	FBR621D018	3.50
	24	1150			FBR611D024	3.33	FBR621D024	3.64
	48	4600			FBR611D048	3.89	FBR621D048	4.20
	60	7200			FBR611D060	4.38	FBR621D060	4.69

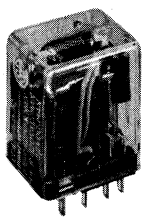
FUJITSU

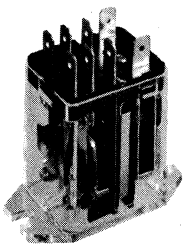
RELAYS

GENERAL PURPOSE RELAYS

FRL260 SERIES

4PDT-5A, 3PDT-5A, DPDT-10A, SPDT-15A





The FRL260 series relays with proven performance and top quality have been designed with emphasis on reliability, safety, cost performance and applicability to a wide range of uses.

These relays provide SPDT to 4PDT contacts, which are offered for contact ratings from 1 amp to 15 amps at 30V DC or 240V AC, resistive. Moreover, they are also available with 4 transfer bifurcated contacts that enable them to meet signal level or other light loads.

The FRL260 series relays are available in both DC- and AC-rated coils, and with a selection of mountings, such as solder, plug-in, P.C. boards and quick connect terminals.

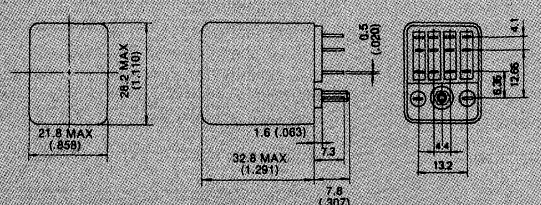
The FRL260 series is UL recognized (File No. 163614/E63615) and C.S.A. certified.

ENGINEERING DATA

Item	Specifications
Contact Ratings (Resistive Load).	As per SELECTION TABLE
Initial Contact Resistance	General (S, K, V Contact): 100mΩ max. (at 6V DC, 1A) Low Level (T, L Contact): 50mΩ max. (at 6V DC, 0.1A)
Operate Time Release Time	25 ms max. (at rated coil voltage) 25 ms max.
Coil Power Dissipation	DC: 0.9W (at rated coil voltage) AC: 1.2 VA (120V max.) at rated coil voltage of 60 Hz 1.4 VA (200V min.) at rated coil voltage of 60 Hz
Coil Temperature Rise	DC: 50° max. AC: 60°C max.
Life Expectancy — Mechanical Electrical	50 x 10^6 ops. min. (at rated load) Medium Load SPDT: 500 x 10^3 ops. min. DPDT: 500 x 10^3 ops. min. 3PDT: 500 x 10^3 ops. min. 4PDT: 200 x 10^3 ops. min. 4PST: 100 x 10^3 ops. min. Heavy Load SPDT: 200 x 10^3 ops. min. SPST: 200 x 10^3 ops. min. DPDT: 500 x 10^3 ops. min.
Insulation Resistance	100MΩ min. (at 500V DC)
Dielectric Withstanding Voltage	1500V AC (1000V AC between open contacts) for 1 minute
Vibration	50 Hz (Dual Amplitude: 0.5mm)
Shock	10G (11 ms)
Temperature Range	−30°C to +55°C
Weight	35 gr. approx.

DIMENSIONS Unit: mm

04CL: DIMENSION AND CONSTRUCTION
04CS: DIMENSION AND CONSTRUCTION
04CT: DIMENSION AND CONSTRUCTION
04CV: DIMENSION AND CONSTRUCTION



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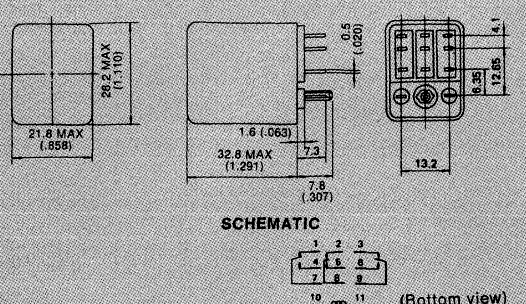

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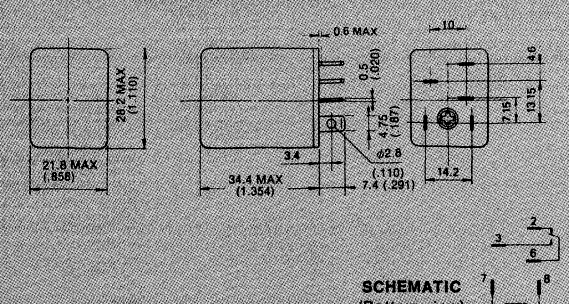

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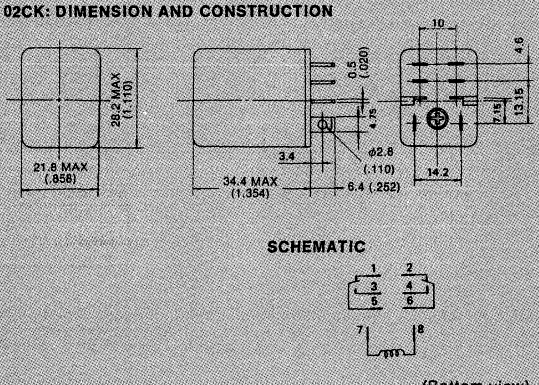


FRL260 SERIES RELAYS SELECTION TABLE — DC COIL

Contact Arrangement and Material	Contact Ratings		Rated Voltage V DC 50/60 Hz	Coil Resistance ±15% Ohms @ 20°C	Pick-Up Voltage @ 20°C	Fujitsu Part Numbers (Plug-In)*	Price
	Resistive	Horsepower					
SPDT AgCdO	15A @ 30V DC or 150V AC 10A @ 240V AC	1/3 HP @ 120V AC 1/2 HP @ 240V AC	6	40	4.5	FRL263D006/01CK	$5.18
			12	160	9	FRL263D012/01CK	5.18
			24	650	18	FRL263D024/01CK	5.18
			48	2600	36	FRL263D048/01CK	5.18
			110	13300	82.5	FRL263D110/01CK	6.44
DPDT AgCdO	10A @ 30V DC or 240V AC	1/3 HP @ 120V AC 1/2 HP @ 240V AC	6	40	4.5	FRL263D006/02CK	$5.39
			12	160	9	FRL263D012/02CK	5.39
			24	650	18	FRL263D024/02CK	5.39
			48	2600	36	FRL263D048/02CK	5.39
			110	13300	82.5	FRL263D110/02CK	6.58
3PDT AgCdO	5A @ 30V DC or 240V AC	1/6 HP @ 120V AC	6	40	4.5	FRL263D006/03CS	$5.39
			12	160	9	FRL263D012/03CS	5.39
			24	650	18	FRL263D024/03CS	5.39
			48	2600	36	FRL263D048/03CS	5.39
			110	13300	82.5	FRL263D110/03CS	6.58
4PDT Ag + Au Clad	3A @ 30V AC or 120V AC 3A @ 120V AC General Purpose	1/10 HP @ 120V AC	6	40	4.5	FRL263D006/04CL	$5.74
			12	160	9	FRL263D012/04CL	5.74
			24	650	18	FRL263D024/04CL	5.74
			48	2600	36	FRL263D048/04CL	5.74
			110	13300	82.5	FRL263D110/04CL	6.97
4PDT Ag	3A @ 30V AC or 120V AC 3A @ 120V AC General Purpose	1/10 HP @ 120V AC	6	40	4.5	FRL263D006/04CS	$5.39
			12	160	9	FRL263D012/04CS	5.39
			24	650	18	FRL263D024/04CS	5.39
			48	2600	36	FRL263D048/04CS	5.39
			110	13300	82.5	FRL263D110/04CS	6.58
4PDT (Bifurcated) Ag + Au Clad	1A @ 30V AC or 120V AC	1/10 HP @ 120V AC	6	40	4.5	FRL263D006/04CT	$6.23
			12	160	9	FRL263D012/04CT	6.23
			24	650	18	FRL263D024/04CT	6.23
			48	2600	36	FRL263D048/04CT	6.23
			110	13300	82.5	FRL263D110/04CT	7.42
4PDT AgCdO	5A @ 30V AC or 240V AC 5A @ 120V AC General Purpose	1/6 HP @ 120V AC	6	40	4.5	FRL263D006/04CV	$5.74
			12	160	9	FRL263D012/04CV	5.74
			24	650	18	FRL263D024/04CV	5.74
			48	2600	36	FRL263D048/04CV	5.74
			110	13300	82.5	FRL263D110/04CV	6.97

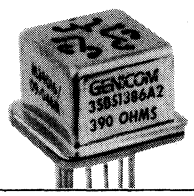
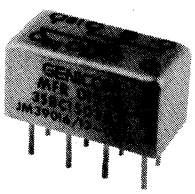
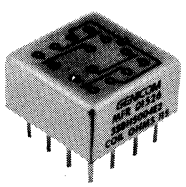
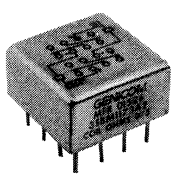
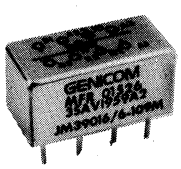
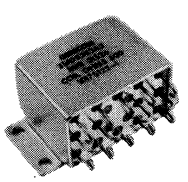
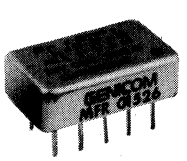
For CSA Certified Relays, —CSA suffix must be added to part number. Price is same.
* For PCB type terminals change prefix to FRL264

FRL260 SERIES RELAYS SELECTION TABLE — AC COIL

Contact Arrangement and Material	Contact Ratings		Rated Voltage V AC 50/60 Hz	Coil Resistance ±15% Ohms @ 20°C	Pick-Up Voltage @ 20°C	Fujitsu Part Numbers (Plug-In)*	Price
	Resistive	Horsepower					
SPDT AgCdO	15A @ 30V DC or 150V AC 10A @ 240V AC	1/3 HP @ 120V AC 1/2 HP @ 240V AC	6	9.5	4.8	FRL263A006/01CK	$5.18
			12	40	9.6	FRL263A012/01CK	5.18
			24	165	19.2	FRL263A024/01CK	5.18
			48	630	38.4	FRL263A048/01CK	5.18
			120	4400	96.0	FRL263A120/01CK	5.53
			240	13000	192.0	FRL263A240/01CK	7.39
DPDT AgCdO	10A @ 30V DC or 240V AC	1/3 HP @ 120V AC 1/2 HP @ 240V AC	6	9.5	4.8	FRL263A006/02CK	$5.39
			12	40	9.6	FRL263A012/02CK	5.39
			24	165	19.2	FRL263A024/02CK	5.39
			48	630	38.4	FRL263A048/02CK	5.39
			120	4400	96.0	FRL263A120/02CK	5.74
			240	13000	192.0	FRL263A240/02CK	7.60
3PDT AgCdO	5A @ 30V DC or 240V AC	1/6 HP @ 120V AC	6	9.5	4.8	FRL263A006/03CS	$5.39
			12	40	9.6	FRL263A012/03CS	5.39
			24	165	19.2	FRL263A024/03CS	5.39
			48	630	38.4	FRL263A048/03CS	5.39
			120	4400	96.0	FRL263A120/03CS	5.74
			240	13000	192.0	FRL263A240/03CS	7.60
4PDT Ag + Au Clad	3A @ 30V AC or 120V AC 3A @ 120V AC General Purpose	1/10 HP @ 120V AC	6	9.5	4.8	FRL263A006/04CL	$5.74
			12	40	9.6	FRL263A012/04CL	5.74
			24	165	19.2	FRL263A024/04CL	5.74
			48	630	38.4	FRL263A048/04CL	5.74
			120	4400	96.0	FRL263A120/04CL	6.13
			240	13000	192.0	FRL263A240/04CL	7.98
4PDT Ag	3A @ 30V AC or 120V AC 3A @ 120V AC General Purpose	1/10 HP @ 120V AC	6	9.5	4.8	FRL263A006/04CS	$5.39
			12	40	9.6	FRL263A012/04CS	5.39
			24	165	19.2	FRL263A024/04CS	5.39
			48	630	38.4	FRL263A048/04CS	5.39
			120	4400	96.0	FRL263A120/04CS	5.74
			240	13000	192.0	FRL263A240/04CS	7.60
4PDT (Bifurcated) Ag + Au Clad	1A @ 30V AC or 120V AC	1/10 HP @ 120V AC	6	9.5	4.8	FRL263A006/04CT	$6.23
			12	40	9.6	FRL263A012/04CT	6.23
			24	165	19.2	FRL263A024/04CT	6.23
			48	630	38.4	FRL263A048/04CT	6.23
			120	4400	96.0	FRL263A120/04CT	6.58
			240	13000	192.0	FRL263A240/04CT	8.44
4PDT AgCdO	5A @ 30V AC or 240V AC 5A @ 120V AC General Purpose	1/6 HP @ 120V AC	6	9.5	4.8	FRL263A006/04CV	$5.74
			12	40	9.6	FRL263A012/04CV	5.74
			24	165	19.2	FRL263A024/04CV	5.74
			48	630	38.4	FRL263A048/04CV	5.74
			120	4400	96.0	FRL263A120/04CV	6.13
			240	13000	192.0	FRL263A240/04CV	7.98

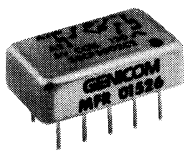
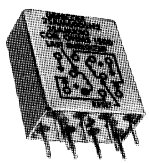
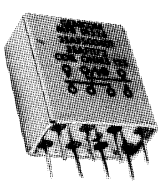
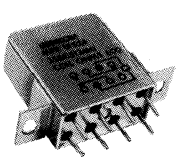
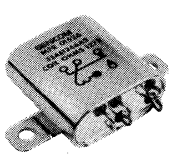
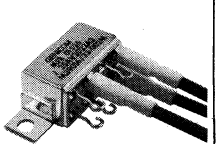
For CSA Certified Relays, —CSA suffix must be added to part number. Price is same.
* For PCB type terminals change prefix to FRL264

SEALED RELAY Selection Guide

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE: CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE: OPERATIONS	SIZE NO MOUNT L" × W" × H" & WEIGHT (OZ.)	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-	SHOCK	VIBRATION	TEMPERATURE RANGE
3SBS Transistor Size Relay		2PDT	1A DC Res .2A DC Ind Low Level	10^5 / 10^6	Size .37 × .37 × .275 Weight 0.09	120 mW	39016/9 39016/15 39016/20	100G @ 11ms	30G 55-3000 Hz	−65C +125C Special +200C
3SBC 1/5 Size Two Pole 150 Grid Hybrid		2PDT 1PDT 1A, 1B	2A DC Res .5A DC Ind .5-AC Low Level	10^5 / 10^6	Size .61 × .31 × .32 Weight 0.13	135 mW	39016/13 39016/37 39016/38	100G @ 11 ms	30G 55-3000 Hz	−65C +125C Special +200C
3SBH 1/5 Size Four Pole 150 Grid Hybrid		4PDT	2A DC Res .5A DC Ind .5A-AC Low Level	10^5 / 10^6	Size .61 × .61 × .32 Weight 0.24	250 mW	39016/14	100G @ 11 ms	30G 55-3000 Hz	−65C +125C Special +200C
3SBM 1/2 Size 150 Grid Latching Hybrid		4PDT	2A DC Res .5A DC Ind .5A-DC Low Level	10^5 / 10^6	Size .61 × .61 × .32 Weight 0.28	100mW Single Coil or 180mW Dual Coil	39016/31 39016/35 39016/36	150G @ 11 ms	30G 55-3000 Hz	−65C +125C Special +200C
3SAV Half-Size Sensitive R.F.		2PDT	2A DC Res .5A DC Ind .75 A-AC Low Level	10^5 / 10^6	Size .80 × .40 × .40 Weight 0.30	100mW to 260mW	39016/6 39016/22 39016/33 39016/44	100G @ 11ms	30G 55-3000 Hz	−65C +125C Special +200C
3SAH Four Pole Grid		4PDT	2A DC Res .5A DC Ind 1A-AC Low Level	2×10^5 at 2A dc at 1A AC / 2×10^6	Size 1.01 × .61 × .81 Weight 1.0	400 mW	39016/39	50G @ 11ms	30G 55-3000 Hz	−65C +125C Special +200C
3SCM DeciGrid® Mag-Latch 1/10 Size		2PDT	.5A DC .1A DC Ind Low Level	10^5 / 10^6	Size .575 × .350 × .170 Weight .075	2.0 mJ at 5ms	39016/47	100G @ 6ms	30G 55-3000 Hz	−65C +125C

*Single-phase load, case not grounded

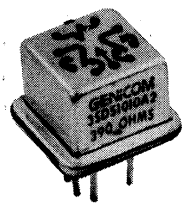
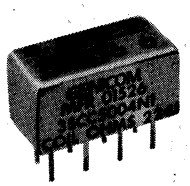
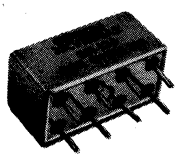
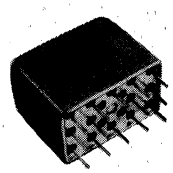
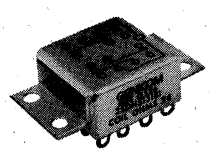
GENICOM®

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE: CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE: OPERATIONS	SIZE L × W × H & WEIGHT (OZ.) NO MOUNT	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-	SHOCK	VIBRATION	TEMPERATURE RANGE
3SCP DeciGrid® Mono-stable 1/10 Size		2PDT	.5A DC .1A DC Ind Low Level	10^5 10^6	Size .575 × .350 × .170 Weight .075	68 mW	39016/48	100G @ 6ms	30G 55- 3000 Hz	−65C +125C
3SAM Mag-Latch Grid-Space		2PDT	2A DC Res .5A DC Ind 1A-AC Low Level	10^5 at 2A DC at 1A AC 10^6	Size .80 × .40 × .90 Weight 0.60	50mW Single Coil 75mW Dual Coil	39016/32	150G @ 11ms	30G 55- 3000 Hz	−65C +125C Special +200C
3SAF Grid Spaced Micro Crystal Can		2PDT 1PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC 10^6	Size .80 × .40 × .90 Weight 0.50	300 mW	5757/10	100G @ 11 ms	30G 55- 2000 Hz	−65C +125C
3SBK Power Relay		2PDT	5A DC 2A AC 2A DC Ind Low Level	10^5 10^6	Size .80 × .40 × .90 Weight 0.7 max	300 mW	5757	90G @ 11ms	30G 55- 2000 Hz	−65C +125C
3SAC Crystal Can "S" Header		2PDT 1PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC at 2A AC 10^6	Size .797 × .359 × 1.187 Weight .090	200 mW	5757/10	50G @ 11ms	10G 55- 500 Hz	−65C +125C
3SAE Crystal Can "S" Header		2PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC at 2A AC 10^6	Size .797 × .359 × .875 Weight 0.45	330mW	5757/10	100G @ 11ms	20G 55- 2000 Hz	−65C +125C
3SAV-RF with Co-ax Cables		2PDT 1PDT	25 Watts 10 Watts	10^5 10^6	Size .86 × .40 × .46 Weight .35 oz. max	260 mW 100 mW	39016/33	100G @ 11ms	30G 55- 3000Hz	−65C +125C

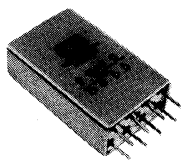
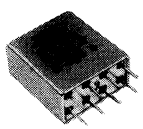
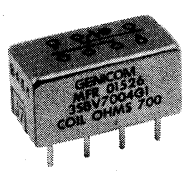
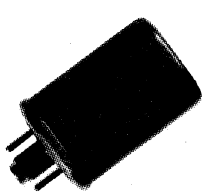
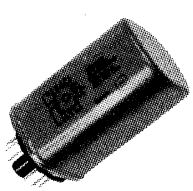
*Single-phase load, case not grounded

Continued on next page.

SEALED RELAY Selection Guide

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE: CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE: OPERATIONS	SIZE NO MOUNT L" × W" × H" & WEIGHT (OZ.)	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-	SHOCK	VIBRATION	TEMPERATURE RANGE
3SDS Long Life		2PDT	1A DC .5A AC Low Level	10^5 / 50×10^6	Size .37 × .37 × .275 Weight 0.13	120 mW		100G @ 11ms	30G 55-3000Hz	−40C +125C
3SCC Long Life		2PDT 1PDT 1A, 1B	2A DC Res .5A DC Ind .5-AC Low Level	10^5 / 100×10^6	Size .61 × .31 × .32 Weight 0.13	135 mW		100G @ 11ms	30G 55-3000Hz	−40C +125C
3SCV Long Life Half-Size		2PDT	2A DC Res .5A DC Ind .5A-AC Low Level	10^5 / 100×10^6	Size .80 × .40 × .40 Weight .30	340mW				−40C + 125C
3SCH Long Life		4PDT	2A Res .5A DC Ind 1A-AC Low Level	2 × 10 at 2A dc at 1A AC / 75×10^6	Size 1.01 × .61 × .81 Weight 1.0	400 mW		50G @ 11ms	30G 55-3000Hz	−40C +125C
3SDH Long Life		4PDT	2A DC .5A AC Low Level	10^5 / 100×10^6	Size .61 × .61 × .32 Weight 0.24	250 mW		100G @ 11ms	55-3000Hz	--40C +125C

*Single-phase load, case not grounded

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE: CURRENT LEVELS AT 28 VDC AT 115 VAC	CONTACT LIFE: OPERATIONS	SIZE L × W × H & WEIGHT (OZ.) NO MOUNT	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-	SHOCK	VIBRATION	TEMPERATURE RANGE
3SAT Sensitive Mil Quality		2PDT 1PDT	2A DC 1A AC Low Level	$\frac{10^5}{10^6}$	Size .80 × .400 × 1.125 Weight .95	40 mW & 25 mW	5757	90G @ 11ms	20G 55-3000Hz	−65C +125C Special 200C
3SBF Sensitive Mil Quality		2PDT 1PDT	2A DC 1A AC Low Level	$\frac{10^5}{10^6}$	Size .80 × .40 × .90 Weight .50	75 mW & 50 mW	5757	90G @ 11ms	25G 55-2500Hz	−65C +125C Special 200C
3SBV Industrial Half-Size		2PDT	2A DC Res .5A-AC Low Level	$\frac{10^5}{10^6}$	Size .88 × .48 × .49 Weight 0.30	285 mW				−45C +71C
3SAA Power Relay Mil Quality		1Pole to 6 Poles	Low Level to 10 Amps	Depends on Rating	Size 1.67 × 1.48 × 2.1 Weight 4.5	600 mW		30G @ 11ms	55-500 Hz	−65C +125C
3SCA Miniature Industrial Relays		2PDT 4PDT 6NO	10A 5A DC Res 2A DC Ind 5A-AC Low Level	Depends on Contact Rating	1.67 × 1.48 × 2.1 Weight 4.5	350mW 600mW 815mW				0C +71C

Note: Long Life relays are rated at 50 μA, 50 mV open circuit DC or Peak AC for the number of operations indicated in selection guide with the contact resistance during life test not to exceed 50 ohms. Testing plan is available on request.

***Single-phase load, case not grounded**

For additional publications and product information contact:
GENICOM Corporation, GENICOM Relays
Waynesboro, VA 22980, 1-703-949-1471

GENICOM®
Relays You Can Rely On.

MINIGLOSSARY TIMERS

Accuracy
The variation of unit performance, i.e., time delay, voltage trip point, etc., over the specified conditions of ambient temperature, input voltage range, and time between operations.

Adjustability
The changing of a unit set point, within the specified range of unit operation, by means of internal or external adjustment mechanism (i.e., changing time delay with potentiometer).

Contact Rating
The electrical power-handling capability of relay contacts under specified environmental conditions and for a prescribed number of operations.

Delayed Interval Timing Function
Input voltage is applied continuously. The timing cycle is started by momentarily actuating the control circuit. The functions of separate Delay-On-Operate and interval type timers are combined in one package providing a single OFF-ON-OFF output cycles

Also called: single shot.

Delay-On-Operate Timing Function
Application of the input voltage starts the time delay. At completion of the time delay, the relay contacts transfer.

Also called: Delay-On-Make, On-Delay, Delay Relay, Delay-On-Pickup.

Delay-On-Release Timing Function
Input voltage must be supplied continuously to timer. Actuation of control circuit causes relay contacts to transfer immediately. Time delay starts when control circuit is released. The relay remains energized for the duration of the time delay—then de-energizes.

Also called: Delay-On-Break, Off-Delay, Delay-On-Dropout, Delay-On-Energization.

Frequency Sensor
A device that monitors a predetermined overfrequency and/or underfrequecy condition, and changes output state when these conditions exist.

Hysteresis
The difference between the response of a unit or system to an increasing and a decreasing signal (example: a voltage sensor).

Interval Timer Timing Function
Application of input voltage causes relay contacts to transfer and time delay to begin. At completion of the time delay, the relay contacts return to de-energized state.

Also called: Delay Interval, One Shot.

Output Control
The switching device, either solid-state or electromechanical, used in the unit to control the load connected to the output terminal(s).

Phase Sensor
A device that monitors for proper phase rotation in 3-phase systems.

Programmability
Ability to modify function, time delay or input voltage of a timer.

Recovery Timer
(Delay-On-Operate/Interval Timer)
The minimum time that input voltage must be interrupted *prior* to time-out to insure a successive timing cycle within the specified limits.

(Delay-On-Release)
The minimum duration of time that control circuit must be re-actuated to insure a new timing cycle when the control circuit is released.

Recycle Time
(Delay-On-Operate or Interval Timer)
The minimum time that input voltage must be interrupted after the timing cycle is completed to assure a successive timing cycle within the repeatability specified.

(Delay-On-Release)
The minimum duration of time that control circuit must be actuated to insure a successive timing cycle within the repeatability specified when the control circuit is released.

Repeat Cycle Timer Timing Function
Application of power automatically initiates continuous off-on cycling of the output relay.
Also called: flasher, intervalometer

Reset Time
The time required for the contacts to return to normal position when power is removed.

Reverse Polarity Protection
Blocking circuitry arrangement within the timer to prevent damage or output actuation if reverse polarity input voltage is applied.

Tolerance
The difference between specified and actual timing or sense point (factory setup tolerance).

Transient Protection
Prevents damage to unit if positive or negative transients are applied to the unit. Insures proper operation of the unit during and after transient occurrence. Max. transients are usually specified as to amplitude and duration, i.e., 1000V for 1 second.

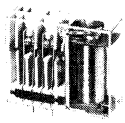
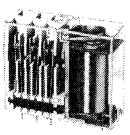
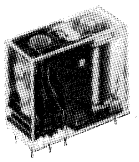
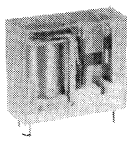
Trip Point
The predetermined point at which a sensing device is set to change the output state.

Voltage Sensor
A device that monitors for a predetermined overvoltage and/or undervoltage condition, and changes output state when these conditions exist.

GlobTek, Inc.

RELAYS

General Purpose, PC Board and Power Relays

Type		RT	RR	RR...D	RR	RY
						
Dimensions (l x w x h)	mm	28,5 x 12,5 , 25	28,7 x 12,5 x 24	28,7 x 12,5 x 24	25,4 x 12,5 x 24	50 x 31 x 28,2
Coil Ratings						
Nominal Voltage up to	V DC V AC	110 —	100 —	100 —	100 —	220 220
Average operating power	m W	250	200 up to 370	200 315	200 315	680
Thermal rating of coil (at 20°C)	W	1,3	1,6	1,6	1,6	2,7
Response / release time approx.	m s	ca. 8/3	ca. 8/2	ca. 8/2	ca. 6/2	ca. 15/3
Contact Ratings						
Contact arrangement max.		2 changeover cont.	1 make cont.[1] 1 changeover 2 changeover	1 make cont.[1] 1 changeover	1 make cont. 1 break cont.	2 make cont. 2 break cont.
Switching current max.	A	8	13/8	16/10[2]	13	16/10
Switching voltage max.	V AC	380	380	380	380	380
Contact rating max.	VA	2000	2860/1760	3520/2200[2]	2860	3520/2200
Special features						
Insulation group acc. to VDE 0110		C 250	C 250	C 250	C 250	C 250
Test voltage Coil / magnetic circuit	V ~ eff	—	500	500	500	750
Test voltage Contact / magnetic circuit	V ~ eff	—	2500 4000[1]	2500 4000[1]	2500	—
Test voltage Contact / coil	V ~ eff	4000	—	—	—	4000
Mechanical service life	switch. operations	$3 \cdot 10^7$	$3 \cdot 10^7$	$3 \cdot 10^7$	$3 \cdot 10^7$	$3 \cdot 10^7$
Certificate of approval		UL, SEV, CSA	VDE, CSA, UL SEV, PTB	VDE, CSA, UL SEV, PTB	VDE, CSA, UL SEV, PTB	VDE, SEV, UL FEMKO
Comments		Wash-tight version, high temperature and remanence type available.	Socket RSF RR 01	Double pin contacts. [2]Version for amb. temp. up to 125°C. SOCKET RSF RR 01		Spacing of contacts: 3mm. 8 mm creepage and clearance distances. Tails for PCB or tab terminations for fitting on standard rail.
Subject to modifications		Socket RSF RR 01	Versions up to 1 changeover cont. with twin contacts available Wash-tight version as well as remanence type are available. [1]Only for types with 8 mm creepage and clearance distances.			

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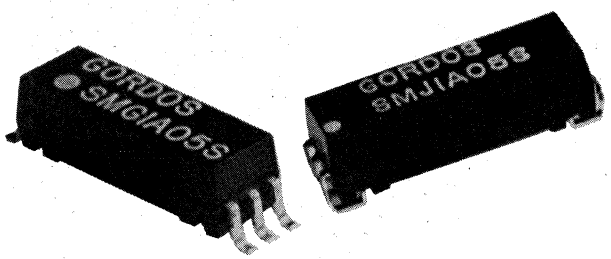
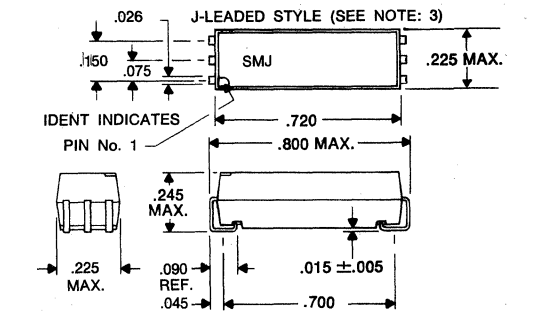
GORDOS

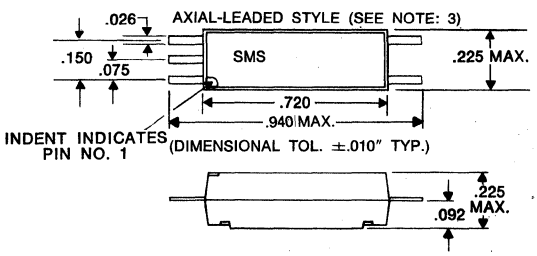
SURFACE MOUNT REED RELAYS

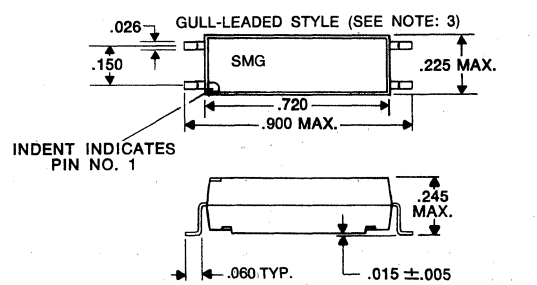


- All Gordos Relays are molded in semiconductor-grade molding compounds that meet Underwriters Laboratories 94V-0 flammability rating
- Withstand continuous exposure for 3 minutes at 215°C
- RF Characteristics
  - Insertion Loss: 0.3 dB max. from 1 to 500 MHz
  - Isolation: 30 dB min. from 1 to 600 MHz
  - Characteristic Impedance: 50, 75, or 93 ohms available

Nominal Coil Voltage DC	5	12
Must Operate Voltage DC	4.0	9.0
Must Release Voltage DC	0.5	1.2
Maximum Voltage DC	10	20







Contact Arrangement Model Type		Standard 1A	Standard 1C	Coaxially Shielded Versions for RF Switching			
				1A05-S 1A12-S	1A05-5	1A05-7	1A05-9
Max. Switching DC[2]	Watts	10	3	10	10	10	10
	Volts	200	30	200	200	200	200
Max. Current DC Amps	Switch	0.5	0.2	0.5	0.5	0.5	0.5
	Carry	1.5	0.5	1.5	1.5	1.5	1.5
Max. Initial Contact Resistance (ohms)[1]		.150	.150	.150	.150	.150	.150
Min. Breakdown Voltage DC	Across Contacts	300	200	300	300	300	300
	Contact to Shield	~	~	1000	1000	1000	1000
	Contact to Coil	1000	1000	1000	1000	1000	1000
	Coil to Shield	~	~	1000	1000	1000	1000
Characteristic Impedance (typical) Ohms		~	~	50	50	75	93
Capacitance (typical) pF	Across Contacts	1.0	1.5	0.6	0.6	0.6	0.5
	Contact to Coil	2.0	2.0	1.5	1.5	1.4	1.1
Capacitance (typical) pF (guarded meas.)	Across Contacts	~	~	0.1	0.1	0.1	0.1
	Contact to Coil	~	~	0.3	0.2	0.2	0.1
Insulation Resistance /typical) Ohms @ 25°C 50% R.H.		10^{14}	10^{12}	10^{14}	10^{14}	10^{14}	10^{14}
Operate Time (typical) mSec (including bounce)		0.3	1.0	0.3	0.3	0.3	0.3
Realese Time (typical) mSec (diode suppressed)		0.2	1.5	0.2	0.2	0.2	0.2

Operating temp range −20°C to 85°C
Storage temp range −20°C to 100°C

REED RELAY SELECTION CHART

Nom. Coil Volt.	Coil Resistance (ohms) ±10%	(See Notes: 3 &4) Part Number	Contact Arrangement Schematics (Top View)
5	500	SMJ1A05 SMG1A05 SMS1A05	STANDARD 1 FORM-A
12	1000	SMJ1A12 SMG1A12 SMS1A12	
5	380	SMJ1A05-S SMG1A05-S SMS1A05-S	COAXIALLY SHIELDED 1 FORM-A
12	800	SMJ1A12-S SMG1A12-S SMS1A12-S	
5	150	SMJ1A05-5 SMG1A05-5 SMS1A05-5	
5	150	SMJ1A05-7 SMG1A05-7 SMS1A05-7	(PIN NUMBERS ARE FOR REFERENCE ONLY)
5	150	SMJ1A05-9 SMG1A05-9 SMS1A05-9	
5	150	SMJ1C05 SMG1C05 SMS1C05	STANDARD 1 FORM-C
12	800	SMJ1C12 SMG1C12 SMS1C12	

Notes: All specifications are based on a 25°C ambient temperature.

1. Measured with nominal coil voltage applied.
2. Higher voltages and/or current may be switched with life expectancy reduced.
3. Lead styles are available in all contact configurations and voltages listed.
4. The prefixes used in the model number designate the following lead styles.
   "SMJ" — J-Leaded
   "SMG" — Gull-Leaded
   "SMS" — Axial-Leaded

Consult factory for magnetic shield requirements.

Products and specifications subject to change without notice.

Consult factory for application assistance.

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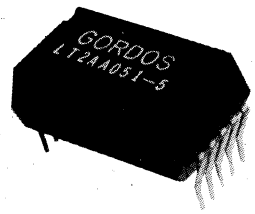
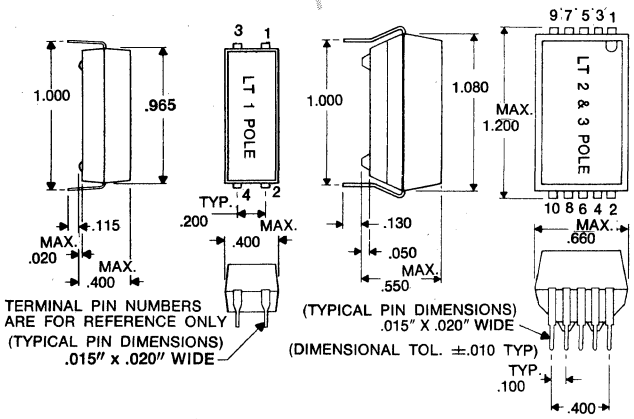
GORDOS

MOLDED LOW THERMAL EMF REED RELAYS





- These Gordos Relays are molded in semiconductor-grade molding compounds that meet Underwriters Laboratories 94V-0 flammability rating
- Insulation resistance $>10^{14}$ ohms
- Thermal EMF rating $<1\ \mu V$ available

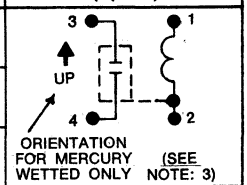
Nominal Coil Voltage	5	12
Must Operate Voltage DC	4.0	9.6
Must Release Voltage DC	0.5	1.2
Maximum Voltage DC	10	20

Contact Arrangement Model Type		"A" Standard	"E" High Volt.	"H" Mercury Wet
Max. Switching DC[2]	Watts	10	10	50
	Volts	200	1000	500
Max. Current DC Amps	Switch	0.5	0.5	1.0
	Carry	1.5	2.0	2.0
Max. Initial Contact Resistance (ohms)[1]		.100	.100	.050
Insulation Resistance (typical) Ohms @ 25°C 50% R.H.		10^{14}	10^{14}	10^{14}
Operate Time (typical) mSec including Bounce		1.0	1.0	2.0
Release Time (typical) mSec Diode Suppressed		0.5	0.5	1.5

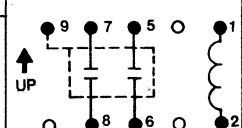
Operating temp range −20°C to 85°C
Storage temp range −20°C to 100°C

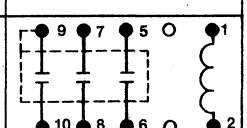
REED RELAY SELECTION CHART

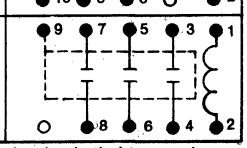
Example Part Number — LT 1A A 05 1 — 5

Family Series	Contact Arrange-ment	Contact Type	Nominal Coil Voltage	Schematic Style	Thermal Offset Voltage* (μV Max.)	Coil Resistance (ohms) ±10%	Minimum Breakdown Voltage DC: Across Contacts	Min. Breakdown Voltage DC: Contact to Shield	Min. Breakdown Voltage DC: Contact to Coil	Min. Breakdown Voltage DC: Shield to Coil	Capacitance** (typical pF): Across Contacts	Capacitance** (typical pF): Contact to Shield	Capacitance** (typical pF): Contact to Coil	Capacitance** (typical pF): Shield to Coil	Schematic (top view)
LT	1A	A	5	1	5	500	250	1500	1500	NA	0.2	2.0	1.0	~	
			12		5	2000									
	1A	E	5	1	5	500	1500	1500	1500	NA	0.8	2.0	1.0	~	
			12		5	2000									
	1A	H	5	1	10	500	1000	1500	1500	NA	0.2	3.0	2.0	~	
			12		10	2000									
	2A	A	5	1	1	400	250	500	1500	1000	0.2	1.5	0.4	12	
					5										
			12		1	2000									
					5										
	2A	E	5	1	5	200	1500	1500	1500	1000	0.8	2.0	0.5	15	
					10										
			12		5	1000									
					10										
	2A	H	5	1	5	200	1000	1000	1500	1000	0.1	2.5	0.6	15	
					10										
			12		5	1000									
					10										
	3A	A	5	1	1	400	250	500	1500	1000	0.2	2	0.4	25	
					5										
			12		1	2000									
					5										
	3A	A	5	2	1	400	250	500	1000	1000	0.2	1.5	0.4	25	
					5										
			12		1	2000									
					5										

ORIENTATION FOR MERCURY WETTED ONLY (SEE NOTE: 3)







* Thermal offset voltage measured between pins 5 and 7 with pins 6 and 8 shorted

** Capacitance values obtained with all other leads tied to guard.

Notes: All specifications are based on a 25°C ambient temperature.
1. Measured with nominal coil voltage applied.
2. Higher voltages and/or current may be switched with life expectancy reduced.
3. Mercury relays are position-sensitive and must be mounted within 30° from vertical, as indicated by the "up" arrow.

Products and specifications subject to change without notice.

Consult factory for application assistance.

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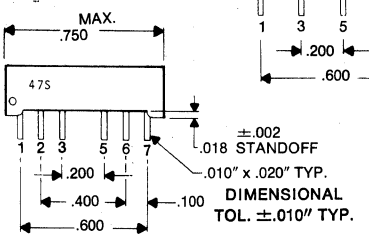
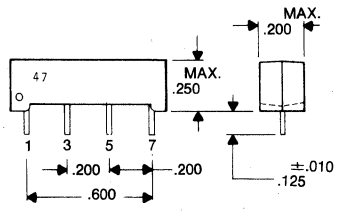
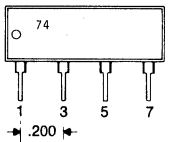
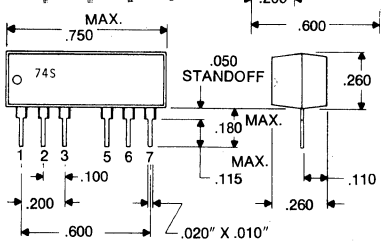
GORDOS

47 SERIES MINI-SIP DRY REED RELAY
74 SERIES SIP DRY & MERCURY WETTED REED RELAY









- These Gordos Relays are molded in semiconductor-grade molding compounds that meet Underwriters Laboratories 94V-0 flammability rating
- RF Characteristics
  - Insertion Loss: 0.3 dB max. from 1 to 500 MHz
  - Isolation: 30 dB min. from 1 to 600 MHz
  - Characteristic Impedance: 50, 75, or 93 ohms available
- Compatible with automatic insertion
- Logic Compatible

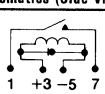
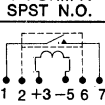
Contact Arrangement Model Type			1 Form-A Std. Dry 47/741A	1 Form-A (4) Mercury Wetted 741AH	(3) 1 Form-B 741B	1 Form-C 741C	Coaxially Shielded 1 Form-A Versions for RF Switching 4705S 4712S 741AS	47055 741A5	47057 741A7	47059 741A9
Max. Switching DC(2)	Watts		10	50	10	3	10	10	10	10
	Volts		200	500	200	30	200	200	200	200
Max.Current DC Amps	Switch		0.5	1.0	0.5	0.2	0.5	0.5	0.5	0.5
	Carry		1.5	2.0	1.5	0.5	1.5	1.5	1.5	1.5
Max. Initial Contact Resistance (ohms)(1)		47	.100	.050	.200	.200	.100	.100	.100	.100
		74	.200	.050	.200	.200	.200	.200	.200	.200
Min. Breakdown Voltage DC	Across Contacts		300	1500	300	200	300	300	300	300
	Contact to Shield		—	—	—	—	1000	1000	1000	1000
	Contact to Coil		1000	1000	1000	1000	1000	1000	1000	1000
	Shield to Coil		—	—	—	—	1000	1000	1000	1000
Characteristic Impedance (typical) Ohms			—	—	—	—	50	50	75	93
Capacitance (typical) pF	Across Contacts		1.0	1.1	—	2.0	0.6	0.6	0.6	0.5
	Contact to Coil		2.0	2.0	3.8	2.0	1.5	1.0	1.0	1.1
Capacitance (typical pF Guarded Measurement	Across Contacts		—	—	—	—	0.1	0.1	0.1	0.1
	Contact to Coil		—	—	—	—	0.3	0.2	0.2	0.1
Insulation Resistance (typical) Ohms at 25°C 50% R.H.		47	10^{14}	10^{12}	10^{10}	10^{9}	10^{14}	10^{14}	10^{14}	10^{14}
		74	10^{10}	10^{12}	10^{10}	10^{9}	10^{10}	10^{10}	10^{10}	10^{10}
Operate Time (typical mSec) Including Bounce			0.5	2.0	0.5	1.0	0.5	0.5	0.5	0.5
Release Time (typical mSec) Diode Suppressed			0.3	1.5	0.5	1.5 includes bounce on N.C. Pole	0.3	0.3	0.3	0.3

Operating temp range −20°C to 85°C
Storage temp range −20°C to 100°C

	Series 47/74	Series 47/74	Series 74
Nominal Coil Voltage DC	5	12	24
Must Operate Voltage DC	3.8	9.0	18.0
Must Release Voltage DC	0.5	1.2	2.4
Maximum Voltage DC (3)	10	20	35

REED RELAY SELECTION CHART

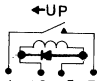
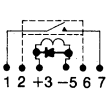
SERIES 47 MINI-SIP

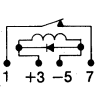
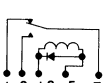
Nom. Coil Volt.	Coil Res. Ohms ±10%	Clamp Diode	Part Number	Contact Arrangement Schematics (Side View)
5	500	No	4705	 1 FORM-A SPST N.O.
		Yes	4705D	
12	1200	No	4712	
		Yes	4712D	
5	150	No	4705-5 4705-7 4705-9	 1 FORM-A SPST N.O. COAXIALLY SHIELDED
	380	No	4705-S	
12	800	No	4712-S	

SERIES 74 STANDARD SIP

Nom. Coil Volt.	Coil Res. Ohms ±10%	Clamp Diode	Part Number	Contact Arrangement Schematics (Side View)
5	380	No	741A-1	1 FORM-A SPST N.O.
		Yes	741A-2	
	500	No	741A-9	
		Yes	741A-10	
12	1000	No	741A-3	
		Yes	741A-4	
24	1750	No	741A-7	
		Yes	741A-8	

SERIES 74 STANDARD SIP (cont.)

Nom. Coil Volt.	Coil Res. Ohms ±10%	Clamp Diode	Part Number	Contact Arrangement Schematics (Side View)
5	200	No	741AH-1	 Hg WETTED 1 FORM-A SPST N.O. UP (SEE NOTE: 4)
		Yes	741AH-2	
12	575	No	741AH-3	
		Yes	741AH-4	
24	1750	No	741AH-7	
		Yes	741AH-8	
5	380	No	741A5-1	 1 FORM-A SPST N.O. COAXIALLY SHIELDED
		Yes	741A5-2	
		No	741A7-1	
		Yes	741A7-2	
		No	741A9-1	
		Yes	741A9-2	
	500	No	741AS-9	
		Yes	741AS-10	
12	1000	No	741AS-3	
		Yes	741AS-4	

Nom. Coil Volt.	Coil Res. Ohms ±10%	Clamp Diode	Part Number	Contact Arrangement Schematics (Side View)
5	200	No	741B-3	 1 FORM-B SPST N.C. (SEE NOTE: 3)
		Yes	741B-4	
	500	No	741B-9	
		Yes	741B10	
12	500	No	741B-5	
		Yes	741B-6	
24	1750	No	741B-7	
		Yes	741B-8	
5	200	No	741C-1	 1 FORM-C SPDT
		Yes	741C-2	
12	500	No	741C-3	
		Yes	741C-4	
24	1750	No	741C-5	
		Yes	741C-6	

Notes: All specifications are based on a 25°C ambient temperature.

1. Measured with nominal coil voltage applied (except Form B).
2. Higher voltages and/or current may be switched with life expectancy reduced.
3. Excessive voltage (maximum of 6.5 VDC for 5 VDC model, 15 VDC for 12 VDC model, and 28 VDC for 24 VDC model), may cause contact re-closure on Form B models.
4. Mercury relays are position-sensitive and must be mounted within 30° from vertical, as indicated by the "up" arrow.

Consult factory for magnetic shield requirements.
Products and specifications subject to change without notice.

Consult factory for application assistance.

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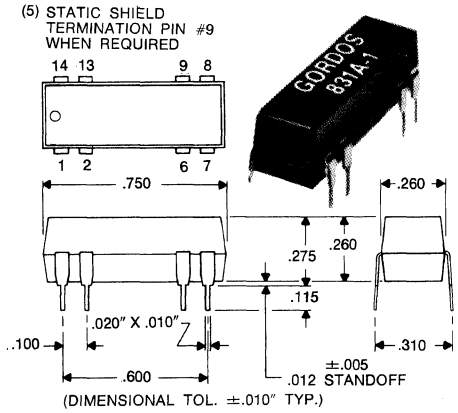
GORDOS

83 SERIES MOLDED DIP DRY AND MERCURY WETTED REED RELAYS



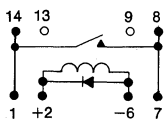
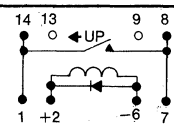
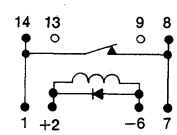
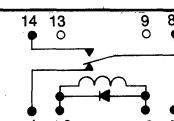
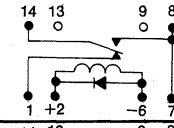
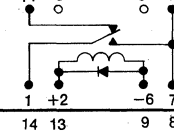
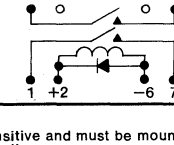
Nominal Coil Voltage DC	5	12	24
Must Operate Voltage DC	3.8	9.0	18.0
Must Release Voltage DC	0.5	1.2	2.4
Maximum Voltage DC (3)	10	20	35

- These Gordos Relays are molded in semiconductor-grade molding compounds that meet Underwriters Laboratories 94V-0 flammability rating
- Compatible with automatic insertion

Contact Arrangement		Form-A		Form-B(3)	Form-C		
Model Type		831A 832A	Mercury Wet (4) 831AH	831B	831C	835C	836C
Max. Switching DC(2)	Watts	10	50	10	3		
	Volts	200	500	200	30		
Max. Current DC (amps)	Switch	0.5	1.0	0.5	0.2		
	Carry	1.5	2.0	1.5	0.5		
Max. Initial Contact Resistance (ohms)(1)		.200	.050	.200	.2Ω		
Min. Breakdown Voltage DC	Across Contacts	300	1000	300	200		
	Contact to Coil	1000	1000	1000	1000		
Capacitance (typical pF)	Across Contacts	1.0	1.0	~	1.5		
	Contact to Coil	2.0	2.0	3.8	2.0		
Insulation Resistance (typical ohms)		10^{10}	10^{12}	10^{10}	10^{9}		
Operate Time (typ. mSec) Including Bounce Except Form-B		0.5	2.0	0.5	1.0		
Release Time (typ. mSec) Diode Suppressed		0.5	1.5	0.5	1.5 Including Bounce on N.C. Pole		

Operating temp range −20°C to 85°C
Storage temp range −20°C to 100°C

REED RELAY SELECTION CHART

Contact Arrangement	Nominal Coil Voltage (VDC)	Coil Resistance (ohms) ±10% @ 25°C	Suppression Diode	Part Number	Schematics (Top View)
1A SPST N.O.	5	380	No	831A-1	
			Yes	831A-2	
		500	No	831A-3	
			Yes	831A-4	
	12	1000	No	831A-5	
			Yes	831A-6	
	24	1750	No	831A-7	
			Yes	831A-8	
1A Mercury Wetted SPST N.O.	5	200	No	831AH-1	 (See Note: 4) Orientation arrow for mercury wetted models only
			Yes	831AH-2	
	12	575	No	831AH-5	
			Yes	831AH-6	
	24	1750	No	831AH-7	
			Yes	831AH-8	
1B (See Note 3) SPST N.C.	5	200	No	831B-1	
			Yes	831B-2	
		500	No	831B-3	
			Yes	831B-4	
	12	500	No	831B-5	
			Yes	831B-6	
	24	1750	No	831B-7	
			Yes	831B-8	
1C SPDT	5	200	No	831C-1	
			Yes	831C-2	
	12	500	No	831C-3	
			Yes	831C-4	
	24	1750	No	831C-5	
			Yes	831C-6	
1C SPDT	5	200	No	835C-1	
			Yes	835C-2	
	12	500	No	835C-3	
			Yes	835C-4	
	24	1750	No	835C-5	
			Yes	835C-6	
1C SPDT	5	200	No	836C-1	
			Yes	836C-2	
	12	500	No	836C-3	
			Yes	836C-4	
	24	2200	No	836C-5	
			Yes	836C-6	
2A DPST N.O.	5	200	No	832A-1	
			Yes	832A-2	
	12	500	No	832A-3	
			Yes	832A-4	
	24	1750	No	832A-5	
			Yes	832A-6	

Notes: All specifications are based on a 25°C ambient temperature.
1. Measured with nominal coil voltage applied (except Form B).
2. Higher voltages and/or current may be switched with life expectancy reduced.
3. Excessive voltage (maximum of 6.5 VDC for 5 VDC model, 15 VDC for 12 VDC model, and 28 VDC for 24 VDC model), may cause contact reclosure on Form B models.
4. Mercury relays are position-sensitive and must be mounted within 30° from vertical, as indicated by the "up" arrow.
5. Consult factory for electrostatic shield and/or magnetic shield requirements.

Products and specifications subject to change wihout notice.

Consult factory for application assistance.

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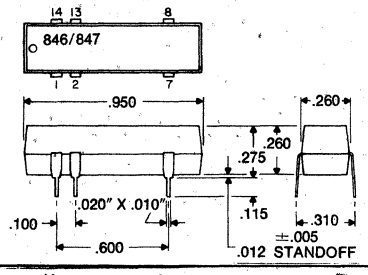
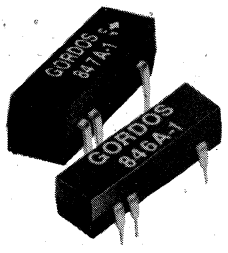
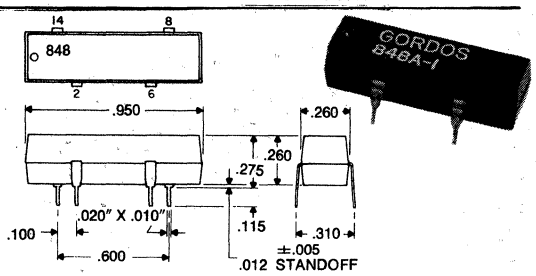
GORDOS

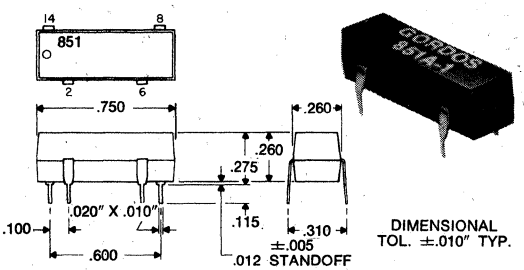
DIP REED RELAYS

846 SERIES High Voltage / 847 SERIES Mercury wetted
848 SERIES High Voltage & High Isolation / 851 SERIES High Isolation









DIMENSIONAL TOL. ±.010" TYP.

- These Gordos Relays are molded in semiconductor-grade molding compounds that meet Underwriters Laboratories 94V-0 flammability rating
- Compatible with automatic insertion
- Logic compatible
- High voltage contacts recommended for FCC Part 68 use

Nominal Coil Voltage DC	5	12	24
Must Operate Voltage DC	4.0	9.6	19.2
Must Release Voltage DC	0.5	1.2	2.4
Maximum Voltage DC (3)	10	20	35

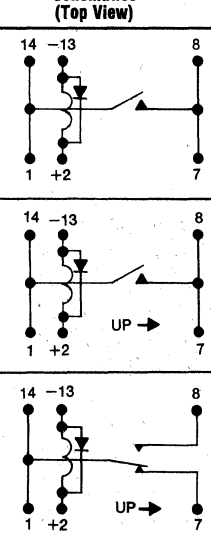
Contact Arrangement		Form-A				Form-B	Form-C
Model Type		846A	Mercury Wetted(4) 847A	848A	851A	(3) 851B	Mercury Wetted(4) 847C
Maximum Switching DC(2)	Watts	25	50	25	10	10	50
	Volts	1000	500	1000	200	200	500
Maximum Current DC (amps)	Switch	1.0	1.0	1.0	0.5	0.5	1.0
	Carry	2.0	2.0	2.0	1.5	1.5	2
Maximum Initial Contact Resistance (ohms)(1)		.200	.050	.200	.200	.200	.050
Min. Breakdown Voltage DC	Across Contacts	1500	1000	1500	500	500	1000
	Contact to Coil	1500	1500	2500	2000	2000	1000
Capacitance (maximum pF)	Across Contacts	1	1.1	1	1	—	1.3
	Contact to Coil	2	2	2	2	3.8	6
Insulation Resistance (typical ohms)		10^{10}	10^{12}	10^{10}	10^{10}	10^{10}	10^{8}
Operate Time (typical mSec) (including bounce except Form-B)		0.5	2.5	0.5	0.5	0.5	2.5
Release Time (typical mSec) (diode) suppressed)		0.3	2.0	0.3	0.3	0.5	2.0

Operating temp range −20°C to 85°C
Storage temp range −20°C to 100°C

REED RELAY SELECTION CHART

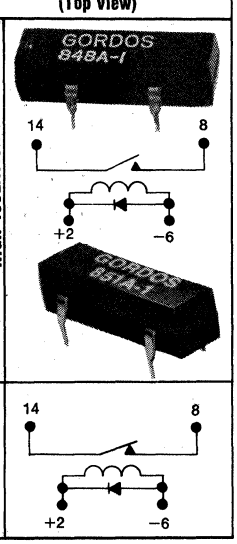
6 PIN DIP RELAYS
846 SERIES HIGH VOLTAGE
847 SERIES MERCURY WETTED

Contact Arrangement	Nom. Coil Volt.	Coil Res. (ohms) ±10%	Clamp Diode	Part Number	Schematics (Top View)
1A SPST N.O.	5	150	No	846A-1	HIGH VOLTAGE
			Yes	846A-2	
	12	575	No	846A-3	
			Yes	846A-4	
	24	1750	No	846A-5	
			Yes	846A-6	
	5	150	No	847A-1	MERCURY WETTED CONTACTS (See Note: 4)
			Yes	847A-2	
	12	575	No	847A-3	
			Yes	847A-4	
	24	1750	No	847A-5	
			Yes	847A-6	
1C SPDT	5	70	No	847C-1	
			Yes	847C-2	
	12	320	No	847C-3	
			Yes	847C-4	
	24	1600	No	847C-5	
			Yes	847C-6	



4 PIN DIP RELAYS
848 SERIES HIGH VOLTAGE, HIGH ISOLATION
851 SERIES HIGH ISOLATION

Contact Arrangement	Nom. Coil Volt.	Coil Res. (ohms) ±10%	Clamp Diode	Part Number	Schematics (Top View)
1A SPST N.O.	5	150	No	848A-1	HIGH VOLTAGE HIGH ISOLATION
			Yes	848A-2	
	12	575	No	848A-3	
			Yes	848A-4	
	24	1750	No	848A-5	
			Yes	848A-6	
	5	380	No	851A-1	
			Yes	851A-2	
		500	No	851A-5	
			Yes	851A-6	
	12	1000	No	851A-3	
			Yes	851A-4	
	24	1750	No	851A-7	
			Yes	851A-8	
(See Note: 3) 1B SPST N.C.	5	200	No	851B-3	HIGH ISOLATION
			Yes	851B-4	
	12	500	No	851B-5	
			Yes	851B-6	
	24	1750	No	851B-7	
			Yes	851B-8	



Notes: All specifications are based on a 25°C ambient temperature.
1. Measured with nominal coil voltage applied (except Form B).
2. Higher voltages and/or current may be switched with life expectancy reduced.
3. Excessive voltage (maximum of 6.5 VDC for 5 VDC model, 15 VDC for 12 VDC model, and 28 VDC for 24 VDC model), may cause contact reclosure on Form B models.
4. Mercury relays are position-sensitive and must be mounted within 30° from vertical, as indicated by the "up" arrow.

Products and specifications subject to change without notice.

Consult factory for application assistance.

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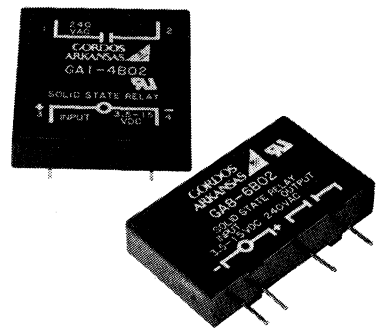
GORDOS

PRINTED CIRCUIT BOARD MOUNTABLE SOLID STATE RELAYS

GA1, GA8 SERIES

- Thick Film Hybrid Construction and Vapor Phase Soldering for Superior Reliability
- Ceramic Substrate for Proper Thermal Management
- Computerized Laser Trimming of Resistors for Optimum Performance
- High Current Thyristor for 100A Surge Capability
- UL Recognized (E46203)/CSA Certified (38595)
- 4KV Optical Isolation
- Zero Voltage Turn-On
- Industry Standard Packaging, SIP or Flat Pack



INPUT SPECIFICATIONS[1]

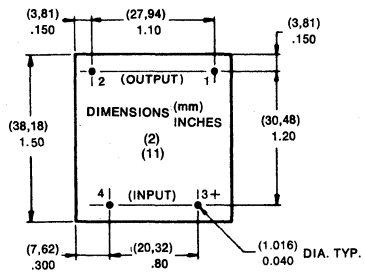
PARAMETER	ALL DEVICES	UNITS
Minimum Turn-On Voltage	3.0	VDC
Maximum Intput Voltage	24	VDC
Drop Out Voltage	1.0	VDC
Maximum Input Current (3)	25	mADC
Nominal Input Resistance (4)	1K	Ohms

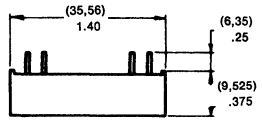
OUTPUT SPECIFICATIONS[1]

Parameter	GA1-2B02 GA8-2B02	GA1-4B02 GA8-4B02	GA1-6B02 GA8-6B02	UNITS
Nominal Line Voltage	120	240	240	Vrms
Minimum Line Voltage	24	24	24	Vrms
Maximum Line Voltage	140	250	280	Vrms
Maximum Peak Off-State Voltage (5)	400	400	600	Vpeak
Static (Off-State) dv/dt	200	200	200	V/μS

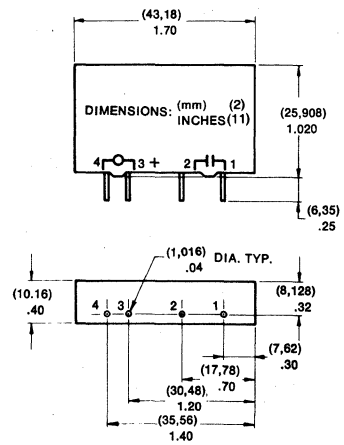
PARAMETER	ALL DEVICES	UNITS
Maximum On-State Current (6)	3.5	Arms
Minimum On-State Current	.05	Arms
Maximum 1-Cycle Surge (7)	100	Apeak
On-State Voltage Drop (8)	1.6	Vpeak
Maximum Off-State Leakage (9)		
(120V Models)	3.0	mArms
(240V Models)	6.0	mArms

GA1





GA8



GENERAL SPECIFICATIONS[1]

PARAMETER	ALL DEVICES	UNITS
Operating Temperature Range	−30 to +80	°C
Storage Temperature Range	−40 to +100	°C
Response Time	.5	Cycle
Input to Output Isolation Voltage (10)	4000	Vrms
Capacitance Input to Output (Max)	8	pF
Line Frequency Range	47 to 63	Hz

FOOTNOTES:
(1) Specifications apply to T_a −30 to +80°C unless otherwise noted.
(2) Tolerance: inches ±.020; millimeters ±0,50.
(3) At maximum input voltage.
(4) Does not include IRED impedance (drop).
(5) One minute maximum duration.
(6) At T_a of 40°C, derate units by 50 mA/C to 80 C. CSA rating is 3.0 A @ 40°C T_a.
(7) At T_a of 25°C, non-repetitive.
(8) At T_a of 25°C and maximum on-state current.
(9) At T_a of 25°C and maximum line voltage.
(10) At T_a of 25°C, for one second, maximum leakage 1mA, VDE compliant versions, meeting VDE specification 0806, and IEC specification 380, are available. Consult factory for details.
(11) Pin Tolerance: inches ±.001, millimeters ±.025.

PART NUMBER GUIDE

Maximum Output Voltage (VAC)			Output Current Rating (AMPS)	Control Voltage
140	250	280		
GA1-2B02 GA8-2B02	GA1-4B02 GA8-4B02	GA1-6B02 GA8-6B02	3 @ 40°C Ambient or 4 @ 20°C Ambient	3-24VDC

Products and specifications subject to change without notice.

Consult factory for application assistance.

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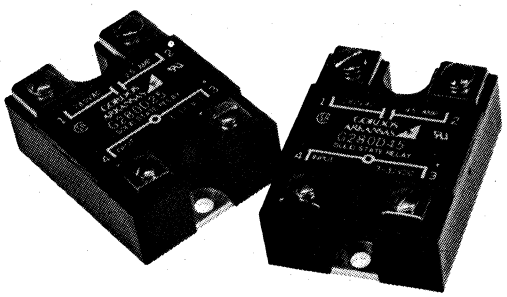
GORDOS

PANEL MOUNT SOLID STATE RELAYS



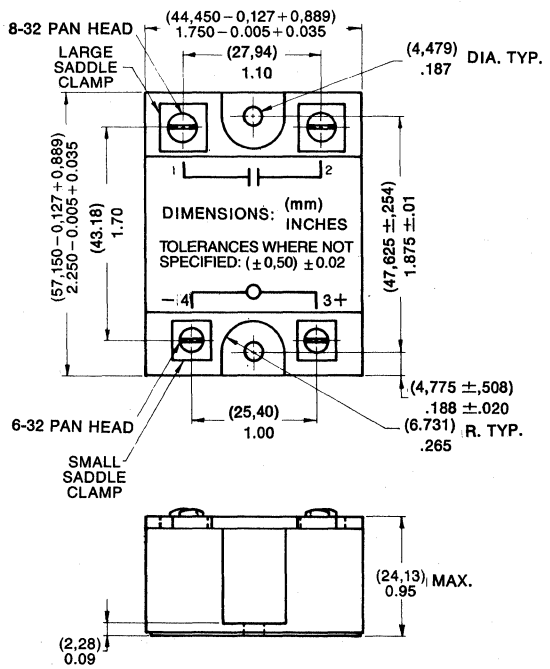
G SERIES POWER RELAYS

- Back-to-back (dual) SCR output for severe inductive loads
- Superior false turn-on immunity and positive turn-off at high dv/dt.

GA5 SERIES POWER RELAYS

- Economical triac output for general purpose applications

G SERIES AND GA5 SERIES OUTLINE DIMENSIONS



Products and specifications subject to change without notice.

G, GA5 SERIES POWER RELAYS

- Current Ratings to 90A
- Output Voltage Ratings to 480V AC with 24V AC Minimum
- AC or DC Inputs
- 4KV Optical Isolation
- Zero AC or Random Turn-on Models
- RC Snubber Network for Inductive Loads
- UL Recognized, CSA Certified
- VDE Approval on Many Models

G SERIES[1]						
Maximum Line Voltage (Vrms)	**140**	**250**	**280**	**480**	**Output Current Rating**	**Control Voltage**
Minimum Line Voltage (Vrms)	24	24	24	36	–	–
Max. Off-state Voltage (Vpeak)[2]	250	500	600	1200	–	–
Max. Off-state Leakage (mArms)[3]	7.5	15.0	15.0	15.0	–	–
Static (Off-state) dv/dt (V/µs)	200	200	200	200	–	–
	G120A10	**G240A10**	**G280A10**	**G480A10**	**10A**	**90-280 VAC**
	G120A25	**G240A25**	**G280A25**	**G480A25**	**25A**	**90-280 VAC**
	G120A45	**G240A45**	**G280A45**	–	**45A**	**90-280 VAC**
	–	–	–	**G480A50**	**50A**	**90-280 VAC**
	–	–	**G280A75**	**G480A75**	**75A**	**90-280 VAC**
	–	–	**G280A90**	**G480A90**	**90A**	**90-280 VAC**
CATALOG NUMBER	**G120D10***	**G240D10***	**G280D10***	**G480D10**	**10A**	**3-32 VDC**
	G120D25*	**G240D25***	**G280D25***	**G480D25**	**25A**	**3-32 VDC**
Specify suffix "R" for random turn-on models	**G120D45***	**G240D45***	**G280D45***	–	**45A**	**3-32 VDC**
	–	–	–	**G480D50**	**50A**	**3-32 VDC**
*Specify suffix "V" for VDE approved models.	–	–	**G280D75**	**G480D75**	**75A**	**3-32 VDC**
	–	–	**G280D90**	**G480D90**	**90A**	**3-32 VDC**
	G120E10	**G240E10**	**G280E10**	**G480E10**	**10A**	**18-36 VAC**
	G120E25	**G240E25**	**G280E25**	**G480E25**	**25A**	**18-36 VAC**
	G120E45	**G240E45**	**G280E45**	–	**45A**	**18-36 VAC**
	–	–	–	**G480E50**	**50A**	**18-36 VAC**
	–	–	**G280E75**	**G480E75**	**75A**	**18-36 VAC**
	–	–	**G280E90**	**G480E90**	**90A**	**18-36 VAC**

GA5 SERIES[1]					
Maximum Line Voltage (Vrms)	**140**	**250**	**280**	**Output Current Rating**	**Control Voltage**
Minimum Line Voltage (Vrms)	24	24	24	–	–
Max. Off-state Voltage (Vpeak)[2]	±250	±400	±600	–	–
Max. Off-state Leakage (mA_{rms})[3]	4.5	9.0	15.0	–	–
Static (Off-state) dv/dt (V/µs)	200	200	200	–	–
CATALOG NUMBER	**GA5-2A10**	**GA5-4A10**	**GA5-6A10**	**10A**	**90-280 VAC**
Specify suffix "R" for random turn-on models	**GA5-2A25**	**GA5-4A25**	**GA5-6A25**	**25A**	**90-280 VAC**
	GA5-2D10*	**GA5-4D10***	**GA5-6D10***	**10A**	**3-32 VDC**
*Specify suffix "V" for VDE approved models.	**GA5-2D25***	**GA5-4D25***	**GA5-6D25***	**25A**	**3-32 VDC**
	GA5-2E10	**GA5-4E10**	**GA5-6E10**	**10A**	**18-36 VAC**
	GA5-2E25	**GA5-4E25**	**GA5-6E25**	**25A**	**18-36 VAC**

FOOTNOTES:
(1) Specifications apply to T_A – 30 to + 80° unless otherwise noted.
(2) One minute maximum duration.
(3) At T_A of 25°C and maximum line voltage.

Consult factory for application assistance.

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GORDOS

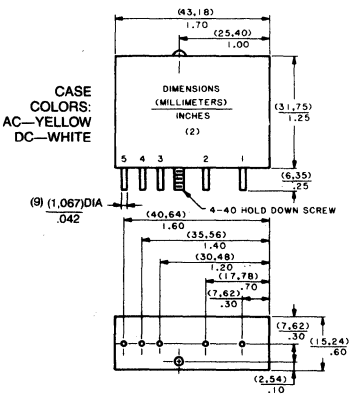
SINGLE POINT I/O MODULES

INPUT MODULES

- Thick Film Hybrid Construction, Vapor-Phase Soldering for Superior Reliability
- Ceramic Substrate for Proper Thermal Management
- Computerized Laser Trimming of Resistors for Optimum Performance
- 4KV Optical Isolation
- UL Recognized/CSA Certified
- Industry Standard Packaging
- Plug into Standard I/O Module Mounting Boards
- VDE Compliant Versions Available

INPUT SPECIFICATIONS(1)

PARAMETER	IAC5 IAC15 IAC24	IAC5A IAC15A IAC24A	IDC5 IDC15 IDC24
Nominal Input Voltage (3) (14)	120 Vrms/VDC	240 Vrms/VDC	—
Maximum Input Voltage	140 Vrms/VDC	280 Vrms/VDC	32 VDC
Minimum Input Voltage	90 Vrms/VDC	90 Vrms/VDC	3.3 VDC
Maximum Input Current (11)	10 mA	10 mA	34 mA
Input Resistance	—	—	1 KOhms (10)
Drop Out Current (4)	2.5 mA	1.5 mA	1.0 mA
Allowable Input For No Output (4)	3.0 mA	2.0 mA	1.5 mA
Allowable Input For No Output	50 Vrms/VDC	50 Vrms/VDC	2.0 VDC



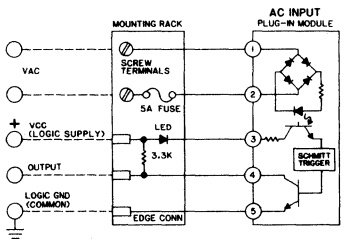
OUTPUT SPECIFICATIONS(1)

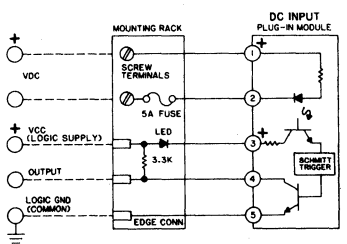
PARAMETER	IAC5 IAC5A IDC5	IAC15 IAC15A IDC15	IAC24 IAC24A IDC24	UNITS
Nominal Logic Supply Voltage	5.0	15	24	VDC
Maximum Logic Supply Voltage	6.0	18	30	VDC
Minimum Logic Supply Voltage	2.75	12	20	VDC
Maximum Logic Supply Current (5)	16	16	16	mADC
Maximum Logic Supply Leakage Current	10	10	10	μADC
Maximum Output Voltage (6)	30	30	30	VDC
Maximum Output Current	50	50	50	mADC
Maximum Output Leakage Current	10	10	10	μADC
Maximum Output Voltage Drop	200	200	200	mVDC

GENERAL SPECIFICATIONS(1)

PARAMETER	AC MODULES	DC MODULES
Operating Temperature Range	−30 to +80°C	−30 to +80°C
Storage Temperature Range	−40 to +100°C	−40 to +100°C
Maximum Turn-On Time	20 ms (7)	1 ms (12)
Maximum Turn-Off Time	30 ms (7)	1 ms (12)
Input To Output Isolation Voltage	4000 Vrms (8)	4000 Vrms (13)
Capacitance Input To Output (Max)	8 pF	8 pF
Line Frequency Range (Input)	47 to 63 Hz	—

WIRING DIAGRAMS





FOOTNOTES:

(1) Specifications apply to T_a −30 to +80°C unless otherwise noted.
(2) Tolerance: inches ±.020; millimeters ±0,50.
(3) Gordos IAC modules will operate on AC or DC input voltage.
(4) Series operation of models without the suffix "A" is permissable.
(5) With external LED indicator, 18 mADC without external LED.
(6) Breakdown voltage of output transistor.
(7) At nominal V_{logic}, V_{out} of 30V, I_{out} of 25 mA, V_{in} of 120 VAC and T_a of 25°C.
(8) At T_a of 25°C, for one second. VDE versions, complying with VDE specification 0806, and IEC specification 380, are available. Specify by adding the suffix 'V' to the part number (example: IAC5AV).
(9) Pin Tolerance: inches ±.001, millimeters ±.025.
(10) Does not include IRED impedance (drop).
(11) At maximum input voltage.
(12) At nominal V_{logic}, V_{out} 30V, I_{out} 25mA, V_{in} 32 VDC, T_a 25°C.
(13) At T_a of 25°C for one second.
(14) Order "24" suffix for 24 VAC input version of IAC5, IAC15, IAC24, IAC5A, IAC15A or IAC24A. Input specifications for these versions are available from factory upon request.

Products and specifications subject to change without notice.

Consult factory for other configurations and application assistance.

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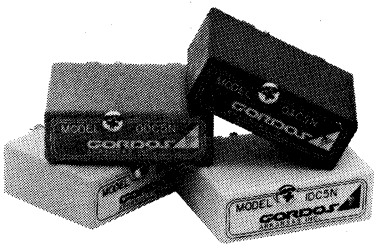
GORDOS

SINGLE POINT I/O MODULES

OUTPUT MODULES

- Thick Film Hybrid Construction, Vapor-Phase Soldering for Superior Reliability
- Ceramic Substrate for Proper Thermal Management
- Computerized Laser Trimming of Resistors for Optimum Performance
- Zero or Random (17) Turn-on AC Modules
- High Current Thyristor for 100A Surge Capability
- 4KV Optical Isolation
- UL Recognized/CSA Certified
- Industry Standard Packaging
- Plug into Standard I/O Module Mounting Boards
- Normally Closed AC Output Option (12)

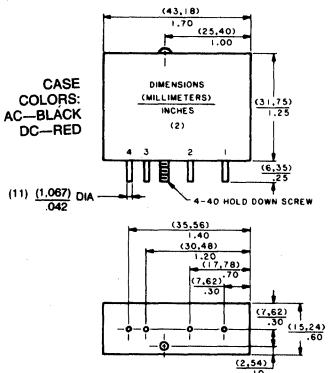


INPUT SPECIFICATIONS(1)

PARAMETER	OAC5 OAC5A	ODC5 ODC5A	OAC15 OAC15A ODC15 ODC15A	OAC24 OAC24A	ODC24 ODC24A	UNITS
Nominal Input Voltage	5.0	5.0	15	24	24	VDC
Minimum Turn-On Voltage	2.5	2.75	9.0	18	18	VDC
Maximum Input Voltage	8.0	8.0	18	32	32	VDC
Drop Out Voltage	1.0	1.0	1.0	1.0	1.0	VDC
Maximum Input Current (3)	20	18	16	14	13	mADC
Nominal Input Resistance (4)	220	250	1K	2K	2K	Ohms

OUTPUT SPECIFICATIONS(1)

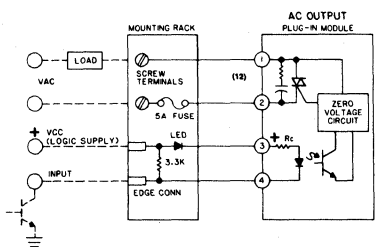
PARAMETER	OAC5 OAC15 OAC24	OAC5A OAC15A OAC24A	ODC5 ODC15 ODC24	ODC5A ODC15A ODC24A
Nominal Line Voltage	120V rms	240V rms	—	—
Minimum Line Voltage	12V rms	24V rms	3.0V DC	5.0V DC
Maximum Line Voltage	140V rms	280V rms	60V DC	200V DC
Maximum Off-State Voltage	400V peak (13)	600V peak (13)	60V DC	200V DC
Maximum Off-State Leakage	3.0 mA rms (14)	6.0 mA rms (14)	1.0 mA DC (5)	2.0 mA DC (5)
Static (Off-State) dv/dt	200V/µs	200V/µs	—	—
Maximum On-State Current	3.5A rms (15)(16)	3.5A rms (15,16)	3.0A DC (6)	1.0A DC (18)
Minimum On-State Current	50 mA rms	50 mA rms	10 mA DC	10 mA DC
Maximum Surge Current (7)	100A peak	100A peak	5.0A DC	5.0A DC
Peak On-State Voltage (8)	1.6V peak	1.6V peak	1.5V DC	1.5V DC

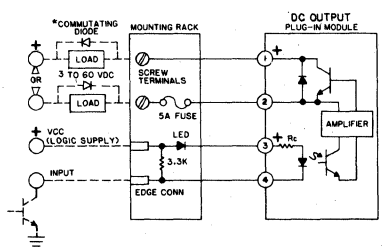


GENERAL SPECIFICATIONS(1)

PARAMETER	AC MODULES	DC MODULES
Operating Temp Range	−30 to +80°C	−30 to +80°C
Storage Temp Range	−40 to +100°C	−40 to +100°C
Response Time	.5 Cycle	—
Maximum Turn-On Time (9)	—	25 µs
Maximum Turn-Off Time (9)	—	50 µs
Input To Output Isolation Voltage (10)	4000V rms	4000V rms
Capacitance Input To Output (Max)	8 pF	8 pF
Line Frequency Range	47 to 63 Hz	—

WIRING DIAGRAMS





*Must be used on inductive loads.

FOOTNOTES:

(1) Specifications apply to T_a −30 to +80°C unless otherwise noted.
(2) Tolerance: inches ±.020; millimeters ±0,50.
(3) At nominal input voltage.
(4) Does not include IRED impedance (Drop).
(5) At T_a of 80°C and maximum line voltage.
(6) At T_a of 40°C, derate 50 mA/°C to 80°C.
(7) At T_a of 25°C, non-repetitive, 1 cycle for AC modules, 1 second for DC.
(8) At T_a of 25°C, and maximum rated current.
(9) At maximum voltage and current, nominal logic supply voltage.
(10) At T_a of 25°C, for one second, maximum leakage 100 µA.
(11) Pin Tolerance: inches ±.001, millimeters ±.025.
(12) Specify suffix "C" for normally closed AC output version of OAC5 and OAC5A.
(13) One minute maximum duration.
(14) At T_A of 25°C and maximum line voltage.
(15) At T_A of 40°C, derate by 58 mA/°C to 80°C.
(16) CSA rating is 3.0 A @ 40°C T_a.
(17) Specify suffix "RN" for random turn-on AC modules.
(18) At T_a of 45°C, derate 18 mA/°C to 80°C.

Products and specifications subject to change without notice.

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GORDOS

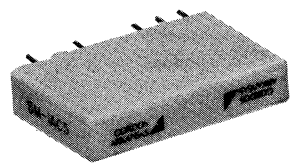
MINIATURE I/O MODULES

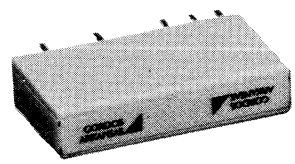
SM SERIES INPUT MODULES

- Thick Film Hybrid Construction, Vapor-Phase Soldering for Superior Reliability
- Ceramic Substrate for Proper Thermal Management
- Computerized Laser Trimming of Resistors for Optimum Performance
- Nylon Retaining Pin for Fast, Secure Installation
- 4KV Optical Isolation
- 33% Thinner than Standard I/O Modules
- UL Recognized/CSA Certified
- Plug into Standard or Subminiature I/O Module Mounting Boards.

INPUT SPECIFICATIONS(1)

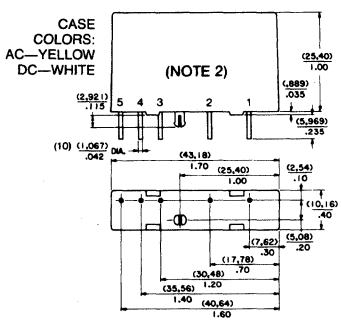
PARAMETER	SM-IAC5 SM-IAC15 SM-IAC24	SM-IAC5A SM-IAC15A SM-IAC24A	SM-IDC5 SM-IDC15 SM-IDC24
Nominal Input Voltage	120 Vrms/VDC (3)	240 Vrms/VDC (3)	—
Maximum Input Voltage	140 Vrms/VDC	280 Vrms/VDC	32 VDC
Minimum Input Voltage	90 Vrms/VDC	90 Vrms/VDC	3.3 VDC
Maximum Input Current (11)	10 mA	10 mA	34 mA DC
Drop Out Current (4)	2.5 mA	1.5 mA	1.0 mA DC
Allowable Input For No Output (4)	3.0 mA	2.0 mA	1.5 mA DC
Allowable Input For No Output	50 Vrms/VDC	50 Vrms/VDC	2.0 VDC
Input Resistance (10)	—	—	1K Ohms





OUTPUT SPECIFICATIONS(1)

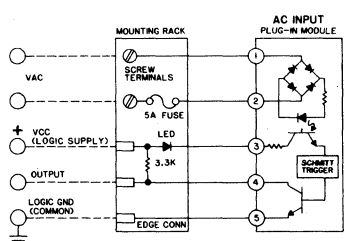
PARAMETER	SM-IAC5 SM-IAC5A SM-IDC5	SM-IAC15 SM-IAC15A SM-IDC15	SM-IAC24 SM-IAC24A SM-IDC24	UNITS
Nominal Logic Supply Voltage	5.0	15	24	VDC
Maximum Logic Supply Voltage	6.0	18	30	VDC
Minimum Logic Supply Voltage	2.75	12	20	VDC
Maximum Logic Supply Current (5)	16	16	16	mADC
Maximum Logic Supply Leakage Current	10	10	10	μADC
Maximum Output Voltage (6)	30	30	30	VDC
Maximum Output Current	50	50	50	mADC
Maximum Output Leakage Current	10	10	10	μADC
Maximum Output Voltage Drop	200	200	200	mVDC

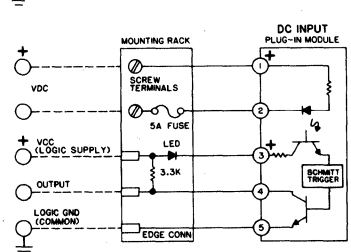


GENERAL SPECIFICATIONS(1)

PARAMETER	AC MODULES	DC MODULES
Operating Temperature Range	−30 to +80°C	−30 to +80°C
Storage Temperature Range	−40 to +100°C	−40 to +100°C
Maximum Turn-On Time	20 mSec (7)	1.0 mSec (12)
Maximum Turn-Off Time	30 mSec (7)	1.0 mSec (12)
Input To Output Isolation Voltage (8)	4000V rms	4000V rms
Capacitance Input To Output (Max)	8 pF	8 pF
Line Frequency Range (Input)	47 to 63 Hz	—

WIRING DIAGRAMS





FOOTNOTES:
(1) Specifications apply to T_a −30 to +80°C unless otherwise noted.
(2) Tolerance: inches ±.020; millimeters ±0,50.
(3) Gordos IAC modules will operate on AC or DC input voltage.
(4) Series operation of models without the suffix "A" is permissible.
(5) With external LED indicator. 18 mADC without external LED.
(6) Breakdown voltage of output transistor.
(7) At nominal V_{logic}, V_{out} of 30V, I_{out} of 25 mA, V_{in} of 120 VAC and T_a of 25°C.
(8) At T_a of 25°C, for one second, maximum leakage 100 μA.
(9) Pin Tolerance: inches ±.001, millimeters ±.025.
(10) Does not include IRED impedance (drop).
(11) At maximum input voltage.
(12) At nominal V_{logic}, V_{out} 30 VDC, I_{out} 25 mA, V_{in} 32 VDC, T_a 25°C.

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Consult factory for other configurations and application assistance.

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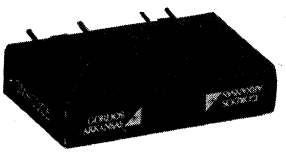
GORDOS

MINIATURE I/O MODULES

SM SERIES OUTPUT MODULES

- Thick Film Hybrid Construction, Vapor-Phase Soldering for Superior Reliability
- Ceramic Substrate for Proper Thermal Management
- Computerized Laser Trimming of Resistors for Optimum Performance
- Nylon Retaining Pin for Fast, Secure Installation
- High Current AC Output Thyristor for 100A Surge Capability
- Zero or Random[15] Turn-on AC Modules
- 4KV Optical Isolation
- 33% Thinner than Standard I/O Modules
- UL Recognized/CSA Certified
- Plug into Standard or Subminiature I/O Module Mounting Boards.

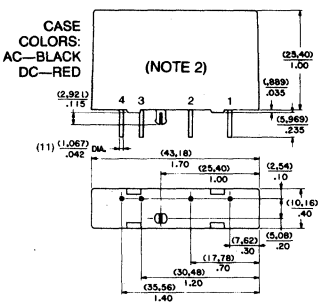


INPUT SPECIFICATIONS[1]

PARAMETER	SM-OAC5 SM-OAC5A	SM-ODC5 SM-ODC5A	SM-OAC15 SM-OAC15A SM-ODC15 SM-ODC15A	SM-OAC24 SM-OAC24A SM-ODC24 SM-ODC24A	UNITS
Nominal Input Voltage	5.0	5.0	15	24	VDC
Minimum Turn-on Voltage	2.75	2.75	9.0	18	VDC
Maximum Input Voltage	8.0	8.0	18	32	VDC
Drop Out Voltage	1.0	1.0	1.0	1.0	VDC
Maximum Input Current (3)	20	18	16	16	mADC
Nominal Input Resistance (4)	220	250	1K	2K	Ohms

OUTPUT SPECIFICATIONS[1]

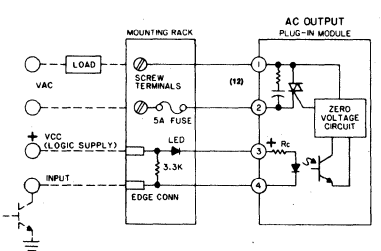
PARAMETER	SM-OAC5 SM-OAC15 SM-OAC24	SM-OAC5A SM-OAC15A SM-OAC24A	SM-ODC5 SM-ODC15 SM-ODC24	SM-ODC5A SM-ODC15A SM-ODC24A
Nominal Line Voltage	120 Vrms	240 Vrms		
Minimum Line Voltage	12 Vrms	24 Vrms	3.0 VDC	5.0 VDC
Maximum Line Voltage	140 Vrms	280 Vrms	60 VDC	200 VDC
Maximum Peak Off-State Volt	400V (5)	500V (5)	60 VDC	200 VDC
Maximum Off-State Leakage	3.0 mA rms (6)	6.0 mA rms (6)	1.0 mA DC (12)	2.0 mA DC (12)
Static (Off-State) dv/dt	200 V/μS	200 V/μS	—	—
Maximum On-State Current	3.5A rms (7)	3.5A rms (7)	3.0A DC (13)	1.0A DC (16)
Minimum On-State Current	50 mA rms	50 mA rms	10 mA DC	10 mA DC
Maximum Surge Current (8)	100A	100A	5.0A DC	5.0A DC
Peak On-State Voltage (9)	1.6V	1.6V	1.5 VDC	1.5 VDC

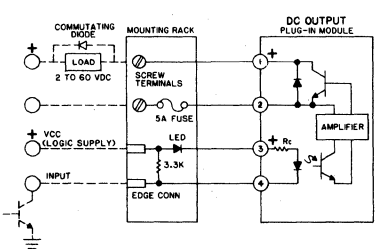


GENERAL SPECIFICATIONS[1]

PARAMETER	AC MODULES	DC MODULES
Operating Temp Range	−30 to +80°C	−30 to +80°C
Storage Temp Range	−40 to +100°C	−40 to +100°C
Response Time	.5 Cycle	—
Maximum Turn-On Time (14)	—	25 μSec
Maximum Turn-Off Time (14)	—	50 μSec
Input To Output Isolation Voltage (10)	4000V rms	4000V rms
Capacitance Input To Output (Max)	8 pF	8 pF
Line Frequency Range	47 to 63 Hz	—

WIRING DIAGRAMS





FOOTNOTES:
(1) Specifications apply to T_a −30 to +80°C unless otherwise noted.
(2) Tolerance: inches ±.020; millimeters ±50.
(3) At nominal input voltage.
(4) Does not include IRED impedance (Drop).
(5) One minute maximum duration.
(6) At T_A of 25°C and maximum line voltage.
(7) At T_A of 40°C, derate by 58 mA/°C to 80°C.
(8) At T_A of 25°C, non-repetitive, 1 cycle for AC modules, 1 second for DC modules.
(9) At T_A of 25°C and maximum on-state current.
(10) At T_A of 25°C, for one second.
(11) Pin Tolerance: inches ±.001, millimeters ±.025.
(12) At T_A of 80°C and maximum line voltage.
(13) At T_A of 40°C, derate by 50mA/°C to 80°C.
(14) At maximum voltage and current, nominal logic supply voltage.
(15) Specify suffix "R" for random turn-on AC modules.
(16) At T_A of 45°C, derate by 18mA/°C to 80°C.

Products and specifications subject to change without notice.

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GORDOS

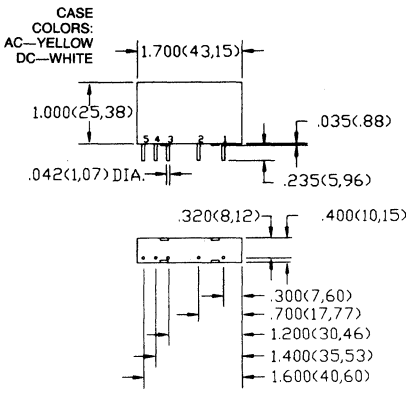
MINIATURE I/O MODULES

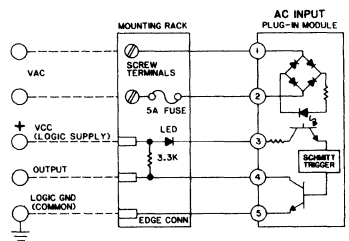
M SERIES

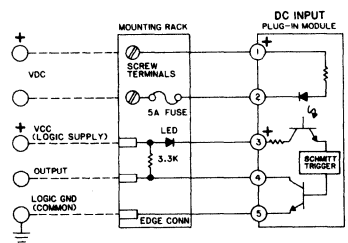
- Thick Film Hybrid Construction, Vapor-Phase Soldering for Superior Reliability
- Ceramic Substrate for Proper Thermal Management
- Computerized Laser Trimming of Resistors for Optimum Performance
- High Current AC Output Thyristor for 100A Surge Capability
- 4KV Optical Isolation
- 33% Thinner than Standard I/O Modules
- UL Recognized/CSA Certified
- Zero AC or Random[15] Turn-on Models

INPUT MODULES

Model	DC Logic Voltage	Input Voltage
M-IAC5	5	90–140 VAC/VDC
M-IAC5A	5	90–280 VAC/VDC
M-IDC5	5	3.3–32 VDC
M-IAC15	15	90–140 VAC/VDC
M-IAC15A	15	90–280 VAC/VDC
M-IDC15	15	3.3–32 VDC
M-IAC24	24	90–140 VAC/VDC
M-IAC24A	24	90–280 VAC/VDC
M-IDC24	24	3.3–32 VDC

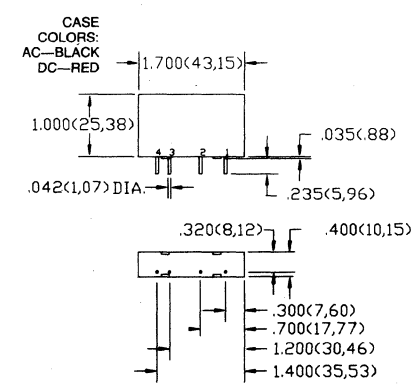


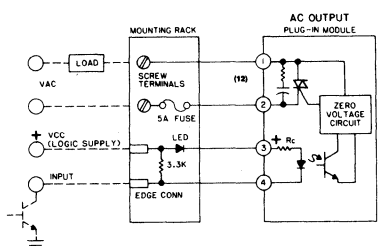


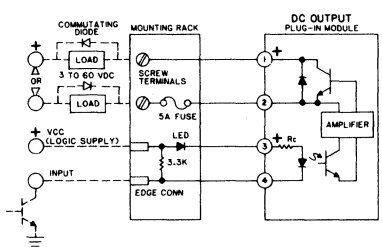


OUTPUT MODULES

Model	DC Logic Voltage	Output Voltage Rating	Current Rating (AMPS)
M-OAC5	5	12–140 VAC	3.5
M-OAC5A	5	24–280 VAC	3.5
M-ODC5	5	3–60 VDC	3.0
M-ODC5A	5	5–200 VDC	1.0
M-OAC15	15	12–140 VAC	3.5
M-OAC15A	15	24–280 VAC	3.5
M-ODC15	15	3–60 VDC	3.0
M-ODC15A	15	5–200 VDC	1.0
M-OAC24	24	12–140 VAC	3.5
M-OAC24A	24	24–280 VAC	3.5
M-ODC24	24	3–60 VDC	3.0
M-ODC24A	24	5–200 VDC	1.0







SPECIFICATIONS

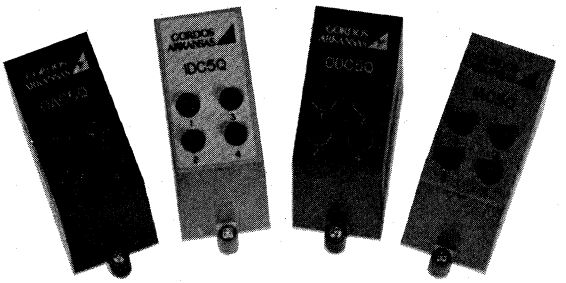
"M Series" I/O modules have the same input, output and general specifications as their equivalents in the "SM Series" of I/O modules, i.e. M-IDC5 = SM-IDC5.

Products and specifications subject to change without notice.

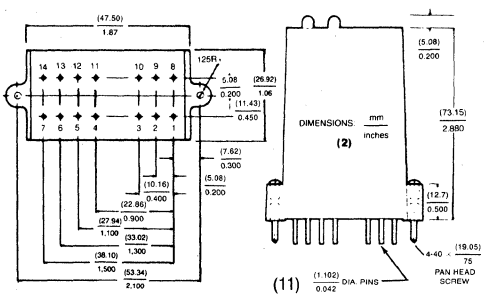
Consult factory for application assistance.

GORDOS

QUAD-PACK I/O MODULES



- Thick Film Hybrid Construction, Vapor-Phase Soldering for Superior Reliability
- Ceramic Substrate for Proper Thermal Management
- Computerized Laser Trimming of Resistors for Optimum Performance
- High Current AC Output Thyristor for 100A Surge Capability
- 4KV Optical Isolation
- UL Recognized/CSA Certified
- 4 Circuits/Module



GENERAL SPECIFICATIONS(1)

PARAMETER	AC MODULES	DC MODULES
Operating Temp Range	−30 to +80°C	−30 to +80°C
Storage Temp Range	−40 to +100°C	−40 to +100°C
Response Time, AC Output Modules	.5 Cycle	—
Maximum Turn-On Time	20 mSec (13)	(15)
Maximum Turn-Off Time	30 mSec (13)	(15)
Input To Output Isolation Voltage (10)	4000V rms	4000V rms
Capacitance Input To Output (Max)	8pF	8pF
Line Frequency Range	47 to 63 Hz	—

INPUT MODULES

INPUT SPECIFICATIONS(1)

PARAMETER	IAC5Q IAC15Q IAC24Q	IAC5AQ IAC15AQ IAC24AQ	IDC5Q IDC15Q IDC24Q
Nominal Input Voltage	120 Vrms/VDC	240 Vrms/VDC	—
Maximum Input Voltage	140 Vrms/VDC	280 Vrms/VDC	60 VDC/VAC
Minimum Input Voltage	90 Vrms/VDC	90 Vrms/VDC	10 VDC/VAC
Maximum Input Current (3)	10 mA	10 mA	33 mA
Drop Out Current (12)	2.5 mA	1.5 mA	1.0 mA
Allowable Input For No Output (12)	3.0 mA	2.0 mA	1.5 mA
Allowable Input For No Output	50 Vrms/VDC	50 Vrms/VDC	2.0 VDC
Input Resistance	—	—	2K Ohms

OUTPUT SPECIFICATIONS(1)

PARAMETER	IAC5Q IAC5AQ IDC5Q	IAC15Q IAC15AQ IDC15Q	IAC24Q IAC24AQ IDC24Q	UNITS
Nominal Logic Supply Voltage	5.0	15	24	VDC
Maximum Logic Supply Voltage	6.0	18	30	VDC
Minimum Logic Supply Voltage	4.5	12	20	VDC
Maximum Logic Supply Current	16	16	16	mADC
Maximum Logic Supply Leakage Current	10	10	10	μADC
Output Transistor Breakdown Voltage	30	30	30	VDC
Maximum Output Current	50	50	50	mADC
Maximum Output Leakage Current (14)	10	10	10	μADC
Maximum Output Voltage Drop	200	200	200	mVDC

OUTPUT MODULES

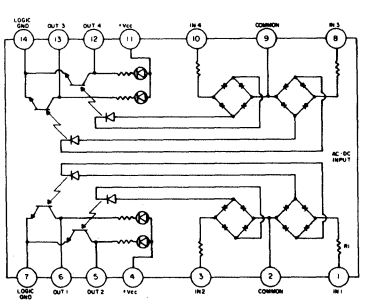
INPUT SPECIFICATIONS(1)

PARAMETER	OAC5Q OAC5AQ ODC5Q	OAC15Q OQC15AQ ODC15Q	OAC24Q OAC24AQ ODC24Q	UNITS
Nominal Input Voltage	5.0	15	24	VDC
Minimum Turn-On Voltage	4.0	9.0	18	VDC
Maximum Input Voltage	8.0	18	32	VDC
Drop Out Voltage	2.5	1.0	1.0	VDC
Maximum Input Current (3)	12	14	12	mADC
Nominal Input Resistance (4)	220	1K	2K	Ohms

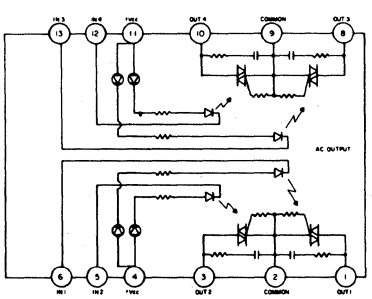
OUTPUT SPECIFICATIONS(1)

PARAMETER	OAC5Q OAC15Q OAC24Q	OAC5AQ OAC15AQ OAC24AQ	ODC5Q ODC15Q ODC24Q
Nominal Line Voltage	120V rms	240V rms	—
Minimum Line Voltage	12V rms	24V rms	3.0 VDC
Maximum Line Voltage	140V rms	280V rms	60 VDC
Maximum Off-State Voltage	400V peak (5)	600V peak (5)	60 VDC
Maximum Off-State Leakage	3.0 mA rms (6)	6.0 mA rms (6)	1.0 mA DC (16)
Static (Off-State) dv/dt	200 V/μS	200 V/μS	—
Maximum On-State Current (7)	3.0A rms	3.0A rms	3.0A DC
Minimum On-State Current	50 mA rms	50 mA rms	10 mA DC
Maximum Surge Current	100A peak (8)	100A peak (8)	5.0A DC (17)
Peak On-State Voltage (9)	1.6V	1.6V	1.5V DC

INPUT MODULES



AC OUTPUT MODULES



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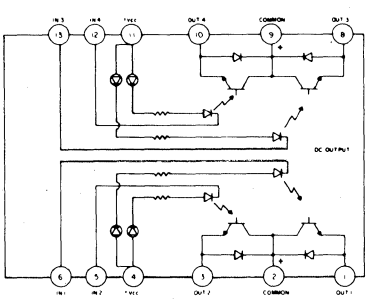

FOOTNOTES

(1) Specifications are per circuit and applicable to T_A of −30 to +80°C unless otherwise noted.
(2) Tolerance: inches ±.020; millimeters ±.050.
(3) At nominal input voltage.
(4) Does not include IRED and internal LED impedance (drop).
(5) One minute maximum duration.
(6) At T_A of 25°C and maximum line voltage.
(7) At T_A of 20°C, derate by 38 mA/°C to 80°C.
(8) 1 Cycle at T_A of 25°C, non-repetitive.
(9) At T_A of 25°C and maximum on-state current.
(10) At T_A of 25°C, for one second.
(11) Pin Tolerance: inches ±.001, millimeters ±.025.
(12) With the exception of 240 Vrms/VDC models, the input of an input module may be used as a series-connected load for an output module.
(13) For AC input modules at nominal V_{logic}, V_{out} of 5V, I_{out} of 25 mA, V_{in} of 120 Vrms and T_A of 25°C.
(14) $V_{logic} = V_{out}$
(15) Input modules: 5 mSec at nominal V_{logic}, V_{out} of 5V, I_{out} of 25 mA, V_{in} of 32 VDC and T_A of 25°C. Output modules: 25 μSec turn-on and 50 μSec turn-off at maximum voltage and current, nominal logic voltage.
(16) At T_A of 80°C and maximum line voltage.
(17) 1 Second at T_A of 25°C, non-repetitive.

Products and specifications subject to change without notice.

Consult factory for other configurations and application assistance.

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WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

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ASCII Code ..... **D**•1080
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Batteries & Fuel Cells, Characteristics ..... **D**•1450
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
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Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide .**A**•1002
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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

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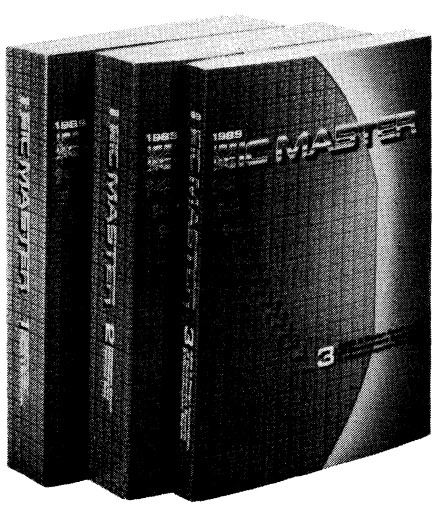

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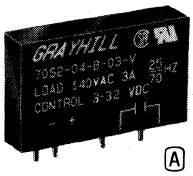

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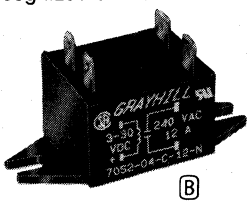

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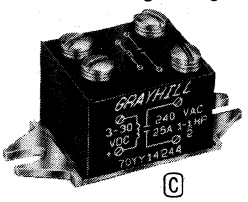

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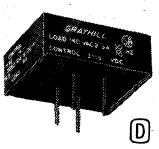

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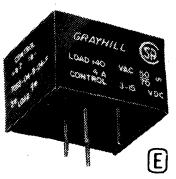

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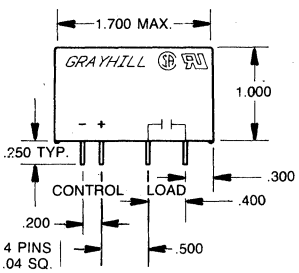

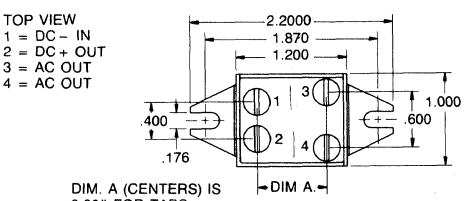

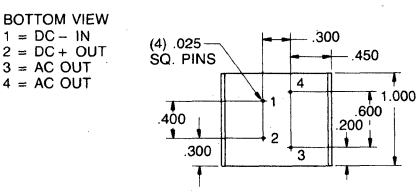

SPECIFICATIONS

Nominal load voltages and currents are in chart. Current is rated at 25°C and derated with increases. Mini Puck relays are rated as mounted on panel 12 x 12 x 1/8 inches.

Control current is 1-17 mA (3-30 Vdc relays), 1-19 mA (3-32 Vdc relays), and 1-6 mA (all others).

Surge current rating at 1 full cycle, non repetitive, is 60A (2.5A, 3A, 4A, and 6A relays); 110A (12A relay); 250A (25A relay).

Blocking voltages are 200V, 400V, and 600V for the 24 Vac, 120 Vac, and 240 Vac relays.

Zero voltage offset is 6V, 8V, and 18V for the 24 Vac, 120 Vac and 240 Vac relays.

Transient protection is 4000 V/μS for 6A and 15A relays, 3000 V/μS for all others.

Average input impedance is 2000 ohms (3-30 & 3-32 Vdc ranges), and 6000 ohms (6-30 & 6-32 Vdc ranges).

Isolation is 10^9 ohms; dielectric strength is 2500 Vac.

Cases are solvent resistant thermoplastic (UL94V-O) potted with high thermal conductive epoxy. Heat sinks are aluminum (copper for the 25A relay), tin plated. Terminal pins are brass, tin plated; tabs are brass, lead-tin plated; screws are steel, tin plated.

STYLE V SINGLE IN-LINE PACKAGE RELAY (FIG. A)

This PC mounted relay requires only .680 inches of board area and is form, fit, and function replacement for industry standard. It is constructed of high performance, surface mount components for high reliability. Package measures .4 inches deep, and line of pins is located .3 inches from label side.

Loads		Control Range	
Load VAC	Max. Amps	VDC	Part Number
24	3	3-32	70S2-04-D-03-V
24	3	6-32	70S2-05-D-03-V
120	3	3-32	70S2-04-B-03-V
120	3	6-32	70S2-05-B-03-V
240	3	3-32	70S2-04-C-03-V
240	3	6-32	70S2-05-C-03-V

STYLES N & S MINI PUCK© SOLID STATE RELAYS (FIGS. B & C)

These heavy duty relays are fit, and function replacements for old "hockey puck" style relays, but require only one-half the space. High thermal conductive epoxy and high quality heat sinks provide superior heat transfer. Minimum panel space for heat sink effectiveness is 12 inches by 12 inches by .125 inches thick; mount with silicon grease. Body measures 1.2 inches x 1.0 inches by .85 inches high. Push tabs (Style N) add .30 inches to height. Screws (Style S) add approximately .08 inches.

120	6	3-30	70S2-04-B-06-N
120	6	6-30	70S2-05-B-06-N
240	6	3-30	70S2-04-C-06-N
240	6	6-30	70S2-05-C-06-N
120	12	3-30	70S2-04-B-12-N
120	12	6-30	70S2-05-B-12-N
240	12	3-30	70S2-04-C-12-N
240	12	6-30	70S2-05-C-12-N
120	6	3-30	70S2-04-B-06-S
120	6	6-30	70S2-05-B-06-S
120	12	3-30	70S2-04-B-12-S
120	12	6-30	70S2-05-B-12-S
120	25	3-30	70S2-03-B-25-S
240	6	3-30	70S2-04-C-06-S
240	6	6-30	70S2-05-C-06-S
240	12	3-30	70S2-04-C-12-S
240	12	6-30	70S2-05-C-12-S
240	25	3-30	70S2-03-C-25-S

STYLES H & F MICRO CUBE® AND MINI CUBE RELAYS (FIGS. D & E)

Low profile, printed circuit mounted relays allow user to stack PC boards closely together, while switching 24 Vac, 120 Vac, or even 240 Vac loads of up to 4 amperes. These relays do not require additional heat sinks. Style H is only .5 inches high; Style F is only .83 inches high. For a relay with .83 inches height and standard plug-in style termination (Style K, not shown), contact a local authorized distributor. For relays with this footprint for larger loads contact GRAYHILL.

24	2.5	3-30	70S2-04-D-02-H
24	2.5	6-30	70S2-05-D-02-H
120	2.5	3-30	70S2-04-B-02-H
120	2.5	6-30	70S2-05-B-02-H
240	2.5	3-30	70S2-04-C-02-H
240	2.5	6-30	70S2-05-C-02-H
24	4	3-30	70S2-04-D-04-F
24	4	6-30	70S2-05-D-04-F
120	4	3-30	70S2-04-B-04-F
120	4	6-30	70S2-05-B-04-F
240	4	3-30	70S2-04-C-04-F
240	4	6-30	70S2-05-C-04-F

All part numbers shown on this page are UL Recognized (file number E58632) and CSA Certified (file number LR38763).

For prices and discounts, contact a local Sales Office, an authorized Distributor, or GRAYHILL.

Available From Your Local GRAYHILL Distributor

Grayhill INC.
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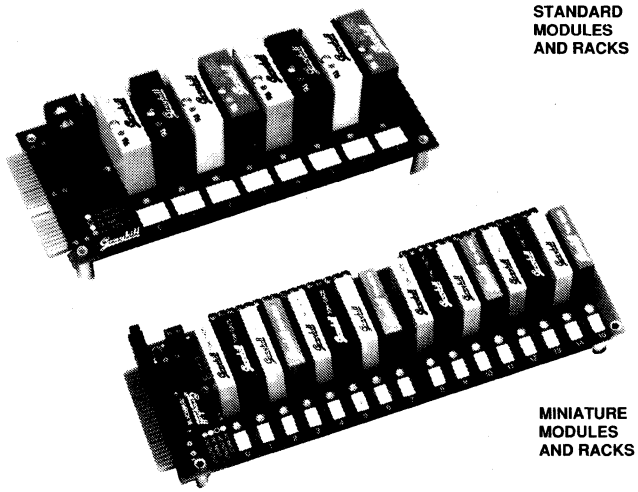
Input/Output Modules



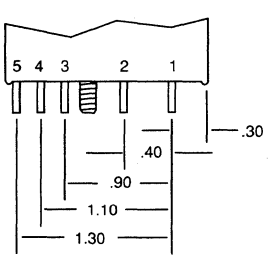
STANDARD MODULES AND RACKS

MINIATURE MODULES AND RACKS

DESCRIPTION - MODULES

I/O Modules provide an optically isolated interface between logic systems and external AC and DC power devices. There are 4 types: AC Output (Black Case); DC Output (Red Case); AC Input (Yellow Case); and DC Input (White Case). UL and CSA certified, all modules are SPST N.O. type and logic compatible. AC types have zero crossing switching. They have standard pinouts, superior noise immunity, transient protection, and high blocking voltages of 400 volts (120VAC) and 600 volts (240 VAC). *All* modules have 4000 volts of isolation, immunity to mechanical shock and vibration, and operate over a wide temperature (–40° to +125°C).

Standard I/O Modules are form, fit function replacements for competitive product; output modules carry up to 3.5 Amps.
Standard modules measure 1.0"L, .6"W, and 1.25" H.



Miniature I/O Modules require only .68 sq inches board area, switch up to 3 Amps, and require only 66% of the power used by standard modules. They meet/pass the following specifications or tests: IEEE 472–1974 and ANSI C37.90 transient withstanding tests, and Electrical Noise Immunity Test per NEMA ICS 2–230.
Mini modules measure 1.0"L, .4"W, and 1.0"H.

TERMINAL NUMBER AND CONNECTION

	•#5	#4	#3	#2	#1
OAC	N/A	DC– In	DC+ In	AC Out	AC Out
ODC	N/A	DC– In	DC+ In	DC- Out	DC+ Out
IAC	Ground	Output	+Vcc	AC In	AC In
IDC	Ground	Output	+Vcc	DC- In	DC+ In

Only input modules have terminal #5.

MOUNTING RACKS

Rack and modules are ordered separately. Standard racks are UL Recognized Miniature; recognition pending for mini racks. Standard and mini racks are CSA certified. Miniature modules fit in standard modules racks, but save space when mounted in mini racks. Miniature rack part numbers include the letter M; styles with Q were designed to replace quad pack racks. Chose 1 of 5 styles: board edge connector (add -EC to mini rack number, use no suffix for standard rack); perpendicular header with short (-HS) or long (-HL) ejector levers; right angle header with short (-RS) or long (-HL) ejector levers.

ORDERING INFORMATION – MODULES

Size and Description	Nominal Vcc Supply	Nominal External V	Part Number
AC OUTPUT MODULES — BLACK CASE			
Miniature	5 Vdc	120 Vac	**70M-OAC5**
Miniature	5 Vdc	240 Vac	**70M-OAC5A**
Miniature	15 Vdc	120 Vac	**70M-OAC15**
Miniature	15 Vdc	240 Vac	**70M-OAC15A**
Miniature	24 Vdc	120 Vac	**70M-OAC24**
Miniature	24 Vdc	240 Vac	**70M-OAC24A**
Standard	5 Vdc	120 Vac	**70-OAC5**
Standard	5 Vdc	240 Vac	**70-OAC5A**
Standard	15 Vdc	120 Vac	**70-OAC15**
Standard	15 Vdc	240 Vac	**70-OAC15A**
Standard	24 Vdc	120 Vac	**70-OAC24**
Standard	24 Vdc	240 Vac	**70-OAC24A**
DC OUTPUT MODULES — RED CASE			
Miniature	5 Vdc	60 Vdc	**70M-ODC5**
Miniature	15 Vdc	60 Vdc	**70M-ODC15**
Miniature	24 Vdc	60 Vdc	**70M-ODC24**
Standard	5 Vdc	60 Vdc	**70-ODC5**
Standard	5 Vdc	200 Vdc	**70-ODC5A**
Standard	15 Vdc	60 Vdc	**70-ODC15**
Standard	24 Vdc	60 Vdc	**70-ODC24**
AC INPUT MODULES — YELLOW CASE			
Miniature	5 Vdc	120 Vac	**70M-IAC5**
Miniature	5 Vdc	240 Vac	**70M-IAC5A**
Miniature	15 Vdc	120 Vac	**70M-IAC15**
Miniature	15 Vdc	240 Vac	**70M-IAC15A**
Miniature	24 Vdc	120 Vac	**70M-IAC24**
Miniature	24 Vdc	240 Vac	**70M-IAC24A**
Standard	5 Vdc	120 Vac	**70-IAC5**
Standard	5 Vdc	240 Vac	**70-IAC5A**
Standard	15 Vdc	120 Vac	**70-IAC15**
Standard	15 Vdc	240 Vac	**70-IAC15A**
Standard	24 Vdc	120 Vac	**70-IAC24**
Standard	24 Vdc	240 Vac	**70-IAC24A**
DC INPUT MODULES — WHITE CASE			
Miniature	5 Vdc	3-32 Vdc	**70M-IDC5**
Miniature	15 Vdc	3-32 Vdc	**70M-IDC15**
Miniature	24 Vdc	3-32 Vdc	**70M-IDC24**
Standard	5 Vdc	3-32 Vdc	**70-IDC5**
Standard, NP*	5 Vdc	3-32 Vdc	**70-IDC5NP**
Standard	15 Vdc	3-32 Vdc	**70-IDC15**
Standard, NP*	15 Vdc	3-32 Vdc	**70-IDC15NP**
Standard	24 Vdc	3-32 Vdc	**70-IDC24**
Standard, NP*	24 Vdc	3-32 Vdc	**70-IDC24NP**

*NP types have non-polarized input.
Additional types available from stock: Random crossing, Normally Closed, 9-140 Vdc Input, or 180-280 Vdc Input .

ORDERING INFORMATION — MOUNTING RACKS

Type	# Modules	Size with Modules	Part Number
Mini	8	3.5" x 6.4" x 2.2"H	**70MRCK8-****
Mini	16	3.5" x 10.4" x 2.2"H	**70MRCK16-****
Mini	24	6.0" x 8.4" x 2.2"H	**70MRCQ24-****
Mini	32	6.2" x 10.6" x 2.2"H	**70MRCQ32-****
Standard	4	3.5" x 4.5" x 2.2"H	**70RCK4**
Standard	8	3.5" x 8.4" x 2.2"H	**70RCK8**
Standard	16	3.5" x 14.5" x 2.2"H	**70RCK16**
Standard	16	3.5" x 14.5" x 2.2"H	**70RCK16-****
Standard	24	4.5" x 18.8" x 2.2"H	**70RCK24**

**Add suffix for connector per paragraph at left. Parts without dash in the number are available in edge connector type only.

For prices contact a Sales Office, a Distributor, or GRAYHILL.

Available From Your Local GRAYHILL Distributor

610 East Tenth Street
Oakland, CA 94606
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BRILL ELECTRONICS

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DIMENSIONS

Dimensions in millimeters
Inches in parenthesis

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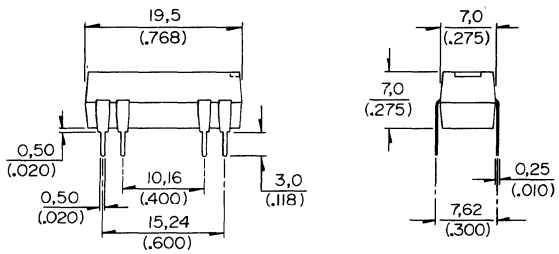
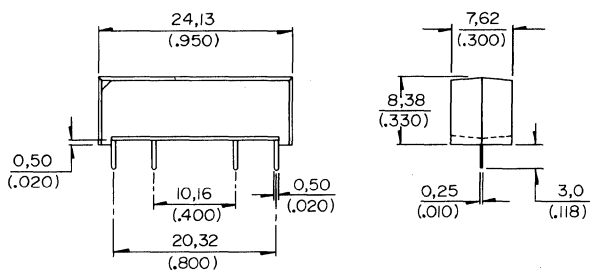
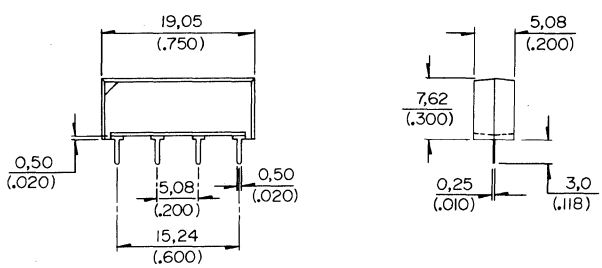


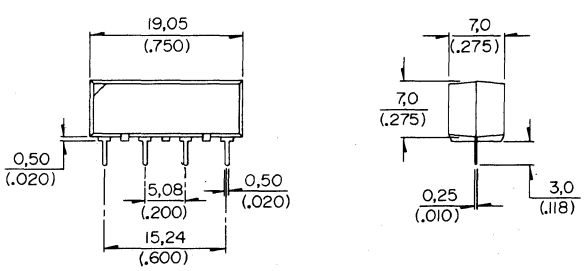
3300 SERIES SIP



3600 SERIES SIP



3700 SERIES SIP



700 SERIES DIP

Contact Form	Contact Rating	Model Number	Diode	Coil Vdc Nom.	Coil Ohms ±10%	List Price 1-24
1A DRY SPST - NO	10W 0.5A 200V	721A0500	-	5	500	$3.38
		721A0510	Yes	5	500	3.85
		721A1200	-	12	1000	3.60
		721A1210	Yes	12	1000	4.05
		721A2400	-	24	2150	4.28
		721A2410	Yes	24	2150	4.73
1C DRY SPST - CO	3W 0.25A 175V	721C0500	-	5	200	5.85
		721C0510	Yes	5	200	6.08
		721C1200	-	12	500	6.08
		721C1210	Yes	12	200	6.30
		721C2400	-	24	2000	6.53
		721C2410	Yes	24	2000	6.75
2A DRY DPST - NO	10W 0.5A 200V	722A0500	-	5	200	4.95
		722A0510	Yes	5	200	5.18
		722A1200	-	12	500	5.63
		722A1210	Yes	12	500	6.08
		722A2400	-	24	2150	6.08
		722A2410	Yes	24	2150	6.58
1A MERCURY SPST - NO	50W 2.0A 500V	731A0500	-	5	55	7.88
		731A0510	Yes	5	55	8.10
		731A1200	-	12	300	8.10
		731A1210	Yes	12	300	8.33
		731A2400	-	24	1100	8.33
		731A2410	Yes	24	1100	8.55
1A SPST - NO HIGH VOLTAGE	10W 0.5A 300V	751A0500	-	5	500	4.50
		751A0510	Yes	5	500	4.95
		751A1200	-	12	1000	4.95
		751A1210	Yes	12	1000	5.40
		751A2400	-	24	2150	5.40
		751A2410	Yes	24	2150	5.85

3300 SERIES SIP

Contact Form	Contact Rating	Model Number	Diode	Coil Vdc Nom.	Coil Ohms ±10%	List Price 1-24
1A SPST - NO DRY	10W 0.5A 200V	3321A0400	-	5	500	$2.70
		3321A1200	-	12	500	2.70
		3321A2400	-	24	2000	3.15
1C SPDT - CO DRY	3W 0.25A 175V	3321C0500	-	5	125	4.73
		3321C1200	-	12	500	4.95
		3321C2400	-	24	2000	5.40
1A SPST - NO MERCURY	50W 2A 500V	3331A0500	-	5	125	7.20
		3331A1200	-	12	500	7.43
		3331A2400	-	24	2000	7.88
1A SPST - NO HIGH VOLTAGE	10W 0.5A 300V	3351A0500	-	5	125	3.60
		3351A1200	-	12	500	3.60
		3351A2400	-	24	200	4.05

3600 SERIES SIP

Contact Form	Contact Rating	Model Number	Diode	Coil Vdc Nom.	Coil Ohms ±10%	List Price 1-24
1A SPST - NO DRY	10W 0.5A 200V	3621A0500	-	5	500	$4.28
		3621A1200	-	12	1000	4.73
		3621A2400	-	24	2150	5.18
1A SPST - NO COAX SCREEN	10W 0.5A 200V	3621A0520	-	5	200	5.63
		3621A1220	-	12	500	6.08
		3621A2420	-	24	1500	6.53

3700 SERIES SIP

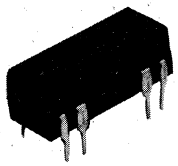
Contact Form	Contact Rating	Model Number	Diode	Coil Vdc Nom.	Coil Ohms ±10%	List Price 1-24
1A SPST - NO DRY	10W 0.5A 200V	3721A0500	-	5	500	$3.15
		3721A0510	Yes	5	500	3.60
		3721A1200	-	12	1000	3.38
		3721A1210	Yes	12	1000	3.83
		3721A2400	-	24	2150	4.05
		3721A2410	Yes	24	2150	4.50
1A SPST - NO MERCURY	50W 2.0A 500V	3731A0500	-	5	100	7.43
		3731A0510	Yes	5	100	7.65
		3731A1200	-	12	500	7.88
		3731A1210	Yes	12	500	8.10
		3731A2400	-	24	1500	8.33
		3731A2410	Yes	24	1500	8.55
1A SPST - NO HIGH VOLTAGE	10W 0.5A 300V	3751A0500	-	5	125	3.83
		3751A0510	Yes	5	125	4.05
		3751A1200	-	12	500	4.05
		3751A1210	Yes	12	500	4.28
		3751A2400	-	24	2000	4.50
		3751A2410	Yes	24	2000	4.73

HASCO COMPONENTS INC. SINCE 1976

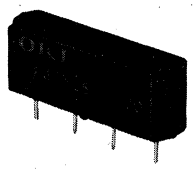
REED RELAYS

DIP AND MINI SIP SERIES

OKI electric industry company, ltd.



DIP SERIES

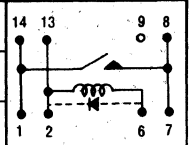
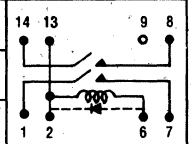
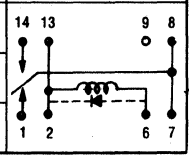


SIP SERIES

FEATURES

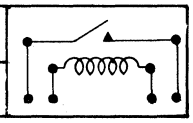
- De-activated rhodium contacts. for stable contact resistance.
- Standard TO-116 Terminal Grid fits all standard DIP sockets.
- Interface directly with RTL, DTL, TTL, HTL logic.
- Molded epoxy package for environmental immunity.
- Automatic insertion compatible.
- Relay testing services test report available.

DIP CHARACTERISTICS

Contact Form	Part Number	Nominal Voltage (V)	Must Operate (V)	Must Release (V)	Coil Resistance (Ω)	Circuit Schematic (Top view)
1A	D51A05(D)*	5	3.75	0.5	500	
	D51A12(D)	12	9.0	1.2	800	
	D51A24 (D)	24	18.0	2.4	2000	
2A	D52A05 (D)	5	3.75	0.5	140	
	D52A12 (D)	12	9.0	1.2	400	
	D52A24 (D)	24	18.0	2.4	1300	
1C	D51C05 (D)	5	3.75	0.5	200	
	D51C12 (D)	12	9.0	1.2	500	
	D51C24 (D)	24	18.0	2.4	1500	

* (D) optional clamp diode

SIP CHARACTERISTICS

1A	F41A05	5	3.75	0.5	500	
	F41A12	12	9.0	1.2	800	

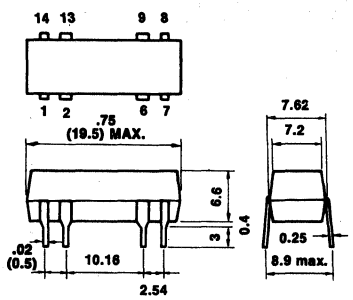
ENGINEERING DATA

	1A, 2A	1C
Operate time	0.5msec max.	0.5msec. max.
Release time	0.2msec max.	0.2msec max.
Bounce time	0.5msec max.	2.0msec max.
Contact resistance	Dip: 150mΩ max. (initial)	150mΩ max. (initial)
	Sip: 0.10Ω max.	150mΩ max. (initial)
Contact ratings	DC10VA max.	DC3VA max.
	DC100V max.	DC30V max.
	DC1.0A max. (carry only)	DC0.5A max. (carry only)
	DC0.5A max. (switched)	DC0.25A max. (switched)
Life expectancy	50 x 10^6 operations at signal level	30 x 10^6 operations at signal level
	3 x 10^6 full rated load	1 x 10^6 at full rated load
Breakdown voltage	DC250V across open contacts	DC200V across open contacts
	DC500V between coil and contact	DC500V between coil and contact
Insulation resistance	10^9Ω min.	10^9Ω min.
Vibration	20G (10 ~ 2000Hz)	20G (10 ~ 2000Hz)
Thermal shock	−55 ~ 105°C	−55 ~ 105°C
Moisture resistance	60°C-90% 240 hours	60°C-90% 240 hours
Terminal strength	225g	225g
Operating temperature	−40 ~ 85°C	−40 ~ 85°C
Storage temperature	−55 ~ 105°C	−55 ~ 105C°
Operations	200 x 10^6 low level	

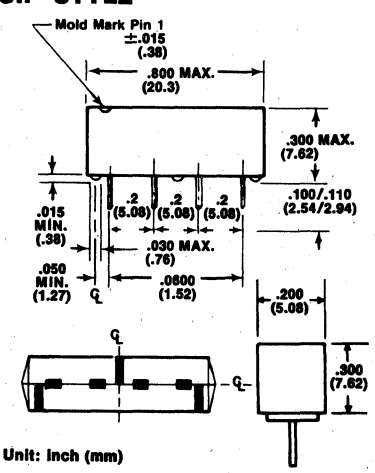
CONSULT CATALOG FOR SURFACE MOUNT SPECIFICATIONS

DIMENSIONS

DIP STYLE



SIP STYLE



Unit: inch (mm)

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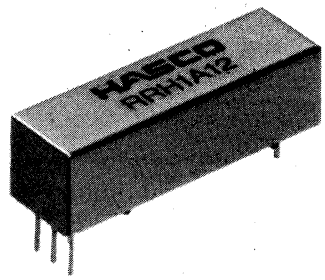
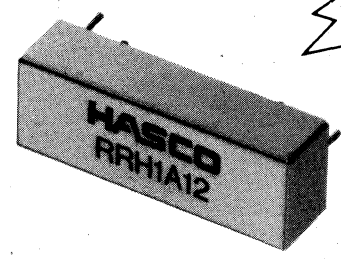
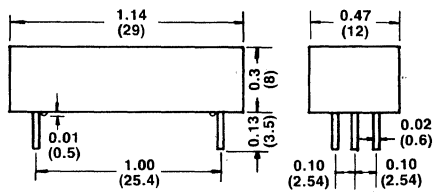
STANDARD FORM 1A 1 INCH X .1 INCH REED RELAY RRH SERIES

SAMPLES SENT SAME DAY!

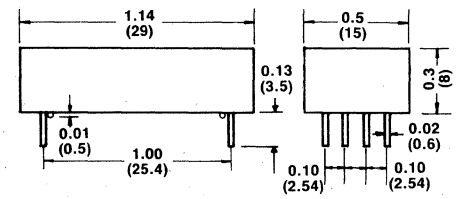






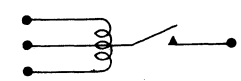
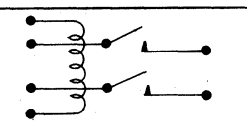
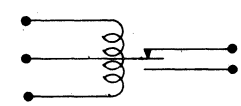
FORM 1A, 1C

Unit: inch(mm)



FORM 2A

SPECIFICATIONS COIL RATINGS

Contact Form	Part Number	Nominal Voltage (V)	Coil Resistance (Ω) ±10%	Rated Current (mA)	Continuous Voltage (Max V)	Circuit Schematic
1A	RRH1A05	5	500	20	10	
	RRH1A12	12	1000	15	20	
	RRH1A24	24	2200	10.90	28	
2A	RRH2A05	5	140	14	10	
	RRH2A12	12	500	15	20	
	RRH2A24	24	2150	12	28	
1C	RRH1C05	5	250	20	10	
	RRH1C12	12	500	15	20	
	RRH1C24	24	2200	10.90	28	

CHARACTERISTICS

Item \ Contact Form		1A, 2A	1C
Contact resistance		150mΩ max.	150mΩ max.
Operate time		0.5msec max.	1.0msec max.
Bounce time		0.5msec max.	2.0msec max.
Release time		0.2msec max.	0.2msec max.
Operating frequency	Mechanically	100 operations/sec.	50 operations/sec.
	Electrically	10 operations/sec (under rated load)	
Insulation resistance		100MΩ min. (at 250 VDC)	50MΩ min. (at 100 VDC)
Service life	Mechanically	100,000,000 operations min.	50,000,000 operations min.
	Electrically	10,000,000 operations min.	2,000,000 operations min.
Carry current		0.5A max.	0.25 max.
Breakdown voltage		DC 250V across open contacts	DC 200V across open cotnacts
		DC 500V between coil and contract	DC 500V between coil and contract
Ambient temperature		−20 ~ 60°C	
Minimum per-missible load		100m VDC 10μA	

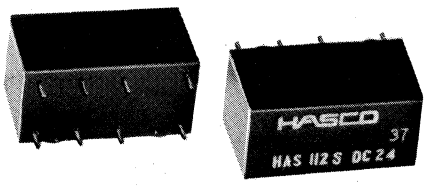
CUSTOM PACKAGING WITH SPECIAL REEDS AVAILABLE

HASCO COMPONENTS, INC. / 247-40 JERICHO TPKE., BELLEROSE VILLAGE, NY 11001 / (516) 328-9292 TWX: 710-582-5750 FAX: 516-326-9125

HASCO COMPONENTS INC. SINCE 1976 — RELAYS

DPDT — DIP or PC STANDARD or SENSITIVE HAS 112/HS 212 RELAY(1.25A – 2.5A)

(2 COIL LATCHING AVAILABLE)



FEATURES

- Available fully sealed.
- Employing 16 pin, IC spacing.
- Low profile for tight spacing.
- Coil voltages: 5, 6, 9, 12, 24 & 48 from stock.
- Compatible and competitive!
- FCC Pt 68 available.
- Sensitive available.
- Thinner option available.
- Bifurcated contacts.
- Nitrogen sealing available.
- In stock!

SAMPLES SENT SAME DAY!

COIL RATINGS FOR **STANDARD** HAS 112

Relay Code (V)	Contact Arrangement	Nom. Volt. (VDC)	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (VDC)	Drop-Out Volt. (VDC)	Max. Volt. (VDC)	Nom. Pwr (W) Cons'p-tion
HAS-112-5	DPDT (2 Form C)	5	45	111.0	3.5	0.5	7.0	Approx. 0.56
HAS-112-6		6	66	90.9	4.2	0.6	8.4	
HAS-112-9		9	140	64.3	6.3	0.9	12.6	
HAS-112-12		12	280	42.9	8.4	1.2	16.8	
HAS-112-24		24	1070	22.4	16.8	2.4	33.6	
HAS-112-48		48	3900	12.3	33.6	4.8	67.2	

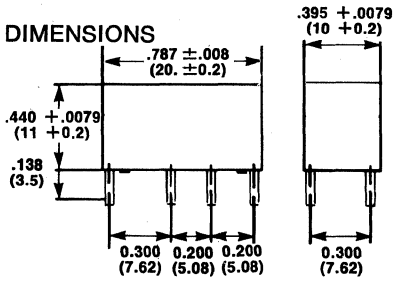
Data Measured at 20°C.

COIL RATINGS FOR **SENSITIVE** HS 212

Relay Code (V)	Contact Arrangement	Nom. Volt. (VDC)	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (VDC)	Drop-Out Volt. (VDC)	Max. Volt. (VDC)	Nom. Pwr (W) Cons'p-tion
HS-212-5	DPDT (2 Form C)	5	167	29.9	3.5	—	12.5	0.15
HS-212-6		6	240	25.0	4.2	—	15.0	0.15
HS-212-9		9	540	16.7	6.3	—	22.5	0.15
HS-212-12		12	960	12.5	8.4	—	30.0	0.15
HS-212-24		24	2880	8.3	16.8	—	51.6	0.2
HS-212-48		48	7680	6.3	32.6	—	84.0	0.3

As for the resistance value, pull-in voltage and drop-out voltage, they show the value at ambient temperature, 20°C, and the tolerance is ±10%.

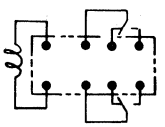
DIMENSIONS



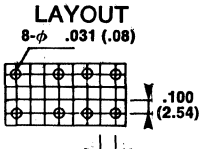
For sealed unit specify "S"
For Pt 68 specify (2)

(Unit: inch (mm))

SCHEMATICS



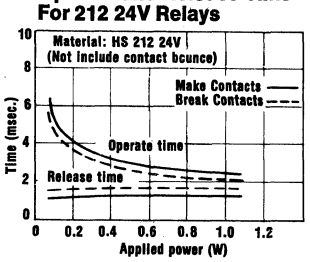
MOUNTING HOLE LAYOUT



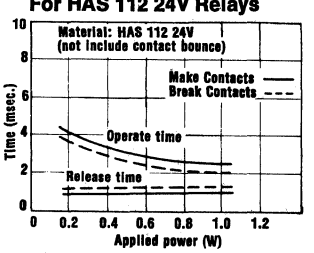
RATING PERFORMANCE

Specifications			Note
Coil	Nominal Voltage	5, 6, 9, 12, 24, 48 VDC	
	Nominal Power Consumption	0.56W	
	Pick-up Voltage	70% of nominal voltage	
	Drop-out Voltage	10% of nominal voltage	
Contact	Contact Arrangement	DPDT, 2 Form C	
	Contact Material	Gold-clad, Ag-Pd alloy	
	Contact Resistance	100 mΩ	at initial value
	Max. Switching Power	DC 30W/AC 60 VA	at resistive load
	Max. Switching Voltage	125 VDC/AC	
	Max. Switching Current	1.25 ADC/AC 2.5A @ 12V	
Time	Operate Time	Approx. 3 mS	at nominal
	Release Time	Approx. 2 mS	voltage
	Bounce Time (Operating)	0.5 to 2.0 mS	no bounce in break contact
	Bounce Time (Releasing)	1.5 to 3.5 mS	no bounce in make contcat
Insulation Resistance		1000 MΩ	at 500 VAC, 25°C, 50% relative humidity
Dielectric Strength		500 VAC	1 minute is at 25°C, 50% relative humidity
Vibration Resistance		1.55 mm DA, 10 ~ 55 Hz	
Temperature Range		−40°C ~ +85°C	
Life	Mechanical Life	10 x 10^6 times	
	Electrical Life	5 x 10^5 times	at 24 VDC, 1A, resistive load
Weight		5 g	

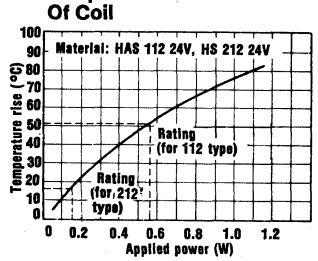
Operate and Release Time For 212 24V Relays



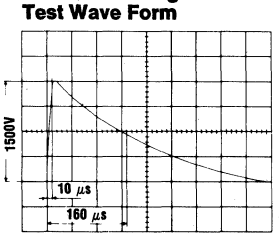
Operate and Release Time For HAS 112 24V Relays



Temperature Rise Of Coil



FCC 1500V Surge Test Wave Form



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HASCO COMPONENTS INC. SINCE 1976

RELAYS

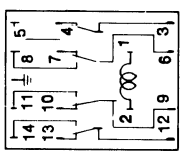
4PDT — HAS 124 FLATPACK

SAMPLES SENT SAME DAY!

FEATURES

- Voltages — 5, 6, 12, 24 and 48.
- Bifurcated contacts.
- Fully sealed versions are in stock.
- Form D available.
- Nitrogen filled.
- FCC Part 68.
- In stock!

SCHEMATIC



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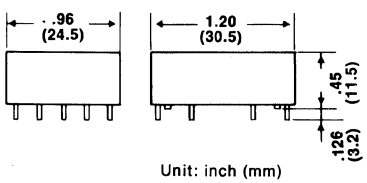
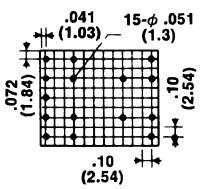
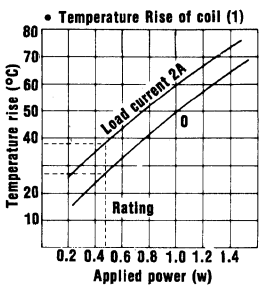
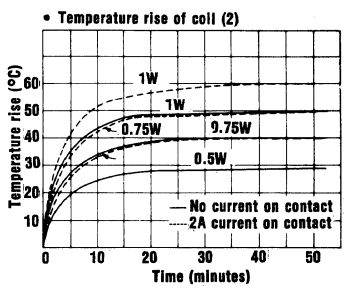


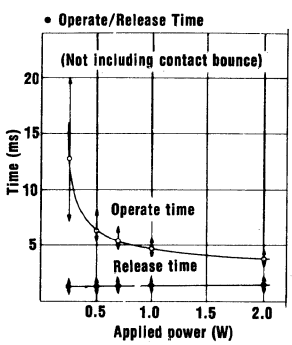
Unit: inch (mm)

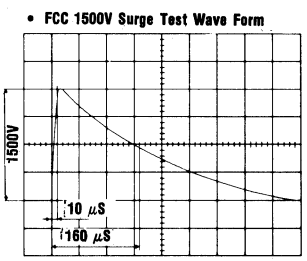
MOUNTING HOLE LAYOUT











COIL RATING

Relay Code	Contact Arrangement	Nom. Volt. (V)	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (V)	Drop-Out Volt. (V)	Max. Volt. (V)*	Nom. Pwr (W) Cons'p-tion
HAS-124-5	4 PDT	5	52	96.2	3.5	0.5	7.0	
HAS-124-6	4	6	85	70.6	4.2	0.6	8.4	
HAS-124-9	Form C	9	170	52.9	6.3	0.9	12.6	0.48
HAS-124-12	S:	12	330	36.4	8.4	1.2	16.8	
HAS-124-24	Sealed	24	1200	20.0	16.8	2.4	33.6	
HAS-124-48		48	4200	11.4	33.6	4.8	67.2	

Data measured at 20°C, *measured at 40°C.

RATING PERFORMANCE

	Specifications		Note
Coil	Nominal Voltage	5, 6, 9, 12, 24, 48 VDC	nominal voltage
	Nominal Power Consumption	0.48W	48V
	Pick-up Voltage	70% of nominal voltage	
	Drop-out Voltage	10% of nominal voltage	
Contact	Contact Arrangement	4 PDT, 4 Form C	crossbar type, bifurcated contact
	Contact Material	Gold-Clad, Ag-Pd Alloy	
	Contact Resistance	100 mΩ	at initial value
	Max. Switching Power	DC 60W, AC 60 VA	at resistive load
	Max. Switching Voltage	110 VDC/AC	
	Max. Switching Current	2A DC/DC	
Time	Operate Time	Approx. 10 mS	at nominal voltage
	Release Time	Approx. 5 mS	
	Bounce Time (Operating)	0 to 3.5 mS on Operate	no bounce in break contact
	Bounce Time (Releasing)	1 to 5 mS on Release	no bounce in make contact
Insulation Resistance		1000 MΩ	at 500 VAC, 25°C, 50% relative humidity
Dielectric Strength		750 VAC	1 minute at 25°C, 50% relative humidity
Vibration Resistance		1.5 mm DA 10 ~ 55 Hz	
Temperature Range		−40°C ~ +70°C	
Life	Mechanical Life	100 x 10^6 times	
	Electrical Life	3 x 10^4 times	at 30 VDC, 1A, resistive load
Weight		15.5 g	

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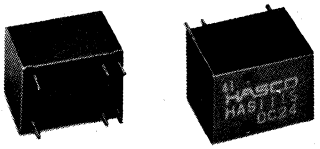
HASCO COMPONENTS INC. SINCE 1976 — RELAYS

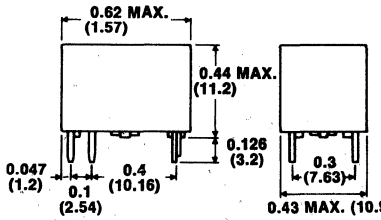
SPDT — 1 AMP DIP OR PC RELAY — STANDARD or SENSITIVE HAS 111/211



FEATURES

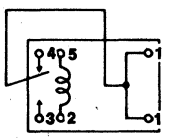
- Small size 1A switching capacity.
- Available semi or fully sealed.
- Voltages 1.5-48 volts available.
- Hi-quality, yet inexpensive.
- FCC Pt 68 available.
- Nitrogen seal option.
- In stock!

SAMPLES SENT SAME DAY!

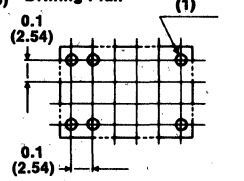


Specifications subject to change without notice.
Unit: inch (mm)
For sealed unit specify "S"

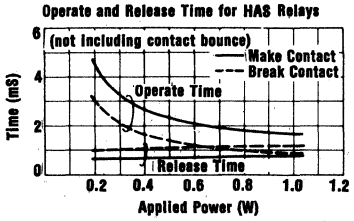
Internal Connections (Bottom View)



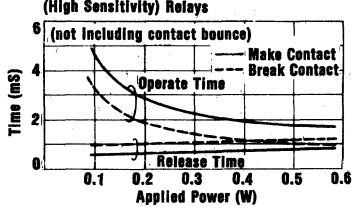
Drilling Plan 6-⌀ 0.039 hole (1)



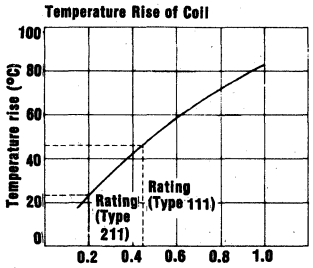
Operate and Release Time for HAS Relays



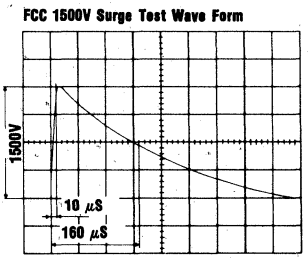
Operate and Release Time for HS (High Sensitivity) Relays



Temperature Rise of Coil



FCC 1500V Surge Test Wave Form



COIL RATINGS FOR **STANDARD** MODEL HAS 111

Relay Code	Contact Arrangement	Nom. Volt. (V)	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (V)	Drop-Out Volt. (V)	Max. Volt. (V)*	Nom. Pwr (W) Cons'p-tion
HAS-111-3	SPDT (1 Form C)	3	20	150	2.1	0.3	3.3	Approx. 0.45
HAS-111-5		5	56	89.3	3.5	0.5	5.5	
HAS-111-6		6	80	75	4.2	0.6	6.6	
HAS-111-9		9	180	50	6.3	0.9	9.9	
HAS-111-12		12	320	37.5	8.4	1.2	13.2	
HAS-111-24		24	1280	18.8	16.8	2.4	26.4	
HAS-111-48		48	5120	9.4	33.6	4.8	52.8	

COIL RATINGS FOR **SENSITIVE** MODEL HS 211

Relay Code	Contact Arrangement	Nom. Volt. (V)	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (V)	Drop-Out Volt. (V)	Max. Volt. (V)*	Nom. Pwr (W) Cons'p-tion
HS-211-3	SPDT (1 Form C)	3	45	66.7	2.1	0.3	4.8	Approx. 0.20
HS-211-5		5	120	41.7	3.5	0.5	8.0	
HS-211-6		6	180	33.3	4.2	0.6	9.6	
HS-211-9		9	400	22.5	6.3	0.9	14.4	
HS-211-12		12	700	17.1	8.4	1.2	19.2	
HS-211-24		24	2800	8.6	16.8	2.4	38.4	

Data measured at 20°C, *measured at 40°C.

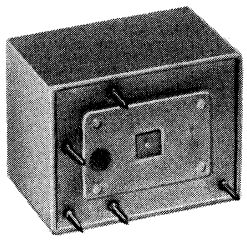
RATING PERFORMANCE

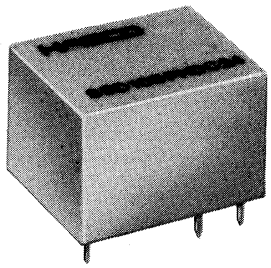
Specifications			Note
Coil	Nominal Voltage	1.5, 3, 5, 6, 9, 12, 24, 48 VDC	
	Nominal Power Consumption	0.45W	
	Pick-up Voltage	70% of nominal voltage	
	Drop-out Voltage	10% of nominal voltage	
Contact	Contact Arrangement	SPDT, 1 Form C	
	Contact Material	Silver-Palladium (Gold overlay)	
	Contact Resistance	Max. 100 mΩ	at initial value
	Max. Switching Power	DC 30W/AC 60 VA	at resistive load
	Max. Switching Voltage	60 VDC/120 VAC	
	Max. Switching Current	1A DC/AC	
Time	Operate Time	Approx. 2 mS	at nominal voltage
	Release Time	Approx. 1 mS	
	Bounce Time (Operating)	Max. 2 mS	no bounce in break contact
	Bounce Time (Releasing)	Max. 7 mS	no bounce in make contact
Insulation Resistance		Min. 100 MΩ	at 500 VDC
Dielectric Strength		500 VAC	1 minute
Vibration Resistance		1.5 mm DA 10 ~ 55 Hz	
Temperature Range		−25°C ~ +55°C	
Life	Mechanical Life	500 x 10^4 times	
	Electrical Life	50 x 10^4 times	at 24 VDC, 1A resistive load
		10 x 10^4 times	at 120 VAC, 0.5A, resistive load
Weight		Approx. 4 g	

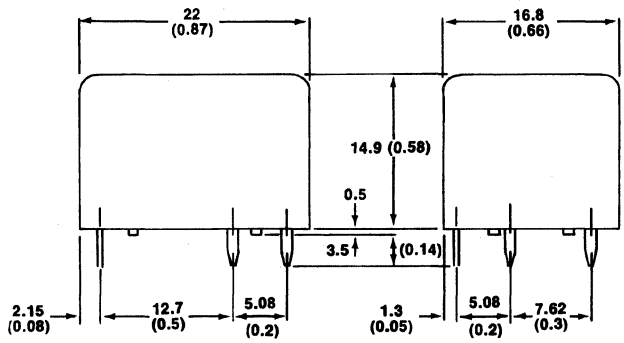
HASCO COMPONENTS INC. SINCE 1976

RELAYS

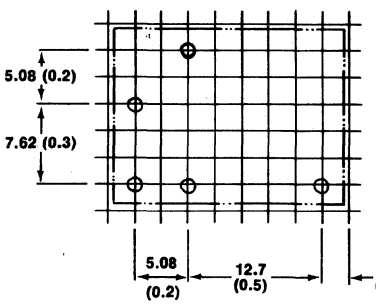
SPDT 3, 6 OR 10 AMP RELAY
SSD106P RELAY SERIES



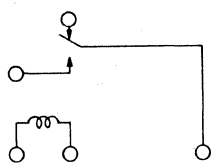




MOUNTING HOLES (BOTTOM VIEW)



TERMINAL ARRANGEMENT (BOTTOM VIEW)



*Hole Dia to be 1.0 — 1.2 (0.039 — 0.047)

Unit: Inch(mm)

MAXIMUM LOAD RATINGS (Resistive)

Type \ Voltage	AC 125V	AC 250V	DC 30V
SSD 103PH	3A	2.5A	3A
SSD 105PH06	5A6	3A	5A
SSD 110PH	10A	5A	10A

FEATURES

- Highly reliable, low cost
- Miniature size (16.8 x 22 x 14.8mm) & large switch capacity up to 10A
- High dielectric strength type
- Printed circuit terminals, fits grid with 2.54mm
- In stock

.74¢ @ 2.5k

SAME DAY SAMPLES

SPECIFICATIONS

CONTACT DATA

Arrangement: 1 Form C (SPDT)
Material & Rating: Silver, gold flash: 3A at 24VDC or 120VAC, 1.5A at 240VAC, resistive
Silver Cadmium oxide, silver flash: 6A at 24VDC or 120VAC, 3A at 240VAC, resistive
Special alloy, silver flash: 10A at 24VDC or 120VAC, 5A at 240VAC, resistive
Max. operating Voltage: 250VAC & 125VDC
Min. permissible load (reference value): Silver contact: 5VDC, 1mA
Other contact: 5VDC, 100mA
Service life: Mechanical: 20 Million operations
Electrical: 100,000 operations min. at rated load

COIL DATA

(See coil data chart)
Voltages: From 3V to 24V
Power (at 20°C): Nominal: 0.45 watt

GENERAL DATA

Contact resistive: 50 m ohm Max.
Operate time: Approx. 6 ms (at nominal voltage)
Operate bounce time: Approx. 2 ms
Release time: Approx. 2 ms
Release bounce time: Approx. 4 ms
Insulation resistance: More than 100 M ohm at DC 500V
Dielectric strength: 750VAC (50/60 Hz), between open contact; 2000VAC (50/60 Hz), between coil & contact
Vibration: 1.5mm double amplitude, 10 to 50 Hz
Shock: 100m/sec² (approx. 10 G's)
Operation frequency: Mechanical: 18,000 operations/hour
Electrical: 1,800 operations/hour (under rated load)
Temperature range: −30°C to +85°C.
Temperature rise: Less than 35 deg.
Humidity: 45° −85% RH
Approximate weight: 10 gr.

COIL RATINGS

Nominal Coil Voltage	Coil Resistance in Ohms, ±10% at 20°C	Must Operate Voltage at 20°C	Must Release Voltage at 20°C	Maximum Voltage
3VDC	20	less than 75% of nominal voltage	More than 10% of nominal voltage	130% of nominal voltage
5VDC	56			
6VDC	80			
9VDC	180			
12VDC	320			
24VDC	1150			

TO ORDER:

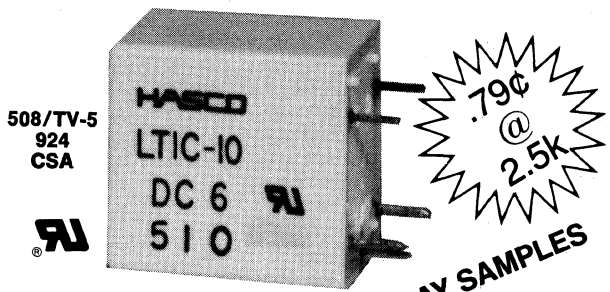
FULLY SEALED
SSD103PH: 3 AMP
SSD106PH: 6 AMP
SSD110PH: 10 AMP

HASCO COMPONENTS, INC. / 247-40 JERICHO TPKE., BELLEROSE VILLAGE, NY 11001 / (516) 328-9292 TWX: 710-582-5750 FAX: 516-326-9125

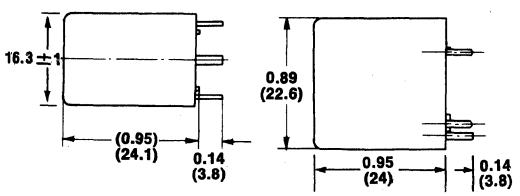
HASCO COMPONENTS INC. SINCE 1976

RELAYS

LT MINIATURE POWER RELAYS SPDT 3, 5 & 10 AMP



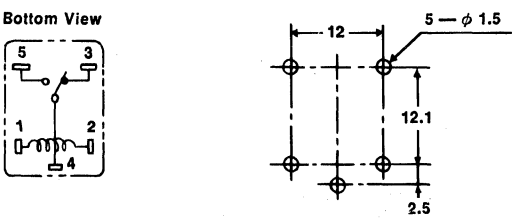
LT DIMENSIONS



Unit: inch (mm)

(Shorter height available)

CIRCUIT DIAGRAM AND MOUNTING



ORDERING INFORMATION

LT	IC	5	XXV
	C: SPDT	3 = 3 amp	5 = 5V
	B: SPNC	5 = 5 amp	6 = 6V
	A: SPNO	10 = 10 amp	9 = 9V
			12 = 12V
			24 = 24V
			48 = 48V

For lower height model use SLT

FEATURES

- Miniature, lightweight relay which requires less mounting space.
- UL 508/TV-5 available.
- High reliable relay with dielectric strength, 2000V which employs the specific construction.
- Economical and favorable price for simple construction.
- Fully sealed.
- In stock for most voltages and amps!

GENERAL CHARACTERISTICS

Ambient Temperature: −20 to +60°C (not to freeze).
Ambient Humidity: 45 to 85% (not to be dewy).
Operating Time: Less than 20 mS.
Release Time: Less than 20 mS.
Contact Resistance (at initial): Less than 100 milliohms at 6V DC, 1A.
Insulation Resistance: 500V DC, more than 100M Ohms.
Dielectric Strength: Between contacts: 500V AC (50/60 Hz) 1 minute — Between coil and contact; 2,000V AC (50/60 Hz) 1 minute.
Vibration: 6G (10 to 55 Hz).
Shock: 10G.
(The above mentioned values are at normal temperature and humidity.)

CHARACTERISTICS

Power Consumption: Approx. 0.36W to approx. 0.5W.
Temperature Rise: Less than 40 deg. after applied max. continuous voltage.

COIL RATINGS(5V – 48V)

Rated Voltage (V)	DC6	DC9	DC12	DC24
Rated Current (mA)	60	40	30	15
Coil Resistance (Ω)	100	225	400	1600

* Coil rated current tolerance is +15%, −20% at ambient temp. of 20°C.
* DC 5V coil rating also in stock.

MAXIMUM LOAD RATINGS

Type	Load	Voltage	AC 125V	DC 24V
3A	Resistive	(cos ϕ = 1)	3A	3A
	Inductive	(cos ϕ = 0.4 T = 7 ms)	1.2A	1.2A
5A	Resistive	(cos ϕ = 1)	5A	5A
	Inductive	(cos ϕ = 0.4 T = 7 ms)	2A	2A
10A	Resistive	(cos ϕ = 1)	10A	10A
	Inductive	(cos ϕ = 0.4 T = 7 ms)	4A	4A

SPECIFICATIONS

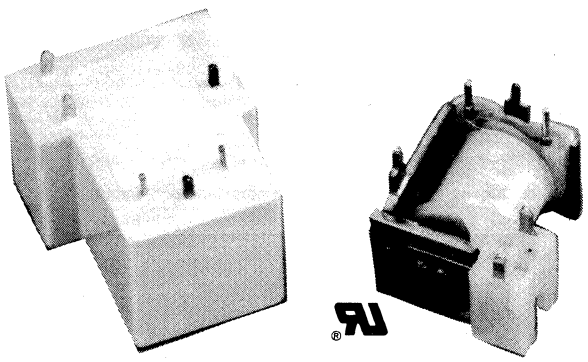
Maximum Continuous Voltage: 115% of rated voltage at 20°C.
Operating Voltage: Less than 80% of rated voltage at 20°C.
Opening Voltage: More than 10% of rated voltage at 20°C.
Coil Temperature Rise: LT 1C 3/LT 1C 5—Less than 50°C at rated voltage. LT 1C 10—Less than 60°C at rated voltage.
Initial Contact Resistance: Less than 100 mΩ (1A 6V DC).
Insulation Resistance: More than 100 MΩ (500V DC).
Dielectric Strength: Between coil and contact — AC 1500V for 1 minute. Between contacts — AC 750V for 1 minute
Electrical Life: More than 100,000 operations at rated voltage.
Mechanical Life: More than 5,000,000 operations.
Contact Material: LT 1C 3 — Gold plated over silver
LT 1C 5 and LT 1C 10 — Silver alloy.
Operating Temperature: LT 1C 3/LT 1C 5 — 30°C ~ +20°C.
LT 1C 10 — 30°C ~ +50°C.

*** Available up to 4000V DC.**

HASCO COMPONENTS, INC. / 247-40 JERICHO TPKE., BELLEROSE VILLAGE, NY 11001 / (516) 328-9292 TWX: 710-582-5750 FAX: 516-326-9125

HASCO COMPONENTS INC. SINCE 1976 — RELAYS

HAT-901 SERIES HEAVY DUTY



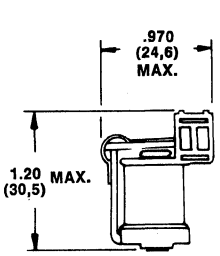
GENERAL SPECIFICATIONS

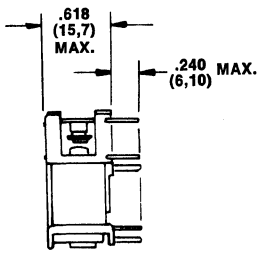
Max. continuous rated voltage: 110% of nominal voltage.
Pull-In voltage: 75% of nominal voltage. Max @ 25°C.
Drop-Out voltage: 10% of nominal voltage. Min @ 25°C.
Contact Resistance: 20 mΩ max. (Initial value)
Operating Temp: −55°C to +85°C.
Insulation Resist: DC 500V 10 MΩ min.
Dielectric Strength: AC 1500V between contact and coil, frame and contact, coil and frame one minute. AC 1500V between contacts one minute.
Operate Time: approx 15 ms.
Release Time: approx. 10 ms.
Electrical Life: 10 x 10^3 operation min.
Mechanical Life: 10 x 10^6 operation min.

COIL SPECIFICATIONS

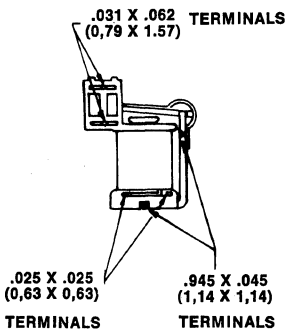
Nominal Voltage (VDC)	Resistance 10% @ 25°C (Ohms)	Coil Power 10% @ 25°C (Watts)
5	27	.93
6	40	.90
9	97	.84
12	155	.93
15	256	.88
18	380	.85
24	660	.87

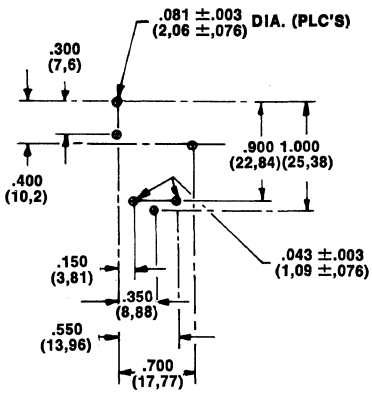
MECHANICAL SPECIFICATIONS





PC BOARD LAYOUT
VIEWED TOWARD TERMINALS





MAXIMUM LOAD SPECIFICATIONS

Voltage	Load Type	SPNC	SPDT	SPNO
AC	Resistive Motor	20A 120 VAC 15A 240 VAC 1HP 120/240 VAC		30A 240 VAC
DC	Resistive	15A 28 VDC		30A 28 VDC

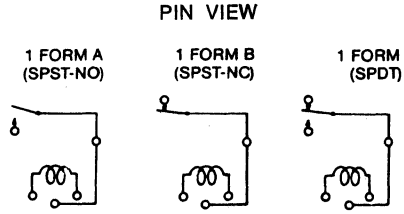
ORDERING INFORMATION

Part Number	Form	Style
HAT 901	**A**	Sealed Type = S
	B	Cover Only = C
	C	Open Style is Standard

(I.e.: HAT-901C-S 12
is an SPDT fully
sealed version with 12V coil.)

WIRING DIAGRAMS

PIN VIEW



High Performance Miniature Relays

Hi-G Company is the leading supplier of rugged, hermetically-sealed, military-qualified relays, rated 10 amperes and under. Because all Hi-G Military Qualified relays are designed for extreme environmental conditions, they are also suited for critical commercial and computer applications.

Hi-G Relay Guide

MILITARY QUALIFIED RELAYS

Contact Rating (AMP)	Contact Arrangement	Enclosure	Sensitivity (mW)	Hi-G Series	Page Number
1	DPDT	TO-5	130	(J) MA	ii
1	SPDT	TO-5	100	(J) 1MA	iii
1	DPDT	TO-5	60	(J) MS	iv
1	SPDT	TO-5	40	(J) 1MS	v
1	DPDT	Square/.100 Grid	130	(J) MGA	vi
1	DPDT	Square/.100 Grid	60	(J) MGS	vii
1	DPDT	Square/.100 Grid	CMOS	(J) MGAT	viii
1	DPDT	Square/.100 Grid	CMOS	(J) MGST	viii
2	DPDT	1/5 Xtal Can	135	(J) G	vii
2	DPDT	1/2 Xtal Can	250	(J) 2K-4730	vii
2	DPDT	1/2 Xtal Can	250	(J) 2K-4940	viii
2	DPDT	Xtal Can	250	2B-1506	viii
2	DPDT	Tall Xtal Can	40	2BC-1510	viii
10	DPDT	Xtal Can	500	2T-2911/2994	viii

SOLID STATE RELAYS

Contact Rating (AMP)	Contact Arrangement	Enclosure	Sensitivity (mW)	Hi-G Series	Page Number
50mA 40Vac or dc	SPST (N.O.)	TO-5	5.0Vdc	JTS-5	xv
250mA 40Vdc	SPST (N.O.)	TO-5	5.0Vdc	JTS-6	xv
100mA 250Vdc	SPST (N.O.)	TO-5	5.0Vdc	JTS-7	xv
600mA 50Vdc	SPST (N.O.)	Dip .300	3-16Vdc	JDS8	xv
1 amp 250Vac	SPST (N.O.)	Dip .300	3.8-32Vdc	JDS9	xv
25 amp 220Vac	SPST (N.O.)	Heat Sink	4-32Vdc	JPS10	xv

MILITARY, COMMERCIAL, AND COMPUTER GRADE RELAYS

Contact Rating (AMP)	Contact Arrangement	Enclosure	Sensitivity (mW)	Hi-G Series	Page Number
1	DPDT	TO-5	185	CA	x
1	DPDT	TO-5	90	CS	x
2	DPDT	1/2 Xtal Can	250	K	**
2	DPDT	Xtal Can	250	B, BR	**
2	4PDT	Xtal Can	400	4B	**
2	2PDT	1/2 Xtal Can	100	KA	**
2	SPDT/DPDT	Xtal Can	25/40	BK	**
2	SPDT/DPDT	Tall Xtal Can	25/40	BC	**
2	DPDT	Xtal Can	100	BA	**
4	DPDT	1/2 Xtal Can	300	HA	**
5	DPDT	Xtal Can	280	BN	**
5	DPDT	Tall Xtal Can	80	BCN	**
10	DPDT	Xtal Can	500	T	**
2	DPDT	1/2 Xtal Can	350	FS2	ix
2	DPDT	1/2 Xtal Can	150	FS3	ix
5	DPDT	1/2 Xtal Can	725	FS5	ix

RF RELAYS

Contact Rating (AMP)	Contact Arrangement	Enclosure	Sensitivity (mW)	Hi-G Series	Page Number
*	SPDT	Cube	150	RFC	**
*	DPDT	1/2 Xtal Can	250	RFK	x
*	DPDT	Xtal Can	250	RFB	**
*	DPDT	Tall Xtal Can	40	RFBC	**

*Contacts rated 75 Watts switching, 200 Watts carry.

**Descriptions of these relays are not listed here. For additional information, please contact Hi-G Company, 101 Locust St., Hartford, CT 06114 for complete miniature relay catalog. Telephone: (203) 522-8600.

HI-G RELAYS

Hi-G offers the most complete selection of qualified relays, rated 10 amperes and under, of any manufacturer in the world. The following charts list the appropriate military specification, relay configuration, relay contact operating parameters, and the corresponding Hi-G part number. A (J) prefix to the Hi-G part number denotes Qualified Relay; L, M, and P suffixes denote applicable failure rate.

Series (J)MA:
TO-5 Case Relay, DPDT

QUALIFIED:
MIL-R-39016/9
MIL-R-39016/15
MIL-R-39016/20
MIL-R-28776/1

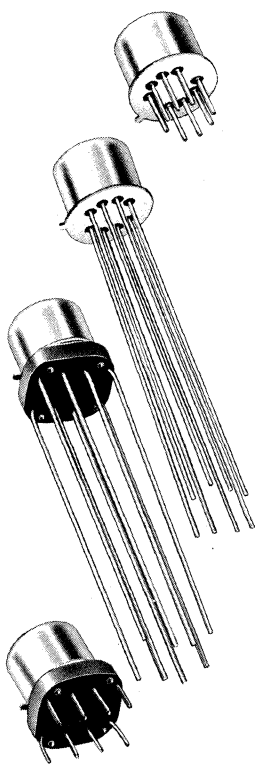
Failure Rate Levels
L, M, P.

These ultra-miniature DPDT relays in transistor-style case are available in **4 types:** basic relay; with diode coil suppression (D); with two diodes for coil suppression and polarity reversal protection (DD); and with integral transistor driver and diode coil suppression (T).

Contacts: 2 Form C
Rating: 1 Amp
Sensitivity: 130 mW

RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M39016/9	
	M39016/9-013L, M, P	JMAW-5XL, M, P
	-014L	-6XL
	-015L	-9XL
	-016L	-12XL
	-017L	-18XL
	-018L	-26XL
	-019L	JMAP-5XL
	-020L	-6XL
	-021L	-9XL
	-022L	-12XL
	-023L	-18XL
	-024L	-26XL
	-051L	JMAW-30XL
	-052L	JMAP-30XL
	-057L	JMAC-5XL
	-058L	-6XL
	-059L	-9XL
	-060L	-12XL
	-061L	-18XL
	-062L	-26XL
	-063L	-30XL
	-071L	JMAC-5XLS
	-072L	-6XLS
	-073L	-9XLS
	-074L	-12XLS
	-075L	-18XLS
	-076L	-26XLS
	-077L	-30XLS
	M39016/15	
	M39016/15-029L, M, P	JMAWD-6XL, M, P
	-030L	-9XL
	-031L	-12XL
	-032L	-18XL
	-033L	-26XL
	-034L	-5XL
	-035L	JMAPD-6XL
	-036L	-9XL
	-037L	-12XL
	-038L	-18XL
	-039L	-26XL
	-040L	-5XL
	-065L	JMAWDG-6XL
	-066L	-9XL
	-067L	-12XL
	-068L	-18XL
	-069L	-26XL
	-070L	-5XL
	-077L	JMACD-6XL
	-078L	-9XL
	-079L	-12XL
	-080L	-18XL
	-081L	-26XL
	-082L	-5XL
	-089L	JMACDG-6XL
	-090L	-9XL
	-091L	-12XL
	-092L	-18XL
	-093L	-26XL
	-094L	-5XL
	-101L	JMACD-6XLS
	-102L	-9XLS
	-103L	-12XLS
	-104L	-18XLS

RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
Series (J)MA Cont'd.	**M39016/15 (cont'd.)**	
	-105L	-26XLS
	-106L	-5XLS
	-113L	JMACDG-6XLS
	-114L	-9XLS
	-115L	-12XLS
	-116L	-18XLS
	-117L	-26XLS
	-118L	-5XLS
	M39016/20	
	M39016/20-007L, M, P	JMAWDD-5XL, M, P
	-008L	-6XL
	-009L	-9XL
	-010L	-12XL
	-011L	-18XL
	-012L	-26XL
	-037L	JMAPDD-5XL
	-038L	-6XL
	-039L	-9XL
	-040L	-12XL
	-041L	-18XL
	-042L	-26XL
	-049L	JMACDD-5XL
	-050L	-6XL
	-051L	-9XL
	-052L	-12XL
	-053L	-18XL
	-054L	-26XL
	-061L	JMACDD-5XLS
	-062L	-6XLS
	-063L	-9XLS
	-064L	-12XLS
	-065L	-18XLS
	-066L	-26XLS
	M28776/1	
	M28776/1-013L, M, P	JMAWT-5XL, M, P
	-014L	-6XL
	-015L	-9XL
	-016L	-12XL
	-017L	-18XL
	-018L	-26XL
	-019L	JMAPT-5XL
	-020L	-6XL
	-021L	-9XL
	-022L	-12XL
	-023L	-18XL
	-024L	-26XL
	-025L	JMACT-5XL
	-026L	-6XL
	-027L	-9XL
	-028L	-12XL
	-029L	-18XL
	-030L	-26XL
	-031L	JMACT-5XLS
	-032L	-6XLS
	-033L	-9XLS
	-034L	-12XLS
	-035L	-18XLS
	-036L	-26XLS



Hi-G Military Relays

Series (J)1MA:

TO-5 Case Relay, SPDT

QUALIFIED:
MIL-R-39016/7
MIL-R-39016/23
MIL-R-39016/24
MIL-R-28776/5

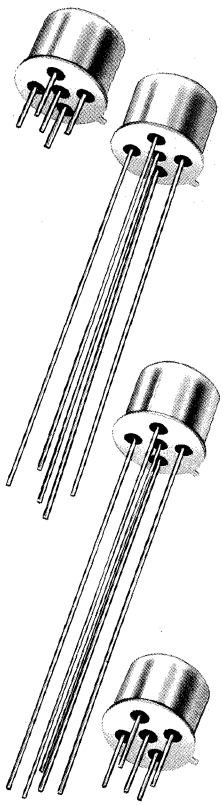
Failure Rate Levels L, M, P.

These ultra-miniature SPDT relays in transistor-style case are available in **4 types:** basic relay; with diode suppression (D); with two diodes for coil suppression and polarity reversal protection (DD); and with integral transistor driver and diode coil suppression (T).

Contacts: 1 Form C
Rating: 1 Amp
Sensitivity: 100 mW

RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M39016/7	
	M39016/7-013L, M, P	J1MAW-5XL, M, P
	-014L	J1MAP-5XL
	-015L	J1MAW-6XL
	-016L	J1MAP-6XL
	-017L	J1MAW-9XL
	-018L	J1MAP-9XL
	-019L	J1MAW-12XL
	-020L	J1MAP-12XL
	-021L	J1MAW-18XL
	-022L	J1MAP-18XL
	-023L	J1MAW-26XL
	-024L	J1MAP-26XL
	-025L	J1MAC-5XL
	-026L	-6XL
	-027L	-9XL
	-028L	-12XL
	-029L	-18XL
	-030L	-26XL
	-031L	J1MAC-5XLS
	-032L	-6XLS
	-033L	-9XLS
	-034L	-12XLS
	-035L	-18XLS
	-036L	-26XLS
	M39016/23	
	M39016/23-013L, M, P	J1MAWD-5XL, M, P
	-014L	-6XL
	-015L	-9XL
	-016L	-12XL
	-017L	-18XL
	-018L	-26XL
	-019L	J1MAPD-5XL
	-020L	-6XL
	-021L	-9XL
	-022L	-12XL
	-023L	-18XL
	-024L	-26XL
	-025L	J1MACD-5XL
	-026L	-6XL
	-027L	-9XL
	-028L	-12XL
	-029L	-18XL
	-030L	-26XL
	-031L	J1MACD-5XLS
	-032L	-6XLS
	-033L	-9XLS
	-034L	-12XLS
	-035L	-18XLS
	-036L	-26XLS

Series (J)1MA Cont'd.



RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M39016/24	
	M39016/24-013L, M, P	J1MAWDD-5XL, M, P
	-014L	-6XL
	-015L	-9XL
	-016L	-12XL
	-017L	-18XL
	-018L	-26XL
	-019L	J1MAPDD-5XL
	-020L	-6XL
	-021L	-9XL
	-022L	-12XL
	-023L	-18XL
	-024L	-26XL
	-025L	J1MACDD-5XL
	-026L	-6XL
	-027L	-9XL
	-028L	-12XL
	-029L	-18XL
	-030L	-26XL
	-031L	J1MACDD-5XLS
	-032L	-6XLS
	-033L	-9XLS
	-034L	-12XLS
	-035L	-18XLS
	-036L	-26XLS
	M28776/5	
	M28776/5-013L, M, P	J1MAWT-5XL, M, P
	-014L	-6XL
	-015L	-9XL
	-016L	-12XL
	-017L	-18XL
	-018L	-26XL
	-019L	J1MAPT-5XL
	-020L	-6XL
	-021L	-9XL
	-022L	-12XL
	-023L	-18XL
	-024L	-26XL
	-025L	J1MACT-5XL
	-026L	-6XL
	-027L	-9XL
	-028L	-12XL
	-029L	-18XL
	-030L	-26XL
	-031L	J1MACT-5XLS
	-032L	-6XLS
	-033L	-9XLS
	-034L	-12XLS
	-035L	-18XLS
	-036L	-26XLS

Hi-G Military Relays

RELAY TYPE

Series (J)MS:

Sensitive TO-5 Case Relay, DPDT

QUALIFIED:
MIL-R-39016/11
MIL-R-39016/16
MIL-R-39016/21
MIL-R-28776/3

Failure Rate Levels L, M, P.

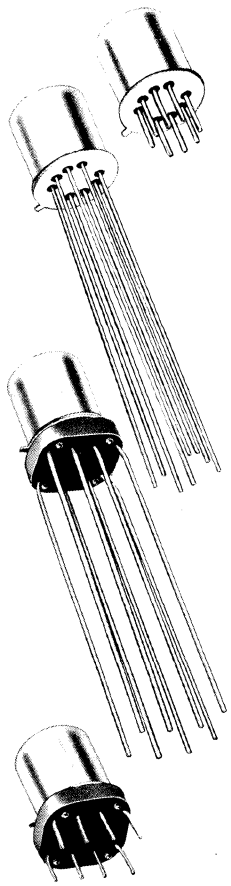
These sensitive ultra-miniature DPDT relays in transistor-style case are available in **4 types:** basic relay; with diode suppression (D); with two diodes for coil suppression and polarity-reversal protection (DD); and with integral transistor driver and diode coil suppression (T).

Contacts: 2 Form C
Rating: 1 Amp
Sensitivity: 60 mW

MILITARY DESIGNATION	HI-G PART NO.
M39016/11	
M39016/11-017L, M, P	JMSW-5XL, M, P
-018L	JMSP-5XL
-019L	JMSW-6XL
-020L	JMSP-6XL
-021L	JMSW-12XL
-022L	JMSP-12XL
-023L	JMSW-26XL
-024L	JMSP-26XL
-025L	JMSW-36XL
-026L	JMSP-36XL
-027L	JMSW-48XL
-028L	JMSP-48XL
-029L	JMSW-9XL
-030L	JMSP-9XL
-031L	JMSW-18XL
-032L	JMSP-18XL
-033L	JMSC-5XL
-034L	-6XL
-035L	-12XL
-036L	-26XL
-037L	-36XL
-038L	-48XL
-039L	-9XL
-040L	-18XL
-041L	JMSC-5XLS
-042L	-6XLS
-043L	-12XLS
-044L	-26XLS
-045L	-36XLS
-046L	-48XLS
-047L	-9XLS
-048L	-18XLS
M39016/16	
M39016/16-017L, M, P	JMSWD-5XL, M, P
-018L	-6XL
-019L	-12XL
-020L	-26XL
-021L	-36XL
-022L	-48XL
-023L	-9XL
-024L	-18XL
-025L	JMSPD-5XL
-026L	-6XL
-027L	-12XL
-028L	-26XL
-029L	-36XL
-030L	-48XL
-031L	-9XL
-032L	-18XL
-033L	JMSCD-5XL
-034L	-6XL
-035L	-12XL
-036L	-26XL
-037L	-36XL
-038L	-48XL
-039L	-9XL
-040L	-18XL
-041L	JMSCD-5XLS
-042L	-6XLS
-043L	-12XLS
-044L	-26XLS
-045L	-36XLS
-046L	-48XLS
-047L	-9XLS
-048L	-18XLS

RELAY TYPE

Series (J)MS Cont'd.



MILITARY DESIGNATION	HI-G PART NO.
M39016/21	
M39016/21-007L, M, P	JMSWDD-5XL, M, P
-008L	-6XL
-009L	-9XL
-010L	-12XL
-011L	-18XL
-012L	-26XL
-019L	JMSPDD-5XL
-020L	-6XL
-021L	-9XL
-022L	-12XL
-023L	-18XL
-024L	-26XL
-029L	JMSWDD-36XL
-030L	-48XL
-031L	JMSPDD-36XL
-032L	-48XL
-033L	JMSCDD-5XL
-034L	-6XL
-035L	-9XL
-036L	-12XL
-037L	-18XL
-038L	-26XL
-039L	-36XL
-040L	-48XL
-041L	JMSCDD-5XLS
-042L	-6XLS
-043L	-9XLS
-044L	-12XLS
-045L	-18XLS
-046L	-26XLS
-047L	-36XLS
-048L	-48XLS
M28776/3	
M28776/3-017L, M, P	JMSWT-5XL, M, P
-018L	-6XL
-019L	-9XL
-020L	-12XL
-021L	-18XL
-022L	-26XL
-023L	-36XL
-024L	-48XL
-025L	JMSPT-5XL
-026L	-6XL
-027L	-9XL
-028L	-12XL
-029L	-18XL
-030L	-26XL
-031L	-36XL
-032L	-48XL
-033L	JMSCT-5XL
-034L	-6XL
-035L	-9XL
-036L	-12XL
-037L	-18XL
-038L	-26XL
-039L	-36XL
-040L	-48XL
-041L	JMSCT-5XLS
-042L	-6XLS
-043L	-9XLS
-044L	-12XLS
-045L	-18XLS
-046L	-26XLS
-047L	-36XLS
-048L	-48XLS

Hi-G Military Relays

Series (J)1MS:
Sensitive TO-5 Case Relay, SPDT

QUALIFIED:
MIL-R-39016/10
MIL-R-39016/25
MIL-R-39016/26
MIL-R-28776/4

Failure Rate Levels L, M, P.

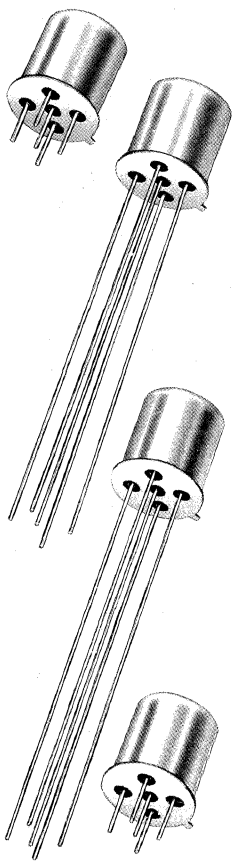
These sensitive ultra-miniature SPDT relays in transistor-style case are available in **4 types:** basic relay; with diode coil suppression (D); with two diodes for coil suppression and polarity reversal protection (DD); with integral transistor driver and coil suppression (T).

Contacts: 1 Form C
Rating: 1 Amp
Sensitivity: 40 mW

Hi-G Military Relays

RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M39016/10	
	M39016/10-017L, M, P	J1MSW-5XL, M, P
	-018L	J1MSP-5XL
	-019L	J1MSW-6XL
	-020L	J1MSP-6XL
	-021L	J1MSW-12XL
	-022L	J1MSP-12XL
	-023L	J1MSW-26XL
	-024L	J1MSP-26XL
	-025L	J1MSW-32XL
	-026L	J1MSP-32XL
	-027L	J1MSW-40XL
	-028L	J1MSP-40XL
	-029L	J1MSW-9XL
	-030L	J1MSP-9XL
	-031L	J1MSW-18XL
	-032L	J1MSP-18XL
	-033L	J1MSC-5XL
	-034L	-6XL
	-035L	-12XL
	-036L	-26XL
	-037L	-32XL
	-038L	-40XL
	-039L	-9XL
	-040L	-18XL
	-041L	J1MSC-5XLS
	-042L	-6XLS
	-043L	-12XLS
	-044L	-26XLS
	-045L	-32XLS
	-046L	-40XLS
	-047L	-9XLS
	-048L	-18XLS
	M39016/25	
	M39016/25-017L, M, P	J1MSWD-5XL, M, P
	-018L	-6XL
	-019L	-12XL
	-020L	-26XL
	-021L	-32XL
	-022L	-40XL
	-023L	-9XL
	-024L	-18XL
	-025L	J1MSPD-5XL
	-026L	-6XL
	-027L	-12XL
	-028L	-26XL
	-029L	-32XL
	-030L	-40XL
	-031L	-9XL
	-032L	-18XL
	-033L	J1MSCD-5XL
	-034L	-6XL
	-035L	-12XL
	-036L	-26XL
	-037L	-32XL
	-038L	-40XL
	-039L	-9XL
	-040L	-18XL
	-041L	J1MSCD-5XLS
	-042L	-6XLS
	-043L	-12XLS
	-044L	-26XLS
	-045L	-32XLS
	-046L	-40XLS
	-047L	-9XLS
	-048L	-18XLS

Series (J)1MS
Cont'd.



RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M39016/26	
	M39016/26-017L, M, P	J1MSWDD-5XL, M, P
	-018L	-6XL
	-019L	-12XL
	-020L	-26XL
	-021L	-32XL
	-022L	-40XL
	-023L	-9XL
	-024L	-18XL
	-025L	J1MSPDD-5XL
	-026L	-6XL
	-027L	-12XL
	-028L	-26XL
	-029L	-32XL
	-030L	-40XL
	-031L	-9XL
	-032L	-18XL
	-033L	J1MSCDD-5XL
	-034L	-6XL
	-035L	-12XL
	-036L	-26XL
	-037L	-32XL
	-038L	-40XL
	-039L	-9XL
	-040L	-18XL
	-041L	J1MSCDD-5XLS
	-042L	-6XLS
	-043L	-12XLS
	-044L	-26XLS
	-045L	-32XLS
	-046L	-40XLS
	-047L	-9XLS
	-048L	-18XLS
	M28776/4	
	M28776/4-017L, M, P	J1MSWT-5XL, M, P
	-018L	-6XL
	-019L	-9XL
	-020L	-12XL
	-021L	-18XL
	-022L	-26XL
	-023L	-32XL
	-024L	-40XL
	-025L	J1MSPT-5XL
	-026L	-6XL
	-027L	-9XL
	-028L	-12XL
	-029L	-18XL
	-030L	-26XL
	-031L	-32XL
	-032L	-40XL
	-033L	J1MSCT-5XL
	-034L	-6XL
	-035L	-9XL
	-036L	-12XL
	-037L	-18XL
	-038L	-26XL
	-039L	-32XL
	-040L	-40XL
	-041L	J1MSCT-5XLS
	-042L	-6XLS
	-043L	-9XLS
	-044L	-12XLS
	-045L	-18XLS
	-046L	-26XLS
	-047L	-32XLS
	-048L	-40XLS

RELAY TYPE

Series (J)MGA:

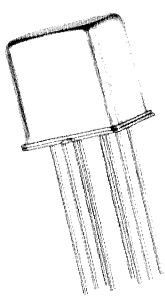
MINIGRID™ Relay, DPDT

QUALIFIED:
MIL-R-39016/17
MIL-R-39016/18
MIL-R-39016/19

Failure Rate Levels L, M, P.

These ultra-miniature DPDT relays are hermetically sealed with .100 inch grid space terminals. These relays are available in **3 types:** basic relay; with diode suppression (D); and with two diodes for coil suppression and polarity reversal protection (DD).

Contacts: 2 Form C
Rating: 1 Amp
Sensitivity: 130 mW



MILITARY DESIGNATION	HI-G PART NO.
M39016/17	
M39016/17-025L, M, P	JMGAP-5L, M, P
-026L	-6L
-027L	-9L
-028L	-12L
-029L	-18L
-030L	-26L
-031L	JMGAC-5L
-032L	-6L
-033L	-9L
-034L	-12L
-035L	-18L
-036L	-26L
-037L	JMGAC-5LW
-038L	-6LW
-039L	-9LW
-040L	-12LW
-041L	-18LW
-042L	-26LW
M39016/18	
M39016/18-025L, M, P	JMGAPD-5L, M, P
-026L	-6L
-027L	-9L
-028L	-12L
-029L	-18L
-030L	-26L
-031L	JMGACD-5L
-032L	-6L
-033L	-9L
-034L	-12L
-035L	-18L
-036L	-26L
-037L	JMGACD-5LW
-038L	-6LW
-039L	-9LW
-040L	-12LW
-041L	-18LW
-042L	-26LW
M39016/19	
M39016/19-025L, M, P	JMGAPDD-5L, M, P
-026L	-6L
-027L	-9L
-028L	-12L
-029L	-18L
-030L	-26L
-031L	JMGACDD-5L
-032L	-6L
-033L	-9L
-034L	-12L
-035L	-18L
-036L	-26L
-037L	JMGACDD-5LW
-038L	-6LW
-039L	-9LW
-040L	-12LW
-041L	-18LW
-042L	-26LW

RELAY TYPE

Series (J)MGS:

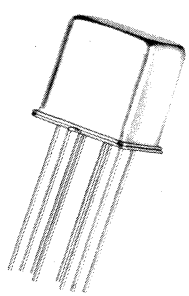
Sensitive MINIGRID™ Relay, DPDT

QUALIFIED:
MIL-R-39016/41
MIL-R-39016/42
MIL-R-39016/43

Failure Rate Levels L, M, P.

These sensitive ultra-miniature DPDT relays, in hermetically-sealed cans with .100 inch grid spaced terminals, are available in **3 types:** basic relay; single-diode suppression (D); and with two diodes for coil suppression and polarity reversal protection (DD).

Contacts: 2 Form C
Rating: 1 Amp
Sensitivity: 60 mW



MILITARY DESIGNATION	HI-G PART NO.
M39016/41	
M39016/41-033L, M, P	JMGSC-5L, M, P
-034L	-6L
-035L	-12L
-036L	-26L
-037L	-36L
-038L	-48L
-039L	-9L
-040L	-18L
-041L	JMGSP-5L
-042L	-6L
-043L	-12L
-044L	-26L
-045L	-36L
-046L	-48L
-047L	-9L
-048L	-18L
-049L	JMGSC-5LW
-050L	-6LW
-051L	-12LW
-052L	-26LW
-053L	-36LW
-054L	-48LW
-055L	-9LW
-056L	-18LW
M39016/42	
M39016/42-033L, M, P	JMGSCD-5L, M, P
-034L	-6L
-035L	-12L
-036L	-26L
-037L	-36L
-038L	-48L
-039L	-9L
-040L	-18L
-041L	JMGSPD-5L
-042L	-6L
-043L	-12L
-044L	-26L
-045L	-36L
-046L	-48L
-047L	-9L
-048L	-18L
-049L	JMGSCD-5LW
-050L	-6LW
-051L	-12LW
-052L	-26LW
-053L	-36LW
-054L	-48LW
-055L	-9LW
-056L	-18LW
M39016/43	
M39016/43-033L, M, P	JMGSCDD-5L, M, P
-034L	-6L
-035L	-9L
-036L	-12L
-037L	-18L
-038L	-26L
-039L	-36L
-040L	-48L
-041L	JMGSPDD-5L
-042L	-6L
-043L	-9L
-044L	-12L
-045L	-18L
-046L	-26L
-047L	-36L
-048L	-48L
-049L	JMGSCDD-5LW
-050L	-6LW
-051L	-9LW
-052L	-12LW
-053L	-18LW
-054L	-26LW
-055L	-36LW
-056L	-48LW

Hi-G Military Relays

Series (J) MGAT:

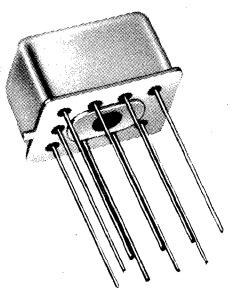
MINIGRID™ Relay, DPDT
CMOS Compatible

QUALIFIED:
MIL-R-28776/6

Failure Rate Levels
L, M

A series of ultra miniature hermetically sealed relays with 0.100 inch grid spaced terminals. The MOSFET MGAT Series construction is similar to HI-G's MA Series TO-5 relays, long recognized for high reliability. The MGAT Relay series incorporates a MOSFET driver and diode coil suppression.

Contacts: 2 Form C
Rating: 1 Amp
Sensitivity: 128 to 216 mw



RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M28776 6	
Series (J) MGAT:	M28776/6-001L, M	JMGAT-5L, M
	-002L	-6L
	-003L	-9L
	-004L	-12L
	-005L	-18L
	-006L	-26L
	-007L	-5LW
	-008L	-6LW
	-009L	-9LW
	-010L	-12LW
	-011L	-18LW
	-012L	-26LW

Series (J) MGST:

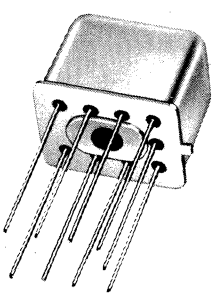
Sensitive
MINIGRID™ Relay, DPDT
CMOS Compatible

QUALIFIED:
MIL-R-28776/7

Failure Rate Levels
L, M

A series of ultra miniature hermetically sealed relays with 0.100 inch grid spaced terminals. The MOSFET MGST Series construction is similar to HI-G's MS Series TO-5 relays, long recognized for high reliability. The MGST Relay series incorporates a MOSFET driver and diode coil suppression.

Contacts: 2 Form C
Rating: 1 Amp
Sensitivity: 61 to 84 mw



RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M28776 7	
Series (J) MGST:	M28776/7-001L, M	JMGST-5L, M
	-002L	-6L
	-003L	-9L
	-004L	-12L
	-005L	-18L
	-006L	-26L
	-007L	-5LW
	-008L	-6LW
	-009L	-9LW
	-010L	-12LW
	-011L	-18LW
	-012L	-26LW

Hi-G Military Relays

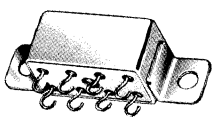
Series G:
1/5 Crystal Can Relay

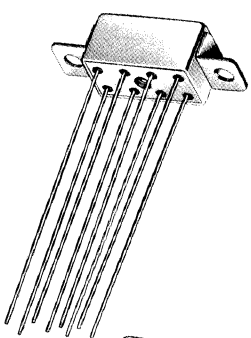
QUALIFIED:
MIL-R-39016/13

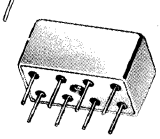
Failure Rate Levels
L, M, P.

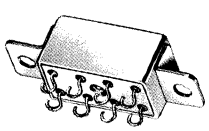
These 2-ampere, .150 grid, low-profile DPDT relays allow maximum packaging density under extreme environmental conditions. Relays are available in three terminal styles and in three enclosures.

Contacts: 2 Form C
Rating: 2 Amp
Sensitivity: 135 mW









RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M39016/13	
Series G: 1/5 Crystal Can Relay	M39016/13-055L, M, P	J2G-4650-55L, M, P
	-056L	-56L
	-057L	-57L
	-058L	-58L
	-059L	-59L
	-060L	-60L
	-061L	-61L
	-062L	-62L
	-063L	-63L
	-064L	-64L
	-065L	-65L
	-066L	-66L
	-067L	-67L
	-068L	-68L
	-069L	-69L
	-070L	-70L
	-071L	-71L
	-072L	-72L
	-073L	-73L
	-074L	-74L
	-075L	-75L
	-076L	-76L
	-077L	-77L
	-078L	-78L
	-079L	-79L
	-080L	-80L
	-081L	-81L
	-082L	-82L
	-083L	-83L
	-084L	-84L
	-085L	-85L
	-086L	-86L
	-087L	-87L
	-088L	-88L
	-089L	-89L
	-090L	-90L
	-091L	-91L
	-092L	-92L
	-093L	-93L
	-094L	-94L
	-095L	-95L
	-096L	-96L
	-097L	-97L
	-098L	-98L
	-099L	-99L
	-100L	-100L
	-101L	-101L
	-102L	-102L
	-103L	-103L
	-104L	-104L
	-105L	-105L
	-106L	-106L
	-107L	-107L
	-108L	-108L
	-109L	-109L
	-110L	-110L
	-111L	-111L
	-112L	-112L
	-113L	-113L
	-114L	-114L
	-115L	-115L
	-116L	-116L
	-117L	-117L

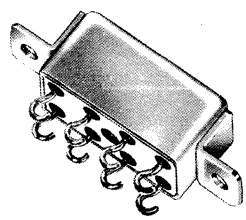
Series (J)2K-4730:
1/2 Crystal Can Relay

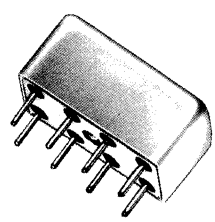
QUALIFIED:
MIL-R-39016/6

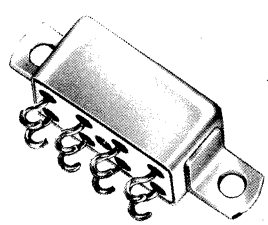
Failure Rate Levels
L, M, P.

This 1/2 size crystal can DPDT relay is available with solder lug, wire leads and pins for printed circuit board mounting. Four mounting styles are available.

Contacts: 2 Form C
Rating: 2 Amp
Sensitivity: 250 mW







RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M39016/6	
Series (J)2K-4730: 1/2 Crystal Can Relay	M39016/6-104L, M, P	J2K-4730-104L, M, P
	-105L	-105L
	-106L	-106L
	-107L	-107L
	-108L	-108L
	-109L	-109L
	-110L	-110L
	-111L	-111L
	-112L	-112L
	-113L	-113L
	-114L	-114L
	-115L	-115L
	-116L	-116L
	-117L	-117L
	-118L	-118L
	-119L	-119L
	-120L	-120L
	-121L	-121L
	-122L	-122L
	-123L	-123L
	-124L	-124L
	-125L	-125L
	-126L	-126L
	-127L	-127L

RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M39016/6 (cont'd.)	
	M39016/6-128L, M, P	J2K-4730-128L, M, P
	-129L	-129L
	-130L	-130L
	-131L	-131L
	-132L	-132L
	-133L	-133L
	-134L	-134L
	-135L	-135L
	-136L	-136L
	-137L	-137L
	-138L	-138L
	-139L	-139L
	-140L	-140L
	-141L	-141L
	-142L	-142L
	-143L	-143L
	-144L	-144L
	-145L	-145L
	-146L	-146L
	-147L	-147L
	-148L	-148L
	-149L	-149L
	-150L	-150L
	-151L	-151L
	-152L	-152L
	-204L	-204L
	-205L	-205L
	-206L	-206L
	-207L	-207L
	-208L	-208L
	-209L	-209L
	-210L	-210L
	-211L	-211L
	-212L	-212L
	-213L	-213L
	-214L	-214L
	-215L	-215L
	-216L	-216L
	-217L	-217L
	-218L	-218L
	-219L	-219L
	-220L	-220L
	-221L	-221L
	-222L	-222L
	-223L	-223L
	-224L	-224L
	-225L	-225L
	-226L	-226L
	-227L	-227L
	-228L	-228L
	-229L	-229L
	-230L	-230L
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	-242L	-242L
	-243L	-243L
	-244L	-244L
	-245L	-245L
	-246L	-246L
	-247L	-247L
	-248L	-248L
	-249L	-249L
	-250L	-250L
	-251L	-251L
	-252L	-252L

Hi-G Military Relays

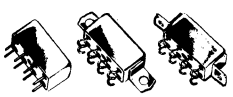
Series (J)2K-4940:

1/2 Crystal Can Relay
Coil Transient Suppressed

QUALIFIED:
MIL-R-39016/22
Failure Rate Levels L, M, P.

These DPDT transient suppressed relays are available with solder lugs, wire leads or pins for printed circuit board mounting. Three mounting styles are available.

Contacts: 2 Form C
Rating: 2 Amp
Sensitivity: 250 mW



MILITARY DESIGNATION	HI-G PART NO.
M39016/22	
M39016/22-004L, M, P	J2K-4940-004L, M, P
-005L	-005L
-006L	-006L
-007L	-007L
-008L	-008L
-009L	-009L
-010L	-010L
-011L	-011L
-012L	-012L
-013L	-013L
-014L	-014L
-015L	-015L
-016L	-016L
-017L	-017L
-018L	-018L
-019L	-019L
-020L	-020L
-021L	-021L
-022L	-022L
-023L	-023L
-024L	-024L

Series 2B-1506:

Crystal Can Relay

QUALIFIED:
MIL-R-5757/10

These full size crystal can DPDT relays are available with solder lugs, wire leads or pins for printed circuit board mounting. Five mounting styles are available.

Contacts: 2 Form C
Rating: 2 Amp
Sensitivity: 250 mW

MILITARY DESIGNATION	HI-G PART NO.
M5757/10	
M5757/10-015	2B-1506-15
-016	-16
-022	-22
-035	-35
-036	-36
-037	-37
-038	-38
-039	-39
-040	-40
-043	-43
-044	-44
-052	-52
-053	-53
-054	-54
-056	-56

Series 2BC-1510:

Sensitive Crystal Can Relay

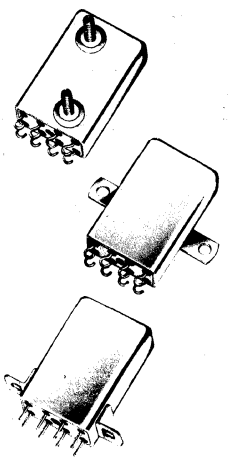
QUALIFIED:
MIL-R-5757/13

These sensitive full size crystal can DPDT relays are available with solder lugs, wire leads and pins for printed circuit board mounting. Four mounting styles are available.

Contacts: 2 Form C
Rating: 2 Amp
Sensitivity: 40 mW

MILITARY DESIGNATION	HI-G PART NO.
M5757/13	
M5757/13-011	2BC-1510-11
-012	-12
-013	-13
-014	-14
-015	-15
-016	-16
-017	-17
-018	-18
-019	-19
-020	-20
-031	-31
-032	-32
-033	-33
-034	-34
-035	-35
-036	-36
-037	-37
-038	-38
-039	-39
-040	-40
-041	-41
-042	-42
-043	-43
-044	-44
-045	-45

Series 2BC-1510 Cont'd.



MILITARY DESIGNATION	HI-G PART NO.
M5757/13 (cont'd.)	
-046	-46
-047	-47
-048	-48
-049	-49
-050	-50
-051	-51
-052	-52
-053	-53
-054	-54
-055	-55
-056	-56
-057	-57
-058	-58
-059	-59
-060	-60
-061	-61
-062	-62
-063	-63
-064	-64
-065	-65
-066	-66
-067	-67
-068	-68
-069	-69
-070	-70
-072	-72
-073	-73
-074	-74
-075	-75
-076	-76
-077	-77
-078	-78
-079	-79
-080	-80
-081	-81

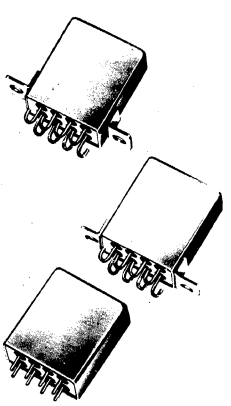
Series 2T-2911 and 2T-2994:

10 Amp Crystal Can Relay

QUALIFIED:
MIL-R-5757/23
MIL-R-5757/28

This 10-ampere full size crystal can DPDT relay is available with plug-in pins and solder lug terminals. Three mounting styles are available.

Contacts: 2 Form C
Rating: 10 Amp
Sensitivity: 500 mW



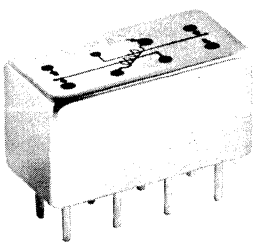
MILITARY DESIGNATION	HI-G PART NO.
M5757/23	
M5757/23-001	2T-2911-1
-002	-2
-003	-3
-004	-4
-005	-5
-006	-6
-007	-7
-008	-8
-009	-9
-010	-10
-011	-11
-012	-12
-013	-13
-014	-14
-015	-15
-016	-16
-017	-17
-018	-18
-019	-19
-020	-20
-026	-26
-027	-27
-028	-28
-029	-29
-030	-30
-031	-31
-032	-32
-033	-33
-034	-34
-036	-36
-037	-37
-038	-38
-039	-39
-040	-40
-041	-41
-042	-42
M5757/28	
M5757/28-001	2T-2994-1

Hi-G Commercial and Computer Relays

The advantages of the hermetically-sealed relay are also available for commercial and computer applications. These versatile, high-quality relays operate reliably under extreme environmental conditions, because they incorporate military design technology.

Series FS2: Flagship™ 2-Ampere Relay

Versatile hermetically-sealed commercial DPDT relay, with 2 form C contacts, switches up to 60 W/100 VA, 2 amperes, maximum. Sensitivity is 350 mW.



Operate Time: 4 ms max. at nominal coil voltage at 25°C.
Release Time: 4 ms max. at nominal coil voltage at 25°C.
Capacitance: Between contacts 2.5 pF.
Dielectric Strength: Between all other mutually insulated points 500 Vrms.
Insulation Resistance: 500 Megohms min.

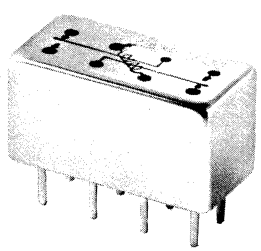
COILS

Resistance: Standard available to 3500 ohms. Standard tolerance ±10%. Other resistances and tolerances available.
Operate Power: 350 milliwatts at 25°C.
Nominal Power Consumption: 660 milliwatts at 25°C.

VOLTAGE CODE	105	106	112	124	136	148
NOMINAL COIL VOLTAGE	5	6	12	24	36	48
MAX. CONTINUOUS VOLTAGE	6	7	14	29	43	57
PICK-UP VOLTAGE (MAX.)	3.7	4.4	8.7	17.5	26.0	35.0
DROP-OUT VOLTAGE (MIN.)	0.3	0.3	0.7	1.4	2.2	2.9
COIL RESISTANCE (OHMS)	39	55	220	870	1960	3480

Series FS3: Flagship™ Sensitive 2-Amp Relay

This sensitive 150 mW hermetically-sealed DPDT relay has 2 form C contacts and switches up to 60 W/100 VA at 2 amperes, maximum.



Operate Time: 6 ms max. at nominal coil voltage at 25°C.
Release Time: 4 ms max. at nominal coil voltage at 25°C.
Capacitance: Between contacts 2.5 pF.
Dielectric Strength: Between all other mutually insulated points 500 Vrms.
Insulation Resistance: 500 Megohms min.

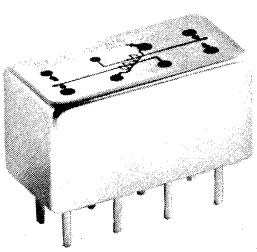
COILS

Resistance: Standard available to 8300 ohms. Standard tolerance ±10%. Other resistances and tolerances available.
Operate Power: 350 milliwatts at 25°C.
Nominal Power Consumption: 280 milliwatts at 25°C.

VOLTAGE CODE	105	106	112	124	136	148
NOMINAL COIL VOLTAGE	5	6	12	24	36	48
MAX. CONTINUOUS VOLTAGE	6	7	14	29	43	57
PICK-UP VOLTAGE (MAX.)	3.7	4.4	8.7	17.5	26.0	35.0
DROP-OUT VOLTAGE (MIN.)	0.25	0.3	0.7	1.4	2.2	2.9
COIL RESISTANCE (OHMS)	90	130	520	2070	4550	8300

Series FS5: Flagship™ 5-Ampere Relay

This 5-ampere DPDT relay has 2 form C contacts and switches up to 150 W/300 VA, 5 amperes, maximum. Sensitivity is 725 mW.



Operate Time: 5 ms max. at nominal coil voltage at 25°C.
Release Time: 3 ms max. at nominal coil voltage at 25°C.
Capacitance: Between contacts 2.5 pF.
Dielectric Strength: Between all other mutually insulated points 500 Vrms.
Insulation Resistance: 500 Megohms min.

COILS

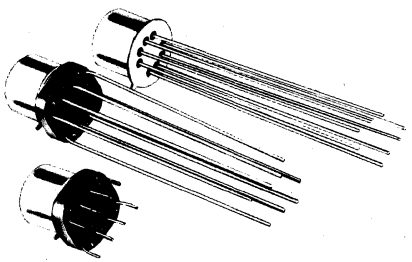
Resistance: Standard available to 1600 ohms. Standard tolerance ±10%. Other resistances and tolerances available.
Operate Power: 725 milliwatts at 25°C.
Nominal Power Consumption: 1.4 Watts at 25°C.

VOLTAGE CODE	105	106	112	124	136	148
NOMINAL COIL VOLTAGE	5	6	12	24	36	48
MAX. CONTINUOUS VOLTAGE	6	7	14	29	43	57
PICK-UP VOLTAGE (MAX.)	3.6	4.3	8.5	17.0	26.0	34.0
DROP-OUT VOLTAGE (MIN.)	0.25	0.3	0.7	1.4	2.2	2.8
COIL RESISTANCE (OHMS)	18	25	100	400	900	1600

RELAY TYPE	GENERAL CHARACTERISTICS	ELECTRICAL CHARACTERISTICS

Series CA:
Commercial TO-5 Case Relay

These sensitive 185 mW 1-ampere TO-5 case DPDT relays, with 2 form C contacts, are available in 3 types: basic relay; with coil-suppression diode (D); and with integral transistor driver and coil-suppression diode (T).



Coil Data: Standard coil resistance available to 1,560 ohms. Design tolerance ±10%.

Contact Resistance: 200 milliohms max., initial.

Operate Time: 4.0 milliseconds max.

Release Time: 3.0 milliseconds max. basic. 6.0 milliseconds max. suppressed. 6.0 milliseconds max. transistor.

Dielectric Strength: 350 Vrms, 60 Hz, all points at sea level except between transistor terminals.

Insulation Resistance: 1,000 megohms min., all points at 500 Vdc.

Contact Capacitance: 0.7 pF typical, between contacts.

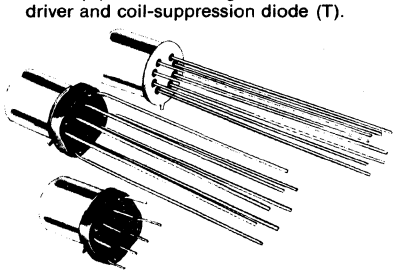
Series: CAW, CAWD, CAWT

Coil Voltage Code	Nominal Coil Voltage (Vdc)	Coil Resistance (ohms) ±10% @25°C	Pick-Up † (Vdc) Max. @25°C	Base Current to †† Turn-on (mAdc) (CAWT only)
-5	5	50	3.6	3.0
-6	6	100	4.2	2.04
-9	9	200	6.5	1.36
-12	12	390	8.4	1.03
-18	18	880	13.0	0.68
-26	26	1560	17.0	0.50

†CAWT — Not Applicable
††Limit Base/Emitter Current to 50 mA max.

Series CS:
Commercial Sensitive TO-5 Case Relay

These ultrasensitive 90 mW 1-ampere DPDT transistor-case relays, with 2 form C contacts, are available in 3 types: basic relay; with coil-suppression diode (D); and with integral transistor driver and coil-suppression diode (T).



Coil Data: Standard coil resistance available to 11,000 ohms. Design tolerance ±10%.

Contact Resistance: 200 milliohms max., initial.

Operate Time: 6.0 milliseconds max.

Release Time: 3.0 milliseconds max. basic. 7.5 milliseconds max. suppressed. 7.5 milliseconds max. transistor.

Dielectric Strength: 250 Vrms, 60 Hz, all points at sea level except between transistor terminals.

Insulation Resistance: 1,000 megohms min., all points at 500 Vdc.

Contact Capacitance: 0.7 pF typical, between contacts.

Series: CSW, CSWD, CSWT

Coil Voltage Code	Nominal Coil Voltage (Vdc)	Coil Resistance (ohms) ±10% @25°C	Pick-Up † (Vdc) Max. @25°C	Base Current to †† Turn-on (mAdc) (CSWT only)
-5	5.0	100	3.6	1.5
-6	6.0	200	4.2	1.00
-9	9.0	400	6.5	0.75
-12	12.0	850	8.4	0.47
-18	18.0	1600	13.0	0.36
-26	26.5	3300	17.0	0.24
-36	36.0	6500	24.0	†††
-48	48.0	11000	32.0	†††

†CSWT — Not Applicable
††Limit Base/Emitter Current to 50 mA max.
†††Consult Factory

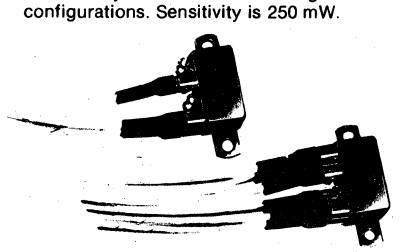
Hi-G Radio Frequency Relays

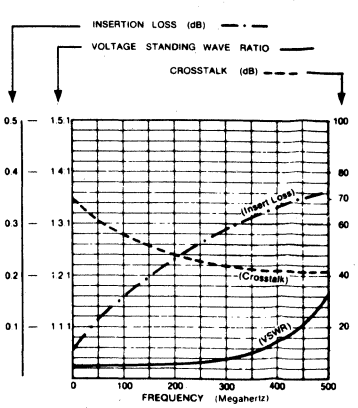
Coaxially terminated and hermetically sealed, these 0-500 MHz relays incorporate a relay design to provide reliable switching functions in the most demanding RF applications. Thousands of testing hours and millions of field operations assure the highest degree of reliability. Two-pole devices are available with either one or both sets of poles cabled. When only one set of poles is cabled, the other set is available for use with pin or hook termination.

RELAY TYPE	OPERATING CHARACTERISTICS	ELECTRICAL CHARACTERISTICS

Series RFK:
75 Watt 1/2 Crystal Can RF Relay

Coaxially-terminated, hermetically-sealed 0 to 500 MHz relays can carry 200 RF watts with low-level to 2 amperes auxiliary switching capability. These relays are available with two terminal styles and three mounting configurations. Sensitivity is 250 mW.





NOTE: Values shown are in a 50 ohm impedance coaxial system.

Voltage Code	106	112	126
Nominal Coil Voltage	6	12	26.5
Max. Continuous Coil Voltage	7.2	14.4	32.0
Max. Pick-up Voltage @ +25°C	3.3	6.5	13.5
Min. Drop-out Voltage @ +25°C	0.3	0.7	1.5
Effective DC Coil Resistance @ +25°C ohms	40	150	675

Hi-G Electronics Division

TIMING & SENSING DEVICES SOLID STATE RELAYS POWER MONITORS

PRODUCT LINES MILITARY/INDUSTRIAL

- Time Delay, Relay Output
- Time Delay, Solid State Output
- Flashers, Relay & Solid State
- Interval Timers
- Solid State Relays
- Custom Electronic Modules
- Power Monitor
- Voltage Sensor (AC & DC)
- Frequency Sensor
- Phase Sensor
- Current Sensor
- Liquid Level Sensor
- Custom Hybrids

QPL CROSS REFERENCE

SOLID STATE RELAYS

JTS5-1	M278750/5
JTS6-1	M278750/6
JTS7-1	M278750/7
JDS8-1	M278750/8
JDS9-1	M278750/9
JPS10-1	M278750/10

TIME DELAYS

6001	M83726/13
6600	M83726/7
6700	M83726/8
6800	M83726/24
6900	M83726/25

SPECIFICATIONS

TYPICAL ELECTRICAL

Input Voltage:	18-31 Vdc, 120/208 Vac
Timing:	50 msec to 600 sec
Timing Tolerance:	+/−10%
Contact Rating:	Dry circuit to 25 Amps
Voltage Sensing:	10-150 Vdc, 50-150 Vac
Frequency Sensing:	50, 60, 400 Hz

TYPICAL ENVIRONMENTAL

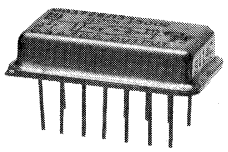
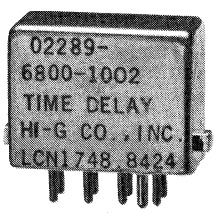
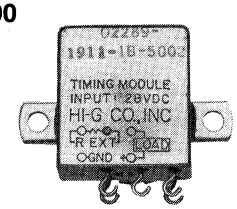
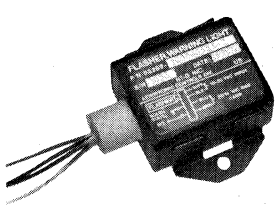
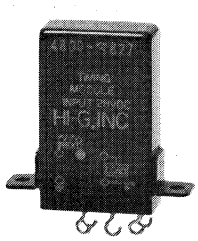
Temperature:	−55C to +85C, 125C
Vibration:	20g's, 10 to 2000 Hz
Shock:	50g's, 11+/−1 msec
Dielectric:	1000 Vrms 60 Hz
Sealing:	Hermetic 1.3 in hg
Life:	100,000 operations

PACKAGING

Hi-G offers P.C. board mount, stud mount, bracket mount, plug in headers, solder hook, connector, etc. Custom packages available. Contact factory.

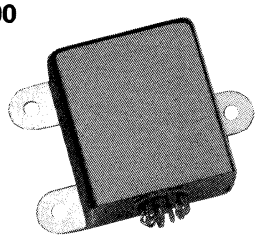
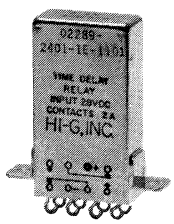
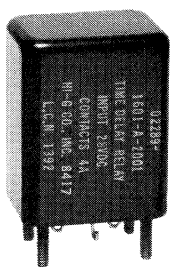
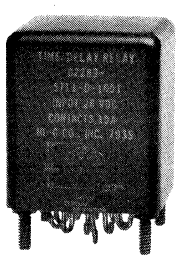
Hi-G Electronics Division

TIME DELAYS WITH SOLID STATE OUTPUT

Series	Function	Input	Output	Technology
6001  **6150**	Delay on Make Fixed	18 Vdc to 31 Vdc	300 mA SPNO SCR to ground	CMOS Digital Hybrid
6800  **6900**	Delay on Make Fixed Delay on Release	20 Vdc to 32 Vdc	150mA SPNO Transistor to B+	CMOS Digital Hybrid
1800  **1900**	Fixed Delay on Make Adjustable	18 Vdc to 31 Vdc	300mA SPNO SCR to ground	CMOS Digital Hybrid
2600 	Flasher Repeat Cycle Fixed	18 Vdc to 31 Vdc	100mA SPNO Transistor to B+ Relay Output available	CMOS Digital Discrete
4800 	Interval Fixed	18 Vdc to 31 Vdc	300mA SPNO Transistor to ground	Analog Discrete
Consult factory for: Custom Electronic Modules				

Hi-G Electronics Division

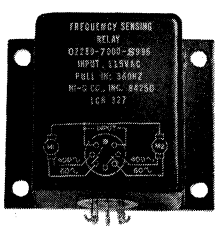
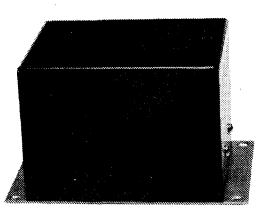
TIME DELAYS WITH RELAY OUTPUT

Series	Function	Input	Output	Technology
6600  **6700**	Delay on Make Fixed Delay on Release	18 Vdc to 31 Vdc	2 Amps DPDT	CMOS Hybrid Digital
2400 	Delay on Make Fixed	18 Vdc to 31 Vdc	2 Amps DPDT	CMOS Digital Hybrid
1600  **1700**	Fixed Delay on Make Adjustable	18/31 Vdc 115 Vac 60Hz/400Hz	4 Amps to 10 Amps SPDT to 4DPT	CMOS Digital Discrete
5600  **5700**	Fixed Delay on Release Adjustable	18 Vdc to 31 Vdc	2 Amps to 10 Amps SPDT to 4DPT	CMOS Digital Discrete
4600 **4700**	Fixed Interval Adjustable	18/31 Vdc 115 Vac 60Hz/400Hz	4 Amps to 10 Amps SPDT to 4DPT	CMOS Digital Discrete

Consult factory for: Custom Time Delay Relay

Hi-G Electronics Division

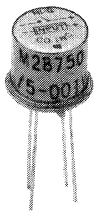
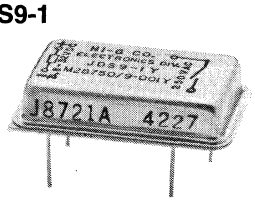
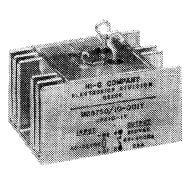
POWER MONITOR, VOLTAGE, PHASE, FREQUENCY, SENSORS

Series	Function	Input Range	Output	Sensing
1310 **1350**	DC Under/Over Voltage Sensors AC	10 Volts to 150 Volts Single phase or 3 phase	2 Amps DPDT	±2½% of set point or less
1400	Phase Sensor	115/208 Line to Line 60Hz/400Hz	2 Amps DPDT	Phase loss or reversal
7000 	Frequency Sensor	95 Vac to 135 Vac Single phase or 3 phase	4 Amps SPDT or DPDT	320/480Hz ±2% of set point 50/60Hz Available
9000 Power Monitor 	AC Under/Over Voltage	80/140 Vac 3 Phase 60/400Hz	1 Amp DPDT Bit test	±1% of set point ±3% field adjustable
	Phase Rotation	80/140 Vac 60/400Hz	1 Amp DPDT Bit test	Phase loss Reversal or missing neutral
	Under/Over Frequency	80/140 Vac 3 Phase 60/400Hz	1 Amp DPDT Bit test	40/480Hz ±1% of set point ±3% field Adjustable

Consult factory for: Custom Voltage, Phase, Frequency, Current Sensors

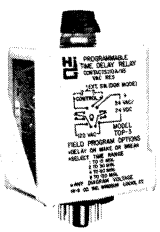
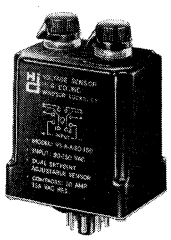
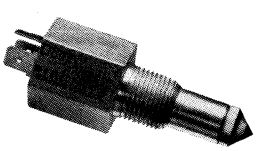
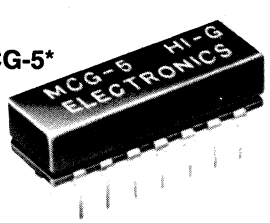
Hi-G Electronics Division

SOLID STATE RELAYS

Series	Function	Input	Output	Technologies
JTS5-1 	Solid State Switch	4.0 Vdc to 7.0 Vdc TTL Compatible	40 Vac/dc 50 mA SPNO	Transformer isolation 1000 Volts P-P
JTS6-1	Solid State Switch	4.0 Vdc to 7.0 Vdc TTL Compatible	40 Vdc 250 mA SPNO	Transformer isolation 1000 Volts P-P
JTS7-1	Solid State Switch	4.0 Vdc to 7.0 Vdc TTL Compatible	250 Vdc 100 mA SPNO	Transformer isolation 1000 Volts P-P
JDS8-1	Solid State Switch	3.0 Vdc to 16.0 Vdc	50 Vdc 600 mA SPNO	Optical isolation 100 Vrms
JDS9-1 	Solid State Switch	3.8 Vdc to 32 Vdc	250 Vac 40-440Hz 1 Amps heat sink 2 Amps SPNO	Optical isolation 1500 Vrms
JPS10-1 	Solid State Switch	4 Vdc to 32 Vdc	250 Vac 45-440Hz 25 Amps SPNO	Optical isolation 1500 Vrms
Consult factory for: Custom SSR's and Switches				

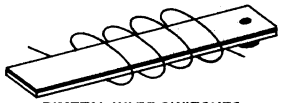
Hi-G Electronics Division

INDUSTRIAL TIMERS, SENSORS, LIQUID LEVEL

Series	Description	Input	Output	Function
TDP 	Multi-programmable Delay on Make Release Timing Adjustable	12Vdc 24Vdc 24Vac 120Vac 240Vac	10 Amp DPDT	.3 to 10 sec 3 to 80 sec 10 to 300 sec 1 to 15 min 2 to 30 min 4 to 60 min 8 to 120 min
VS 	AC/DC Voltage Sensor Under/Over	18-30 Volts 35-60 Volts 90-150 Volts	10 Amps DPDT	Adjustable Delay time 1 sec Repeatibility +1%
PS	Phase Sensor	115/220 Line/line 60/400Hz	2 Amps SPDT	Phase loss Reversal Shorted Missing
LQD 	Liquid Level Sensor	12 Vdc 24 Vdc	200mA or 1 Amp normally open or normally closed	Solid State Switch to Ground Transistor
MCG-5* 	Power on reset 500 msec Fixed	5 Vdc TTL Compatible	20mA sink current for 500 MS	Solid State Switch to Ground Transistor

***Also available in: Hermetic Military Dip Package**

"HOLD-HEET®" PRODUCTS

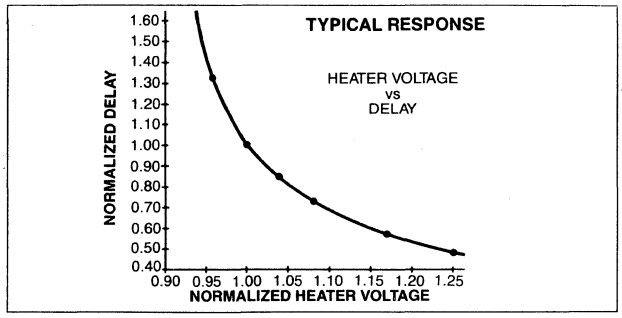


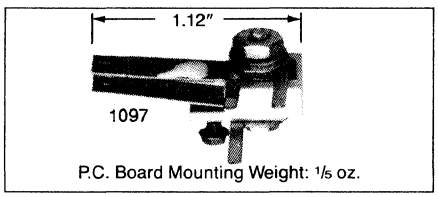
BIMETAL WARP SWITCHES
CUSTOM ENGINEERED • HIGH QUALITY
LOW COST • PRODUCTION QUANTITIES

5011 N. RAVENSWOOD AVENUE
CHICAGO, ILLINOIS 60640
312/728-4454 FAX 312/728-2016
BUSINESS HOURS: 8am-3:30pm
CENTRAL TIME

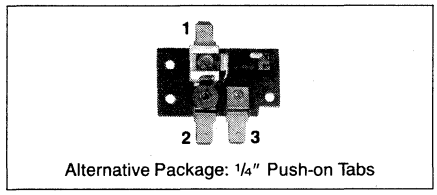
These time delay relays are actuated by heated bi-metallic blade, and thus are
- Immune to transients.
- Independent of wave form.
- Exceptionally low-cost (some models as low as $1.30 in volume).

By using a bi-metallic mating blade, temperature compensation up to −20°F to +150°F can be achieved. All models available with contacts N.O. or N.C. Heater coil can be isolated from contacts, or made common with one contact for greater economy.



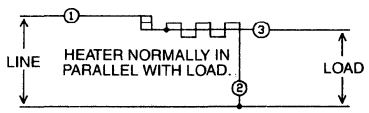


P.C. Board Mounting Weight: 1/5 oz.

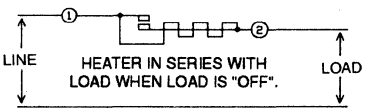


Alternative Package: 1/4" Push-on Tabs

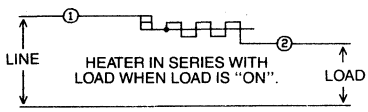
Heater Coil: 4v to 115v AC or DC. 1¼ w. continuous to 5 watts momentary
Contacts: (Non-inductive Loads) AC: 6 to 115v, 35 to 350 ma, 2 to 25 w — DC: 6 to 12v, 35 to 350 ma, 2 to 4 w
Delay: 4 to 90 sec., opening or closing
Alternative Arrangements for use as a Flasher:



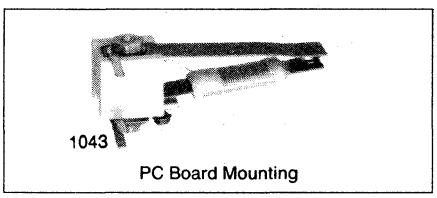
FLASHER OPERATES INDEPENDENT OF LOAD. LOAD IS FULLY "ON" OR "OFF".



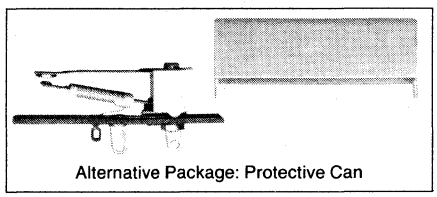
FLASHER IS DEPENDENT ON LOAD. LOAD IS "ON" OR PARTIALLY "OFF".



FLASHER IS DEPENDENT ON LOAD AND MUST BE MATCHED TO IT. LOAD IS "OFF" OR PARTIALLY "ON".

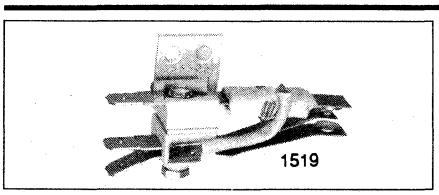


PC Board Mounting

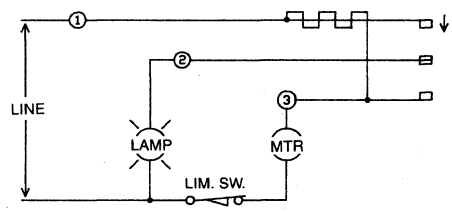


Alternative Package: Protective Can

Heater Coil: 6.3 to 28v AC or DC; 1.5w to 2.25 w. continuous.
Contacts: (Non-inductive Loads) AC: 6 to 115v, 35 to 350 ma, 2 to 40 w — DC: 6 to 12v, 35 to 350 ma, 2 to 4 w
Delay: 20 to 150 seconds, opening or closing



Motor Current Actuated Time Delay



Automatic light time delay switch for use in electric door opener circuits and similar applications. Features include:
- light goes on in a few seconds
- light maintained for 1½ to 2½ minutes
- all 3 blades are same bi-metallic material for good temperature compensation
- shorting blade prevents heater burn-out in case of motor or door malfunction

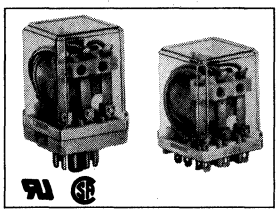
"Hold-Heet" switches provide service in many applications. Any number of recombinations are possible with component elements. This great versatility can result in tremendous savings over magnetic relays or timing motors. Please direct your technical questions to Gifford Neill, Chief Engineer, at 312/837-7709.

idec CORPORATION
Your Switch Specialists

IDEC Relay Selection Guide

IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211
Catalog Requests: 1-800-283-4080, Extension 844.
Telephone: Corporate Office: (408) 747-0550; Fax: (408) 744-9055
Regional Sales Offices: Schaumburg, IL (312) 706-3880; Fort Pierce, FL (305) 461-4494

RR Series



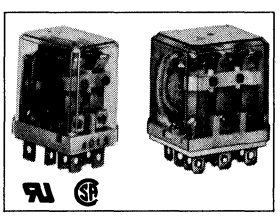
Contacts
Form: 1C, 2C, 3C
Current: 10A
Rating: 10A 240VAC (Resist.)
1/3 HP 240V
1/4 HP 120V
10A 30VDC (Resist.)
Material: Silver
Resistance: 30mΩ max.

Nominal Operating Voltages And DC Coil Resistance (Ω)

6VAC: 4.6	6VDC: 25
12VAC: 20	12VDC: 100
24VAC: 80	24VDC: 400
120VAC: 2,200	48VDC: 1,600
240VAC: 8,930	110VDC: 8,450
Power Consumption: 2.5VA	Power Consumption: 1.5W

Operating Temperature
−22°F to +158°F
Life Expectancy
Mechanical: 10,000,000
Electrical: 500,000
Terminals
Pin/Plug-In
Blade/Plug-In

RH Series



Contacts
Form: 1C, 2C, 3C, 4C
Current: 10A
Rating: 10A 240VAC (Resist.)
1HP 240VAC
10A 30VDC (Resist.)
Material: Silver Cadmium Oxide
Resistance: 50mΩ max.

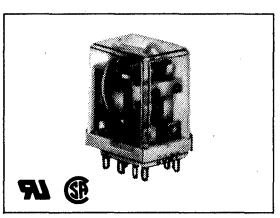
***Nominal Operating Voltages And DC Coil Resistance (Ω)**

6VAC: 9.6	6VDC: 40
12VAC: 40.5	12VDC: 160
24VAC: 156.7	24VDC: 650
120VAC: 4,280	48VDC: 2,600
240VAC: 15,720	110VDC: 12,100
Power Consumption: 1.2VA	Power Consumption: 0.9W

**Specifications for 2C version.*

Operating Temperature
−22°F to +158°F
Life Expectancy
Mechanical: 50,000,000
Electrical: 500,000
Terminals
Blade/Plug-In
P.C. Mount

RM Series



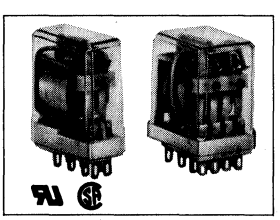
Contacts
Form: 2C
Current: 5A
Ratings: 5A 240VAC (Resist.)
5A 30VDC (Resist.)
Material: Fine Silver
Resistance: 30mΩ max.

Nominal Operating Voltages And DC Coil Resistance (Ω)

6VAC: 9.6	6VDC: 40
12VAC: 40.5	12VDC: 160
24VAC: 156.7	24VDC: 650
120VAC: 4,280	48VDC: 2,600
240VAC: 15,720	110VDC: 12,100
Power Consumption: 1.2VA	Power Consumption: 0.9W

Operating Temperature
−22°F to +158°F
Life Expectancy
Mechanical: 50,000,000
Electrical: 500,000
Terminals
Solder/Plug-In
P.C. Mount

RY Series



Contacts
Form: 2C, 4C
Current: 3A
Rating: 3A 240VAC (Resist.)
3A 30VDC (Resist.)
Material: Silver (Gold-Plated)
Resistance: 50mΩ max.

****Nominal Operating Voltages And DC Coil Resistance (Ω)**

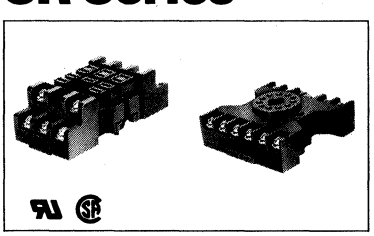
6VAC: 9.6	6VDC: 40
12VAC: 40.5	12VDC: 160
24VAC: 156.7	24VDC: 650
120VAC: 4,280	48VDC: 2,600
240VAC: 15,720	110VDC: 12,100
Power Consumption: 1.2VA	Power Consumption: 0.9W

***Specifications for 4C version.*

Operating Temperature
−22°F to +158°F
Life Expectancy
Mechanical: 50,000,000
Electrical: 200,000
Terminals
Solder/Plug-In
P.C. Mount

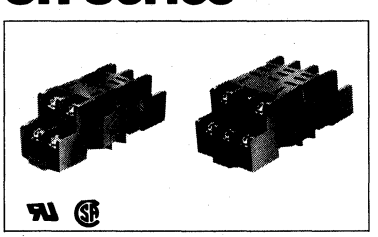
IDEC Selection Guide To Quality "Snap-Mount" Sockets

SR Series



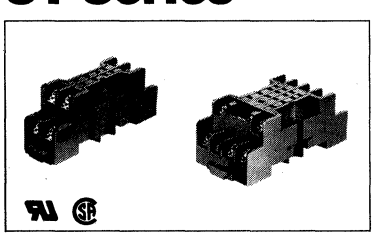
Type: 2-Pole, 8-Pin/Plug-in
3-Pole, 11-Pin/Plug-in
1-3-Pole, 11-Blade/Plug-in
Ratings: 10A 250V-Blade Type
10A 250V-Pin Type
Mounting: DIN Rail, Surface
Compatible IDEC Relay: RR Series

SH Series



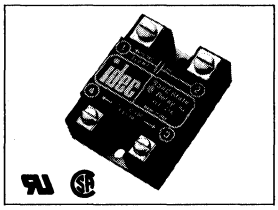
Type: 1-4 Pole, Blade/Plug-in
Ratings: 10A 250V
Mounting: DIN Rail, Surface
Compatible IDEC Relay: RH Series
RH2L Series

SY Series



Type: 2, 4-Pole, Solder/Plug-in
Ratings: 7A 250V
Mounting: DIN Rail, Surface
Compatible IDEC Relay: RM Series
RY Series
RY2L Series

RSS Series Solid State Relays



Input (DC)
Voltage Range: 3–32V DC
Isolation Voltage: 4000V AC (Input to Output)
Output

Current Ratings:	10A	25A	40A
1 Cycle Surge Peak:	100A	250A	650A

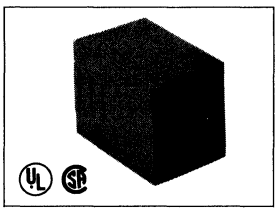
Voltage Range: 24–330V AC

Input (AC)
Voltage Range: 90–280V AC
Isolation Voltage: 4000V AC (Input to Output)
Output

Current Ratings:	10A	25A	40A
1 Cycle Surge Peak:	100A	250A	650A

Voltage Range: 24–330V AC

RTE Series Multi-Function/Range Time Delay Relay

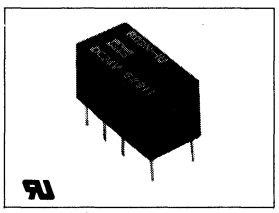


Contacts
Form: 2 Form C, DPDT
Current: 10A
Rating: 10A 240VAC (Res.)
10A, 30VDC
1/6HP 120VAC
1/3HP 240VAC
Operating Voltages
Input: 120VAC
12, 24V AC/DC
Power Consumption: 2.2VA

Timing/Operation
Mode of
Operation: Delay-On-Make/Interval
Delay-On-Break/Single-Shot
Time Range: 1 Sec. to 10 Hrs.
Repeat Accuracy: ±0.25%, 10ms
Reset Time: 100ms or less
Type of Control: Programmable DIP switch and adjustable potentiometer

Operating Temperature
–20°C to +65°C
Mounting
Plug-In
8-Pin, 11-Pin/Blade

RD Series

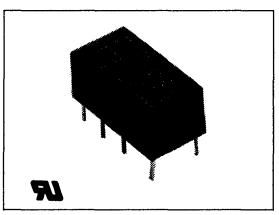


Contacts
Form: 2 Form C
Current: 1.25A, max.
Material: Silver (Gold-Clad)
Resistance: 100mΩ max.
Surge
Withstand Voltage: 1500V (FCC)

Nominal Operating Voltages And DC Coil Resistance (Ω)
3VDC: 22.5
5VDC: 62.5
6VDC: 90
12VDC: 360
24VDC: 1440
48VDC: 5760
Power Consumption: 400mW

Operating Temperature
–30°C to +70°C
Life Expectancy
Mechanical: 50,000,000
Electrical: 500,000
Terminals
P.C. Mount

RW Series

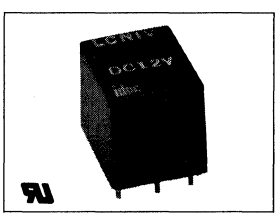


Contacts
Form: 2 Form C
Current: 2A
Rating: 0.5A, 110VAC
2A, 30VDC
Material: Silver (Gold-Clad)
Resistance: 50mΩ max.
Surge
Withstand Voltage: 1,500V (FCC)

Nominal Operating Voltages And DC Coil Resistance (Ω)
1.5VDC: 11.3
3VDC: 45
5VDC: 125
6VDC: 180
12VDC: 720
24VDC: 2880
48VDC: 5760
Power Consumption: 200mW

Operating Temperature
–40°C to +70°C
Life Expectancy
Mechanical: 10,000,000
Electrical: 50,000
Terminals
P.C. Mount

LCN Series

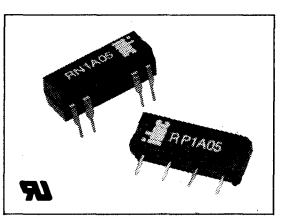


Contacts
Form: 1C
Current: 1A, 5A, 10A
Ratings: 1A, 120VAC (Resist.)
1A 30VDC (Resist.)
5A 120VAC (Resist.)
5A 30VDC (Resist.)
Material: Silver 1A
Silver Alloy (5A)
Resistance: 100mΩ max.

Nominal Operating Voltages And DC Coil Resistance (Ω)
5VDC: 70
6VDC: 100
12VDC: 400
24VDC: 1,600
48VDC: 4,500
Power Consumption: 0.36W

Operating Temperature
–22°F to +158°F
Life Expectancy
Mechanical: 10,000,000
Electrical: 100,000
Terminals
P.C. Mount

RN/RP Series/Dry Reed Relay



Contacts
Form: 1A, 2A, 1B, 1C (DIP)
1A (SIP)
Current: (1A, 1B, 2A) 0.50A
(1C) 0.25A
Ratings: 0.50A, 100V AC/DC
0.25A, 100V AC/DC
Material: Ruthenium
Resistance: 200mΩ max.

Nominal Operating Voltages And DC Coil Resistance (Ω)
(1 Form C)
5VDC: 200
12VDC: 500
24VDC: 2150
Power Consumption: 125-268mW

Life Expectancy
Electrical: 20,000,000
Terminals
P.C. Mount

IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94098-2211,
Telephone: Corporate Office (408) 747-0550, Catalog Requests 1-800-283-4030, Ext. 844, Fax, (408) 844-9055

SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States (ANSI) American National Standards Institute

United States (NEMA) National Electrical Manufacturers Association

Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

Yugoslavia Federal Institute of Standardization

International IOR Rectifier

MICROELECTRONIC POWER IC RELAYS

ChipSwitch® Solid State Relay

UL, CSA, VDE Rated

The ChipSwitch relays utilize power integrated circuits for AC power line switching while maintaining turn-on at zero voltage crossing and turn-off at zero current crossing. They are a compact, low cost, and highly reliable interface for isolating and switching AC loads such as solenoids, valves, lamps, contactors, small motors, and heaters from low level DC signals.

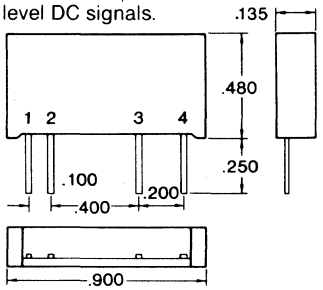


Figure 1 ChipSwitch SP

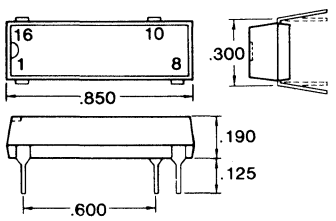


Figure 2 ChipSwitch DP

SERIES	PART NUMBER	Operating Voltage Range V(RMS)	Maximum Load Current @40°C A(RMS)	Trans. Over-Volt V(Pk)	Turn-On Signal (DC)	Outline Drawing	Tech. Bulletin No.
SP 1 FORM A	SP1110	20-140	1.0 Free Standing	300	5mA	Figure 1	PD1.018
	SP1210	20-140		300	10mA		
	SP2110	20-280		450	5mA		
	SP2210	20-280	3.0 With Heat Sink	450	10mA		
	SP6110	20-280		600	5mA		
	SP6210	20-280		600	10mA		
DP 1 FORM A	DP1110	20-140	1.0	300	5mA	Figure 2	PD1.017
	DP1210	20-140		300	10mA		
	DP1610	20-140		300	3.5V		
	DP2110	20-280		450	5mA		
	DP2210	20-280		450	10mA		
	DP2610	20-280		450	3.5V		
	DP6110	20-280		600	5mA		
	DP6210	20-280		600	10mA		
	DP6610	20-280		600	3.5V		
CS 1 FORM A	CS5005	20-280	0.3	500	5mA	Figure 3	PD1.016
	CS5010	20-280		500	10mA		
	CS6005	20-280		600	5mA		
	CS6010	20-280		600	10mA		

GENERAL CHARACTERISTICS	SP	DP	CS	UNITS
Dielectric Strength Input/Output	3750	4000	4000	VRMS
Min. off state dv/dt @ rated V 25°C	600		1200	V/μ sec
Max. off state leakage	10			μ A
Power factor range	0.5 to 1	0.2 to 1		—
Ambient operating temperature	-30 to +85			°C

BOSFET® PhotoVoltaic Relay

International Rectifier Photo-Voltaic Relays utilize a unique power integrated circuit termed a BOSFET to form a solid state replacement for signal level electromechanical relays. They feature high speed, zero offset voltage, low pick-up power, miniaturization, and are widely applied in instrumentation, multiplexing, automatic test equipment, thermocouple switching and telecommunications for general purpose switching of AC/DC analog and digital signals.

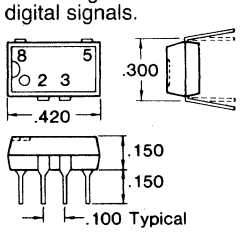


Figure 3 ChipSwitch CS, BOSFET PVD & PVA

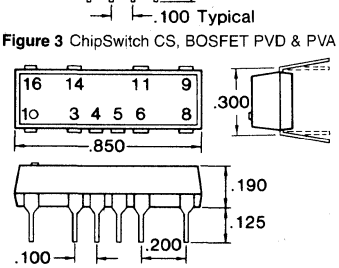


Figure 4 BOSFET PVR

SERIES	PART NUMBER	Operating Voltage Range V(Pk)	Max. On-State Res. @ 25°C Ohms AC	Max. On-State Res. @ 25°C Ohms DC	Max Load Current @ 40°C (DC) mA	Nom. Control Current (DC) mA	Min. Off-State Res. Ohms	Outline Drawing	Tech. Bulletin No.
PVR 2 FORM A	PVR1300	+100	5.0	1.5	600	10	10^8	Figure 4	PD1.027
	PVR1301	+100	5.0	1.5	600		10^{10}		PD1.027
	PVR2300	+200	24	6.0	260		10^8		PD1.028
	PVR3300	+300	24	6.0	260		10^8		PD1.028
	PVR3301	+300	24	6.0	260		10^{10}		PD1.028
PVA 1 FORM A	PVA1052	±100	35	35	70	5.0	10^8	Figure 3	PD1.019
	PVA1054	±100	35	35	70	5.0	10^{10}		PD1.019
	PVA1352	±100	5.0	5.0	250	5.0	10^8		PD1.020
	PVA1354	±100	5.0	5.0	250	5.0	10^{10}		PD1.020
	PVA2352	±200	24	24	130	5.0	10^8		PD1.021
	PVA3324	±300	24	24	130	2.0	10^{10}		PD1.021
	PVA3354	±300	24	24	130	5.0	10^{10}		PD1.021
	PVAZ172	±60	0.5	0.5	1000	10	10^8		PD1.022
PVD 1 FORM A	PVD1052	+100		8.0	160	5.0	10^8	Figure 3	PD1.023
	PVD1054	+100		8.0	160	5.0	10^{10}		PD1.023
	PVD1352	+100		1.5	500	5.0	10^8		PD1.024
	PVD1354	+100		1.5	500	5.0	10^{10}		PD1.024
	PVD2352	+200		6.0	220	5.0	10^8		PD1.025
	PVD3354	+300		6.0	220	5.0	10^{10}		PD1.025
	PVDZ172	+60		0.25	1400	10	10^8		PD1.026

GENERAL CHARACTERISTICS	PVR	PVA	PVD	UNITS
Dielectric Strength Input/Output	1500	1500 and 4000		VRMS
Min. off state dv/dt @ rated V 25°C	1000			V/μ sec
Max. thermal offset voltage @ 5mA control	0.2			μV
Output	AC or DC	AC or DC	DC	—
Ambient operating temperature	-40 to +85			°C

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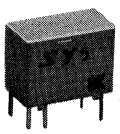
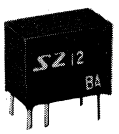
TAKAMISAWA ELECTRIC CO., LTD.

Sub Miniature Printed Circuit Board Relays

SY/SZ RELAYS

1 Amp SPDT
L — 0.492″,
W — 0.291″,
H — 0.374″





CONTACT DATA

Arrangement — 1 Form C

Material — Gold overlay silver-palladium

Resistance — Max. 100 mΩ (initial value)

Ratings — 0.5A, 120V AC or 1A, 24V DC (resistive) switched
2.0A carrying curent

Life Expectancy — Mechanical: Min. 5 million operations
Electrical: SZ Min. 200,000 operations at rated load
SY Min. 150,000 operations at rated load

COIL DATA

Voltages — 1.5 to 24V DC

Power (at 20°C) —
SZ Operate — 0.15 watt (0.16 watt for 18V coil, 0.18 watt for 24V coil)
Nominal — 0.3 watt (0.32 watt for 18V coil, 0.36 watt for 24V coil)
SY Operate — 0.075 watt
Nominal — 0.15 watt

Operate (at 20°C) — 70% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — 100 MΩ minimum at 500V DC

Dielectric Strength — 500V AC (50, 60 Hz), between open contacts
1000V AC between contacts and coil

Temperature Range — SZ −40°C to +70°C (18V coil: −30°C to +65°C, 25V coil; −30°C to +60°C) (at nominal voltage)
SY −40°C to +90°C

Time Values (approx.) — Operate 1.5 mS, Release 1 mS (at nominal voltage)

Vibration Resistance — 20G (10 ~ 300 Hz) amplitude 3 mm

Shock Resistance — 50G

Mounting — For direct printed circuit mounting on grid spacing of 2.54 mm (0.1 in.)

Approximate Weight — 1.7 gr (0.06 oz.)

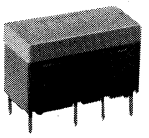
Enclosure — Polybutylene terephthalate (PBT)

Surge Strength — 1000V

Nominal Coil Voltage	Coil Resistance	Operate Voltage	Type No.	List Price
3	30	2.1	SZ-3W	$2.66
5	**83**	**3.5**	**SZ-5W**	**$2.66**
6	100	3.9	SZ-6W	$2.66
9	270	6.3	SZ-9W	$2.66
12	**480**	**8.4**	**SZ-12W**	**$2.66**
18	1000	12.6	SZ-18W	$2.66
24	**1600**	**16.8**	**SZ-24W**	**$2.66**
5	**167**	**3.5**	**SY-5**	**$2.93**
6	240	4.2	SY-6	$2.93
9	540	6.3	SY-9	$2.93
12	**960**	**8.4**	**SY-12**	**$2.93**

RY RELAY

1 Amp DPDT
L — 0.795″,
W — 0.386″,
H — 0.472″



CONTACT DATA

Arrangement — 2 Form C, 2 Form D

Material — Gold overlay silver-palladium

Resistance — Max. 100 mΩ (initial)

Ratings — 0.5A 120V AC or 1A 24V DC (resistive)

Life Expectancy — Mechanical: Min. 20 million operations
Electrical: Min. 500,000 operations at 1A 24V DC
Min. 200,000 operations at 0.5A 120V AC

COIL DATA

Voltages — 4.5 to 48V DC

Power (at 20°C) —
Operate — 0.075 watt (0.098 watt for 18V, 24V coil, 0.138 watt for 48V coil)
Nominal — 0.15 watt (0.2 watt for 18V, 24V coil, 0.3 watt for 48V coil)

Operate (at 20°C) — 68 ~ 71% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — 1000 MΩ min. at 500V DC

Dielectric Strength — 500V AC between open contact
1000V AC between all other conductors

Temperature Range — −40°C ~ +85°C at nominal voltage

Surge Strength — 1500V between all conductors

Time Values (max.) — Operate 6 ms, Release 3 ms at nominal voltage

Vibration Resistance — 10G (10 ~ 55 Hz)

Shock Resistance — 10G 11 ±1 ms) — Unerror, 100G (6 ±1 ms) — Destruction

Enclosure — Polybutylene terephthalate (PBT)

Standard Coil and Contact Combination (20°C)

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code	List Price
B-M (2 form C)					
5	**3.6**	**12.5**	**167**	**RY-5W**	**$3.73**
6	4.3	15.0	240	RY-6W	$3.73
9	6.4	22.5	540	RY-9W	$3.73
12	**8.5**	**30.0**	**960**	**RY-12W**	**$3.73**
24	**16.8**	**51.6**	**2880**	**RY-24W**	**$3.73**
48	32.6	84.0	7680	RY-48W	$4.62
M-B (2 form D)					
5	**3.3**	**7.1**	**55**	**RY-5D**	**$4.17**
6	4.0	8.5	80	RY-6D	$4.17
9	5.9	12.8	180	RY-9D	$4.17
12	**7.9**	**17.0**	**320**	**RY-12D**	**$4.17**
24	**15.8**	**34.1**	**1280**	**RY-24D**	**$4.17**
48	31.8	65.8	4800	RY-48D	$5.06

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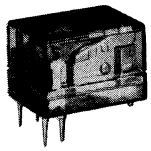
TAKAMISAWA ELECTRIC CO., LTD.

Sub Miniature Printed Circuit Board Relays

MZ RELAY

1 Amp SPDT
L — 0.606″,
W — 0.449,
H — 0.433″



CONTACT DATA

Arrangement — 1 Form C
Material — Gold overlay silver-palladium alloy
Resistance — 100 milliohms maximum (initial value)
Ratings — 50μ amps to 1 amp at 30V DC or 120V AC, resistive
2A maximum carrying current
Life Expectancy — Mechanical: 20 million operations
Electrical: 500,000 operations minimum at 1 amp 24V DC resistive load
200,000 operations minimum at 0.5 amps 120V AC resistive load

COIL DATA

Voltages — 1.5 to 24 volts DC
Power (at 20°C) —
Standard type: Operate—0.22 watt, Nominal—0.45 watt, Maximum—1 watt
High sensitive type: Operate—0.1 watt, Nominal—0.2 watt, Maximum—1 watt
Operate (at 20°C) — 70% of nominal voltage
Duty — Continuous

GENERAL DATA

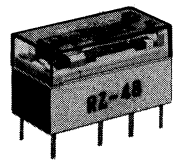
Insulation Resistance — 100 megohms minimum at 500V DC
Dielectric Strength — 500V AC (50/60 Hz), between all insulated elements
Temperature Range — Standard type: −40°C to +55°C
(at nominal voltage) High sensitive type: −30°C to +75°C
Time Values — Operate <3 ms standard, <6 ms sensitive; release <1 ms
Mounting — For direct printed circuit mounting on grid spacing of 2.54 mm (0.1 in.) up to board thickness of 2.5 mm (0.98 in.)
Approximate Weight — 3.5 gr. (0.12 oz.)
Enclosure — Standard — polycarbonate
Washable or sealed — PBT

Standard Coil and Contact Combination (20°C)

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code	List Price
Standard Types					
1.5	1.05	2.0	5	MZ-1.5HG	$2.44
3	2.1	4.1	20	MZ-3HG	$2.44
5	**3.5**	**6.8**	**56**	**MZ-5HG**	**$2.44**
6	4.2	8.1	80	MZ-6HG	$2.44
9	6.3	12.2	180	MZ-9HG	$2.44
12	**8.4**	**16.2**	**320**	**MZ-12HG**	**$2.44**
24	**16.8**	**32.4**	**1280**	**MZ-24HG**	**$2.44**
High Sensitive Types					
1.5	1.05	3.0	12	MZ-1.5HS	$2.62
3	2.1	6.0	45	MZ-3HS	$2.62
5	**3.5**	**10.0**	**120**	**MZ-5HS**	**$2.62**
6	**4.2**	**12.0**	**180**	**MZ-6HS**	**$2.62**
9	6.3	18.0	400	MZ-9HS	$2.62
12	**8.4**	**24.0**	**700**	**MZ-12HS**	**$2.62**
24	**16.8**	**48.0**	**2800**	**MZ-24HS**	**$2.62**
Latching Types					
3	2.1	NA	5.7	MZL-3	$3.64
5	3.5	NA	15	MZL-5	$3.64
6	4.2	NA	21	MZL-6	$3.64
9	6.3	NA	50	MZL-9	$3.64
12	**8.4**	**NA**	**87**	**MZL-12**	**$3.64**
24	16.8	NA	350	MZL-24	$3.64

RZ/RZL RELAYS

2 Amp DPDT
L — 0.795″,
W — 0.386″,
H — 0.457″



CONTACT DATA

Arrangement — DPDT (B-M) — RZ, RZ( )W Type
Material — Gold overlaid silver-palladium alloy
Max. Switching Power —
30W/60VA — Single Contact
30W/50VA — Bifurcated contact at resistive load
Max. Switching Current —
2A AC or DC — Single Contact
1A AC or DC — Bifurcated contact at resistive load
Max. Switching Voltage —
150V DC/125V AC — Single Contact
100V DC/90V AC — Bifurcated contact at resistive load
Contact Resistance (Pin-pin) — 100mΩ Max.
Capacitance — 1.5PF max. between open contact
0.5PF max. between adjacent change-over contact
Life Expectancy —
Mechanical: 20 million operations — Single Contact
15 million operations — Bifurcated contact
Electrical: 0.5 million operations at 1.25A 24V DC or 0.4A 125V AC at resistive load — Single contact
0.5 million operations at 0.7A 24V DC or 0.25A 125V AC at resistive load — Bifurcated contact

COIL DATA

Nominal Voltage — 3 to 48 V DC — RZ, RZ( )W Type,
3 to 24V DC — RZ1, RZ1( )W Type
Power (at 20°C) — Nominal: 515 ~ 560 mW — RZ, RZ( )W Type,
Operate: 200 ~ 324 mW — RZ, RZ( )W Type
Max: 1050 mV
Temperature Range — −40°C ~ +65°C — RZ RZ( )W Type
(at nominal voltage) −40°C ~ +75°C — RZ1 RZ1( ) Type

GENERAL DATA

Dielectric Strength — 500V AC (50/60 Hz) between open contacts, 1000V AC contact-coil
Insulation Resistance — 1000 MΩ min. at 500V DC
Timing — Operate <4 ms, release <2
Bounce Time — Approx. 1 ms on operate
Approx. 4 ms on release
Vibration Resistance — 10 to 60 Hz amplitude 1.5 mm (10G)
Shock Resistance — Destruction shock: 100G (11 ms ±1 ms)
Unerror shock: 10G (11 ms ± 1 ms)
Surge Strength — 1500V AC between all conductors

Standard Coil and Contact Combinations (20°C)

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code	List Price
Standard Types					
5	**3.2**	**7.0**	**45**	**RZ-5**	**$3.42**
6	**3.8**	**8.4**	**66**	**RZ-6**	**$3.42**
9	5.1	12.6	140	RZ-9	$3.42
12	**7.6**	**16.8**	**280**	**RZ-12**	**$3.42**
24	**15.2**	**33.6**	**1070**	**RZ-24**	**$3.42**
48	**36.0**	**67.2**	**4000**	**RZ-48**	**$3.82**
Latching Types					
5	3.2	NA	8.4	RZL-5	$4.57
6	3.8	NA	12	RZL-6	$4.57
9	5.7	NA	27	RZL-9	$4.57
12	**7.6**	**NA**	**52**	**RZL-12**	**$4.57**
24	15.2	NA	192	RZL-24	$4.57
48	36.0	NA	820	RZL-48	$4.97

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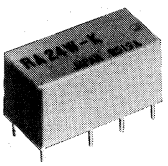
TAKAMISAWA ELECTRIC CO., LTD.

Sub Miniature Printed Circuit Board Relays

RA RELAY



1 Amp DPDT Relay
L — 0.795″
W — 0.394″
H — 0.394″

CONTACT DATA

Arrangement — 2 Form C (DPDT)
Material — Gold overlaid silver palladium alloy vs silver palladium alloy
Resistance — Max. 100 mΩ (Initial)
Rating — 24V DC 1A, or 120V AC 0.5A
Life Expectancy — Mechanical: Min. 20 million operations
Electrical: Min. 500,000 operations at 24V DC 1A
Min. 200,000 operations at 120V AC 0.5A
Max. Carrying Current — 2A

COIL DATA

Voltages — 1.5 to 48V DC
Power (at 20°C) — Operate: Standard 100—200 mW
Single winding latching 35~100 mW
Double winding latching 75~180 mW
Nominal: Standard 200~400 mW
Single winding latching 75~200 mW
Double winding latching 150~360 mW
Operate (at 20°C) — Less than 70% of nominal voltage
Duty — Continuous

GENERAL DATA

Insulation Resistance — 1000 MΩ at 500V DC
(Expect between P & S coil)
Dielectric Strength — 1000V AC between open contact
1500V AC between all other conductors
(Expect between P & S coil)
Temperature Range — −40°C~+80°C (RA-W, RA-WN, RAL-W, RAL-DW, RAL-WP, RAL-DWP)
−40°C~+70°C (RA-WM, RAL-DWM), at nominal voltage, Non carring Contact
Surge Strength — 1500V between coil and contact, adjacent contacts
Time Value (Max.) — Operate: (RA-WM, RAL-DWM) 4 mS
(RA-W, RA-WN, RAL-W, RAL-DWN, RAL-WP, RAL-DWP) 6 mS
Release: (RA-WM) 3 mS
(RA-W, RA-WN, RAL-DWM) 4 mS
(RAL-W, RAL-DWN, RAL-WP, RAL-DWP) 6 mS, at nominal voltage
Vibration Resistance — 30G (10~55 Hz) Unerror
30G (10~55 Hz) Destruction
Shock Resistance — 50G (11 ±1 mS) Unerror
100G (11 ±1 mS) Destruction
Enclosure — Polybutylene terephthalate (PBT)

Ordering Code		Nominal Coil Voltage (VDC)	Coil Resistance ±10% at 20°C(Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
RA( )W-K TYPE						
Non-Latching						
RA	1.5W-K	1.5	15	+1.0	+0.15	$4.17
RA	3W-K	3	60	+2.0	+0.3	$4.17
RA	4.5W-K	4.5	135	+3.1	+0.45	$4.17
RA	**5W-K**	**5**	**167**	**+3.4**	**+0.5**	**$4.17**
RA	6W-K	6	240	+4.0	+0.6	$4.17
RA	9W-K	9	540	+6.1	+0.9	$4.17
RA	**12W-K**	**12**	**900**	**+8.1**	**+1.2**	**$4.17**
RA	18W-K	18	2160	+12.3	+1.8	$4.17
RA	**24W-K**	**24**	**2880**	**+16.1**	**+2.4**	**$4.17**
RA	**48W-K**	**48**	**11520**	**+32.2**	**+4.8**	**$5.02**

Ordering Code		Nominal Coil Voltage (VDC)	Coil Resistance ±10% at 20°C(Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
RA( )W-K TYPE) (Continued)						
Single Winding Latching						
RAL	1.5W-K	1.5	30	+1.0	−1.0	$4.80
RAL	3W-K	3	120	+2.1	−2.1	$4.80
RAL	4.5W-K	4.5	270	+3.1	−3.1	$4.80
RAL	5W-K	5	335	+3.4	−3.4	$4.80
RA	6W-K	6	480	+4.1	−4.1	$4.80
RAL	9W-K	9	1080	+6.3	−6.3	$4.80
RAL	**12W-K**	**12**	**1920**	**+8.3**	**−8.3**	**$4.80**
RAL	18W-K	18	4320	+12.5	−12.5	$4.80
RAL	24W-K	24	5760	+16.6	−16.6	$4.80
RAL	48W-K	48	11520	+21.0	−21.0	$5.73
Double Winding Latching						
RAL	D1.5W-K	1.5 P/S	15	+1.0*	+1.0*	$5.06
RAL	D3W-K	3 P/S	60	+2.0*	+2.0**	$5.06
RAL	D4.5W-K	4.5 P/S	135	+3.1*	+3.1**	$5.06
RAL	**D5W-K**	**5 P/S**	**167**	**+3.4***	**+3.4****	**$5.06**
RAL	D6W-K	6 P/S	240	+4.0*	+4.0**	$5.06
RAL	D9W-K	9 P/S	540	+6.1*	+6.1*	$5.06
RAL	**D12W-K**	**12 P/S**	**960**	**+8.1***	**+8.1****	**$5.06**
RAL	18W-K	18 P/S	2160	+12.3*	+12.3*	$5.06
RAL	**D24W-K**	**24 P/S**	**2880**	**+16.1***	**+16.1****	**$5.06**
RAL	D48W-K	48 P/S	11520	+32.2*	+32.2*	$7.68
RA( )WN-K TYPE						
Non-Latching						
RA	1.5WN-K	1.5	11.3	+1.0	+0.15	$4.08
RA	3WN-K	3	45	+2.0	+0.3	$4.08
RA	4.5WN-K	4.5	100	+3.1	+0.45	$4.08
RA	5WN-K	5	125	+3.4	+0.5	$4.08
RA	6WN-K	6	180	+4.0	+0.6	$4.08
RA	9WN-K	9	405	+6.1	+0.9	$4.08
RA	12WN-K	12	720	+8.1	+1.2	$4.08
RA	18WN-K	18	1620	+12.3	+1.8	$4.08
Double Winding Latching						
RAL	D1.5WM-K	1.5 P/S	12.5	+1.0*	+1.0**	$4.93
RAL	D3WM-K	3 P/S	50	+2.0*	+2.0**	$4.93
RAL	D4.5WM-K	4.5 P/S	113	+3.1*	+3.1**	$4.93
RAL	D5WM-K	5 P/S	139	+3.4*	+3.4**	$4.93
RAL	D6WM-K	6 P/S	200	+4.0*	+4.0**	$4.93
RAL	D9WM-K	9 P/S	450	+6.1*	+6.1**	$4.93
RAL	D12WM-K	12 P/S	800	+8.1*	+8.1**	$4.93
RAL	D18WM-K	18 P/S	1800	+12.3*	+12.3**	$4.93
RA( )WM-K TYPE						
Non-Latching						
RA	1.5WM-K	1.5	5.63	+0.9	+0.15	$4.00
RA	3WM-K	3	22.5	+1.9	+0.3	$4.00
RA	4.5WM-K	4.5	50.6	+2.9	+0.45	$4.00
RA	**5WM-K**	**5**	**62.5**	**+3.3**	**+0.5**	**$4.00**
RA4	6WM-K	6	90.0	+3.9	+0.6	$4.00
RA4	9WM-K	9	203.0	+5.9	+0.9	$4.00
RA	**12WM-K**	**12**	**360.0**	**+7.9**	**+1.2**	**$4.00**
RA	18WM-K	18	810.0	+11.8	+1.8	$4.00
RA	**24WM-K**	**24**	**1440**	**+15.8**	**+2.4**	**$4.00**
RA	**48WM-K**	**48**	**5760**	**+31.6**	**+4.8**	**$4.88**
Double Winding Latching						
RAL	1.5WM-K	1.5 P/S	6.2	+1.0*	+1.0**	$4.88
RAL	D3WM-K	3 P/S	25	+2.0*	+2.0**	$4.88
RAL	D4.5WM-K	4.5 P/S	56	+3.0*	+3.0**	$4.88
RAL	**D5WM-K**	**5 P/S**	**69**	**+3.3***	**+3.3****	**$4.88**
RAL	D6WM-K	6 P/S	100	+4.0*	+4.0**	$4.88
RAL	D9WM-K	9 P/S	225	+6.0*	+6.0*	$4.88
RAL	**D12WM-K**	**12 P/S**	**400**	**+8.0***	**+8.0****	**$4.88**
RAL	18WM-K	18 P/S	900	+12.0*	+12.0**	$4.88
RAL	**D24WM-K**	**24 P/S**	**1600**	**+16.0***	**+16.0****	**$4.88**
RAL	D48WM-K	48 P/S	6400	+32.1*	+32.1*	$7.50

Notes: • If correct polarity is not applied to the coil terminals, relay does not operate properly.
• To release latched contact, polarity to be applied to coil terminals should be reversed.

* P only. ** S only.

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TAKAMISAWA ELECTRIC CO., LTD.

Sub Miniature Printed Circuit Board Relays

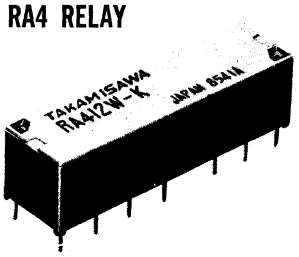
RA4 RELAY

1 Amp 4PDT

L — 1.387″,

W — 0.390″,

H — 0.433″



CONTACT DATA

Arrangement — 4 Form C (4PDT)

Material — Gold overlaid silver palladium alloy vs silver palladium alloy

Resistance — Max. 100 mΩ

Ratings — 120V AC 0.5A, 24V DC 1A (Resistive)

Max. Current — 2A

Life Expectancy Mechanical — Min. 20 million operations

Electrical — Min. 500,000 operations at 24V DC
Min. 200,000 operations at 120V AC 0.5A

COIL DATA

Voltages — 1.5 to 48V DC Power (at 20°C)

Type	RA4, RA4L		RA4-M, RA4L-M	
	Operate	Nominal	Operate	Nominal
Single Winding Non Latching	0.1W	0.2W	0.2W	0.4W
Single Winding Latching	0.045W	0.09W	0.09W	0.18W
Double Winding Latching	0.09W	0.18W	0.18W	0.36W

Operate (at 20°C) 70% of nominal voltage

Pulse Length—20ms min.

GENERAL DATA

Insulation Resistance — 1000 mΩ min. at 500V DC

Dielectric Strength — 1000V AC between open contacts
1500V AC btween all other conductors

Temperature Range — −40°C ~ +80°C (RA4, RA4L),
−40°C ~ +70°C (RA4-M, RA4L-M)

Surge Strength — 1500V between coil and contact, adjacent contacts

Time Value — Operate: 6 msec max.
Release: 4 msec max.

Vibration Resistance — 30G (10 ~ 55 Hz) Destructive
20G (10 ~ 55 Hz) Unerring
} reference value

Shock Resistance — 100G (6 ±1 msec) Destructive
30G (11 ±1 msec) Unerring
} reference value

Enclosure — PBT

ORDERING INFORMATION

RA4 L D 12 W M —K

- Enclosure K: Washable
- Coil Sensitivity Nill: HighSensitive Power, M: Standard
- Contact W: Bifurcated
- Nominal Coil Voltage
- Coil Winding Nill: Single Winding, D: Double Windings
- Type of Relays Nill: Non Latching Type, L: Latching Type
- Type

Ordering Code		Nominal Coil Voltage (VDC)	Coil Resistance ±10% at 20°C(Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
Standard						
RA4	1.5W-K	1.5	11	+1.0	0.15	$ 9.81
RA4	3W-K	3	45	+2.0	0.3	$ 9.81
RA4	4.5W-K	4.5	101	+3.0	0.45	$ 9.81
RA4	**5W-K**	**5**	**125**	**+3.4**	**0.5**	**$ 9.81**
RA4	6W-K	6	180	+4.1	0.6	$ 9.81
RA4	9W-K	9	405	+6.1	0.9	$ 9.81
RA4	**12W-K**	**12**	**720**	**+8.2**	**1.2**	**$ 9.81**
RA4	18W-K	18	1620	+12.3	1.8	$ 9.81
RA4	**24W-K**	**24**	**2880**	**+16.4**	**2.4**	**$ 9.81**
RA4	**48W-K**	**48**	**11520**	**+32.9**	**4.8**	**$11.77**
RA4	1.5WM-K	1.5	5.63	+1.0	0.15	$ 9.32
RA4	3WM-K	3	22.5	+2.0	0.3	$ 9.32
RA4	4.5WM-K	4.5	50.6	+3.0	0.45	$ 9.32
RA4	**5WM-K**	**5**	**62.5**	**+3.4**	**0.5**	**$ 9.32**
RA4	6WM-K	6	90	+4.1	0.6	$ 9.32
RA4	9WM-K	9	203	+6.1	0.9	$ 9.32
RA4	**12WM-K**	**12**	**360**	**+8.2**	**1.2**	**$ 9.32**
RA4	18WM-K	18	810	+12.3	1.8	$ 9.32
RA4	**24WM-K**	**24**	**1440**	**16.4**	**2.4**	**$ 9.32**
RA4	**48WM-K**	**48**	**5760**	**32.9**	**4.8**	**$11.19**
Single winding latching						
RA4L	1.5W-K	1.5	25	+1.0	−1.0	$10.21
RA4L	3W-K	3	100	+2.1	−2.1	$10.21
RA4L	4.5W-K	4.5	225	+3.1	−3.1	$10.21
RA4L	5W-K	5	278	+3.5	−3.5	$10.21
RA4L	6W-K	6	400	+4.2	−4.2	$10.21
RA4L	9W-K	9	900	+6.3	−6.3	$10.21
RA4L	**12W-K**	**12**	**1600**	**+8.4**	**−8.4**	**$10.21**
RA4L	18W-K	18	3600	+12.6	−12.6	$10.21
RA4L	24W-K	24	6400	+16.8	−16.8	$10.21
RA4L	48W-K	48	25600	+33.6	−33.6	$12.17
RA4L	1.5WM-K	1.5	12.5	+1.0	−1.0	$ 9.72
RA4L	3WM-K	3	50	+2.0	−2.0	$ 9.72
RA4L	4.5WM-K	4.5	113	+3.1	−3.1	$ 9.72
RA4L	5WM-K	5	139	+3.4	−3.4	$ 9.72
RA4L	6WM-K	6	200	+4.1	−4.1	$ 9.72
RA4L	9WM-K	9	450	+6.2	−6.2	$ 9.72
RA4L	**12WM-K**	**12**	**800**	**+8.2**	**−8.2**	**$ 9.72**
RA4L	18WM-K	18	1800	+12.4	−12.4	$ 9.72
RA4L	24WM-K	24	3200	+16.5	−16.5	$ 9.72
RA4L	48WM-K	48	12800	+33.0	−33.0	$11.59
Double winding latching						
RA4L	D1.5W-K	1.5	P/S	12.5	+1.0	+1.0	$10.35
RA4L	D3W-K	3	P/S	50	+2.0	+2.0	$10.35
RA4L	D4.5W-K	4.5	P/S	113	+3.1	+3.1	$10.35
RA4L	**D5W-K**	**5**	**P/S**	**139**	**+3.4**	**+3.4**	**$10.35**
RA4L	D6W-K	6	P/S	200	+4.1	+4.1	$10.35
RA4L	D9W-K	9	P/S	450	+6.2	+6.2	$10.35
RA4L	**D12W-K**	**12**	**P/S**	**800**	**+8.2**	**+8.2**	**$10.35**
RA4L	D18W-K	18	P/S	1800	+12.4	+12.4	$10.35
RA4L	**D24W-K**	**24**	**P/S**	**3200**	**+16.5**	**+16.5**	**$10.35**
RA4L	**D48W-K**	**48**	**P/S**	**12800**	**+33.0**	**+33.0**	**$12.30**
RA4L	D1.5WM-K	1.5	P/S	6.3	+1.0	+1.0	$ 9.86
RA4L	D3WM-K	3	P/S	25	+2.0	+2.0	$ 9.86
RA4L	D4.5WM-K	4.5	P/S	56	+3.0	+3.0	$ 9.86
RA4L	**D5WM-K**	**5**	**P/S**	**69**	**+3.3**	**+3.3**	**$ 9.86**
RA4L	D6WM-K	6	P/S	100	+4.0	+4.0	$ 9.86
RA4L	D9WM-K	9	P/S	225	+6.0	+6.0	$ 9.86
RA4L	**D12WM-K**	**12**	**P/S**	**400**	**+8.0**	**+8.0**	**$ 9.86**
RA4L	D18WM-K	18	P/S	900	+12.0	+12.0	$ 9.86
RA4L	**D24WM-K**	**24**	**P/S**	**1600**	**+16.0**	**+16.0**	**$ 9.86**
RA4L	**D48WM-K**	**48**	**P/S**	**6400**	**+32.0**	**+32.0**	**$11.72**

Notes

- As to the positive (+) symbol of each value, such as working voltage, positive working voltage, open voltage and reverse working voltage, positive (+) electrode of power source should be connected to the positive (+) terminal of pin arrangements.
- Reverse working voltage for wirewound latch type.
  As to the negative (−) symbol, positive (+) electrode of power source should be connected to negative (−) terminal of pin arrangements.

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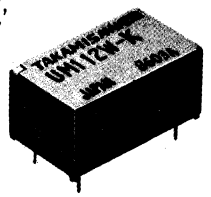
TAKAMISAWA ELECTRIC CO., LTD.

Sub Miniature RF Printed Circuit Board Relays

UM RELAY

0.1 Amp SPDT W — 0.449", L —0.787", H — 0.394"



CONTACT DATA
Arrangement — 1 form C (SPDT bifurcated)
Ratings — 24V DC 10 mA, 1W at 900 MHz
Resistance — 100 mΩ max. (initial value)
Max. Current — 100 mA DC
Max. Voltage — 30V DC
Max. Power — 1W DC, 10W at 900 MHz
Life Expectancy — Mechanical: 1,000,000 operations min.
Electrical: 300,000 operating min. at rated load

COIL DATA
Voltage — 1.5 to 48V DC
Power — (at 20°C)

Type	Operate	Nominal
Single Winding Non Latching	0.1W (0.11W for 48V coil)	0.2W (0.22W for 48V coil)
Single Winding Latching	0.1W	0.2W
Double Winding Latching	0.2W	0.4W

Operate wattage less than 70% of nominal voltage

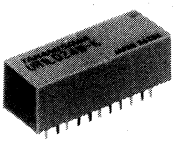
GENERAL DATA
Insulation Resistance — 1000 MΩ min. at 500V DC (UMIL-D, except between P.S. Coil)
Dielectric Strength — 500V AC between open contacts, between contacts and earth
1000V AC between coil and other terminals
Temperature Range — −30°C ~ +80°C at nominal voltage
Time Value — 6 msec max. at nominal voltage (UMI Release Time 5 ms)
Vibration Resistance — 30G (10 ~ 55 Hz) Destructive
20G (10 ~ 55 Hz) Unerring
Shock Resistance — 100G (6 msec) Destructive
50G (11 msec) Unerring
} reference value

HIGH FREQUENCY CHARACTERISTICS
Isolation — 60 dB min. at 900 MHz
Insertion Loss — 1 dB max. at 900 MHz
V.S.W.R. — 1.2 max. at 900 MHZ
(Impedance of the measuring devices is 75Ω)

Ordering Code		Nominal Coil Voltage (VDC)	Coil Resistance ± 10% at 20°C(Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
Standard						
UM1	3W-K	3	45	+2.1	+0.3	$7.19
UM1	**5W-K**	**5**	**125**	**+2.1**	**+0.3**	**$7.19**
UM1	6W-K	6	180	+4.2	+0.6	$7.19
UM1	9W-K	9	405	+6.3	+0.9	$7.19
UM1	**12W-K**	**12**	**720**	**+8.4**	**+1.2**	**$7.19**
UM1	18W-K	18	1620	+12.6	+1.8	$7.19
UM1	**24W-K**	**24**	**2880**	**+16.8**	**+2.4**	**$7.19**
UM1	48W-K	48	10472	+33.6	+4.8	$8.79
Single Winding Latching						
UM1L	3W-K	3	45	+2.1	−2.1	$7.73
UM1L	5W-K	5	125	+3.5	−3.5	$7.73
UM1L	6W-K	6	180	+4.2	−4.2	$7.73
UM1L	9W-K	9	405	+6.3	−6.3	$7.73
UM1L	**12W-K**	**12**	**720**	**+8.4**	**−8.4**	**$7.73**
UM1	18W-K	18	1620	+12.6	−12.6	$7.73
UM1L	24W-K	24	2880	+16.8	−16.8	$7.73
UM1L	48W-K	48	11520	+33.6	−33.6	$9.32
Double Winding Latching						
UM1L	3W-K	3	22.5	+2.1	−2.1	$8.26
UM1L	5W-K	5	62.5	+3.5	−3.5	$8.26
UM1L	6W-K	6	90	+4.2	−4.2	$8.26
UM1L	9W-K	9	202.5	+6.3	−6.3	$8.26
UM1L	**12W-K**	**12**	**360**	**+8.4**	**−8.4**	**$8.26**
UM1	18W-K	18	910	+12.6	−12.6	$8.26
UM1L	24W-K	24	1440	+16.8	−16.8	$8.26
UM1L	48W-K	48	5760	+33.6	−33.6	$9.86

Notes
- As to the positive (+) symbol of each value, such as working voltage, positive working voltage, open voltage and reverse working voltage, positive (+) electrode of power source should be connected to the positive (+) terminal of pin arrangements.
- Reverse working voltage for wirewound latch type.
As to the negative (−) symbol, positive (+) electrode of power source should be connected to negative (−) terminal of pin arrangements.

UR RELAY



L–1.291"
W–0.504"
H–0.425"

CONTACT DATA
Arrangement—2 Form C (DPDT bifurcated contact)
Ratings—24VDC 10mA, 1W at 900 MHz
Resistance—100 mΩ max. (Initial value)
Max. Current—100 mA DC
Max. Voltage—30 VDC
Max. Power—1WDC, 10W at 900 MHz
Life Expectancy—Mechanical: 1,000,000 operations min.
Electrical: 300,000 operations min.

COIL DATA
Voltage—1.5 to 48 VDC **Power**—(at 20°C)

Type	Operate	Nominal
Single winding non latching	0.18W (0.2W for 48V coil)	0.36W (0.39W for 48V coil)
Single winding latching	0.125W	0.25W
Double winding latching	0.25W (0.28W for 48V coil)	0.5W (0.55W for 48V coil)

GENERAL DATA
Insulation Resistance—1000MΩ min. at 500 VDC (Except between P & S Coil)
Dielectric Strength—500VAC between open contact, between contact & Shield terminals 1000VAC between coil & other terminals
Temperature Range—−30°C ~+80°C at nominal voltage
Time Value—approx. 6 ms at nominal voltage
Vibration Resistance—30G (10~55Hz)...Destructive
20G (10~55Hz)...Unerring
Shock Resistance—100G (6ms)...Destructive
50G (11ms)...Unerring
Reference value

TABLE-1 Non Latching type

Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance ± 10% at 20°C (Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
UR1—1.5W-K	1.5	6.3	+1.05	+0.08	16.38
UR1—3W-K	3	25	+2.1	+0.15	16.38
UR1—4.5W-K	4.5	56.3	+3.15	+0.23	16.38
UR1—5W-K	**5**	**69.5**	**+3.5**	**+0.25**	**16.38**
UR1—6W-K	6	100	+4.2	+0.3	16.38
UR1—9W-K	9	225	+6.3	+0.45	16.38
UR1—12W-K	**12**	**400**	**+8.4**	**+0.6**	**16.38**
UR1—18W-K	18	900	+12.6	+0.9	16.38
UR1—24W-K	**24**	**1600**	**+16.8**	**+1.2**	**16.38**
UR1—48W-K	48	5900	+33.6	+2.4	17.98

TABLE-2 Single winding latching type

UR1L—1.5W-K	1.5	9	+1.05	−1.05	16.52
UR1L—3W-K	3	36	+2.1	−2.1	16.52
UR1L—4.5W-K	4.5	81	+3.15	−3.15	16.52
UR1L—5W-K	5	100	+3.5	−3.5	16.52
UR1L—6W-K	6	144	+4.2	−4.2	16.52
UR1L—9W-K	9	324	+6.3	−6.3	16.52
UR1L—12W-K	**12**	**576**	**+8.4**	**−8.4**	**16.52**
UR1L—18W-K	18	1296	+12.6	−12.6	16.52
UR1L—24W-K	24	2304	+16.8	−16.8	16.52
UR1L—48W-K	48	9216	+33.6	−33.6	18.82

TABLE-3 Double winding latching type

UR1L—D1.5W-K	1.5	P S	4.5 4.5	+1.05	+1.05	17.05
UR1L—D3W-K	3	P S	18 18	+2.1	+2.1	17.05
UR1L—D4.5W-K	4.5	P S	40.5 40.5	+3.15	+3.15	17.05
UR1L—D5W-K	5	P S	50 50	+3.5	+3.5	17.05
UR1L—D6W-K	6	P S	72 72	+4.2	+4.2	17.05
UR1L—D9W-K	9	P S	162 162	+6.3	+6.3	17.05
UR1L—D12W-K	**12**	**P** **S**	**288** **288**	**+8.4**	**+8.4**	**17.05**
UR1L—D18W-K	18	P S	648 648	+12.6	+12.6	17.05
UR1L—D24W-K	24	P S	1152 1152	+16.8	+16.8	17.05
UR1L—D48W-K	48	P S	4189 4189	+33.6	+33.6	18.65

Notes • If correct polarity is not applied to the coil terminals, relay does not operate properly. • To release latched contact, polarity to be applied to coil terminals should be reversed. • Since this is the polarized relay, Confirm the relays performance in the actual circuit, prior to use. When relays are expected to be mounted very closely together or to be used under strong magnetic fields.

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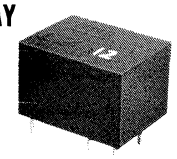
Miniature General Purpose Relays

LZ RELAY



5 Amp SPDT
L — 0.843″
W — 0.646″
H — 0.583″

CONTACT DATA

Arrangement — 1 Form C

Material — 5A type: Gold overlay silver-nickel alloy (single)
3A type: Gold overlay silver (single)
1A type: Gold overlay silver-palladium alloy (bifurcated)

Load — 5A type: 5A @ 30V DC or 120V AC, 4A @ 240V AC resistive, 1/8 HP
3A type: 3A @ 30V DC or 120V AC, 2.5A @ 240V AC resistive, 1/10 HP
1A type: 1A @ 30V DC or 120V AC, resistive

Life — Mechanical: 20 million operations minimum
Electrical: 0.1 x 10^6 operations minimum at rated load

Timing — Operate: < 5 ms (standard type), < 6 ms (high sensitive type)
Release: < 2 ms

COIL DATA (@ 20°C)

Operate Power — 210 mW (standard type), 150 mW (high sensitive type)

Nominal Power — 450 mW (standard type), 330 mW (high sensitive type)

Maximum Power — 1.4W

GENERAL DATA

Insulation Resistance — 250 MΩ at 500V DC

Dielectric Strength — 750V AC between open contacts
2000V AC between all other points

Temperature Range — standard type −40°C to +70°C
sensitive type −40°C to +80°C

Vibration Resistance — 15G (10-55 Hz)

Shock Resistance — 15G (11 ms ±1 ms)

Approximate Weight — 8 gr (0.28 oz.)

Enclosure — Standard — polycarbonate
Washable or sealed — PBT

Surge Strength — 3000V

Standard Coil and Contact Combinations (20°C)

Nominal Voltage	Pull-In Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code 5A*	Ordering Code 3A	Ordering Code List Price
Standard types						
5	**3.25**	**8.3**	**56**	**LZ-5H**	**LZ-5**	**$2.71**
6	3.90	9.9	80	LZ-6H	LZ-6	$2.71
9	5.85	14.9	180	LZ-9H	LZ-9	$2.71
12	**7.80**	**19.8**	**320**	**LZ-12H**	**LZ-12**	**$2.71**
24	**15.6**	**39.6**	**1280**	**LZ-24H**	**LZ-24**	**$2.71**
48	28.8	79.2	3800	LZ-48H	LZ-48	$3.06
High sensitive types						
5	**3.25**	**9.8**	**80**	**LZ-5HS**	**LZ-5S**	**$2.80**
6	3.90	11.7	110	LZ-6HS	LZ-6S	$2.80
9	5.85	17.6	250	LZ-9HS	LZ-9S	$2.80
12	**7.80**	**23.4**	**440**	**LZ-12HS**	**LZ-12S**	**$2.80**
24	**15.6**	**45.6**	**1780**	**LZ-24HS**	**LZ-24S**	**$2.80**

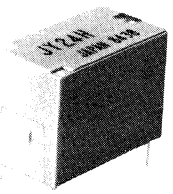
*Add $0.10 to List Price

Latch types

5	**3.4**	**NA**	**12**	**LZL-5H**	**LZL-5**	**$4.17**
6	4.1	NA	17.5	LZL-6H	LZL-6	$4.17
9	6.2	NA	40	LZL-9H	LZL-9	$4.17
12	**8.1**	**NA**	**70**	**LZL-12H**	**LZL-12**	**$4.17**
24	16.2	NA	275	LZL-24H	LZL-24	$4.17
48	32.3	NA	1000	LZL-48H	LZL-48	$4.17
60	40.4	NA	1500	LZL-60H	LZL-60	$4.17

*Add $0.10 to List Price

JY RELAYS



5 Amp SPST-NO
L — 0.787″,
W — 0.394″,
H — 0.504″

CONTACT DATA

Arrangement — 1 Form A (SPST-N.O.)

Material & Rating —
JY-( )H, JY-( ) — Gold plated silver cadmium oxide alloy
JY-( )H — 5A, 30V DC or 250V AC resistive
JY-( ) — 3A, 30V DC or 250V AC resistive

Life Expectancy — Mechanical — 20 million operations
Electrical — 100,000 operations at rated load

COIL DATA

Voltage — JY- 4.5 to 24V DC

Power (at 20°C) — JY- Nominal 0.2W
JY- Operate 0.098W

Max. Operate (at 20°C) — 70% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — Min. 1000MΩ at 500V DC

Dielectric Strength — JY- 750V AC (50/60 Hz) between open contacts

Surge Strength — 6000V (1 x 40μs)

Temperature Range (at Nominal Voltage) —
JY- −40°C to +80°C — Non-carrying condition of contacts

Time Value — Operate Max. 10ms
Release Max. 10ms

Weight — 5gr (Approx.)

Enclosure — PBT

Standard Coil and Contact Combinations

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance	Ordering Code	List Price
5	**3.5**	**11.5**	**125**	**JY-5-H-K**	**$3.73**
6	4.2	13.8	180	JY-6-H-K	$3.73
9	6.3	20.7	405	JY-9-H-K	$3.73
12	**8.4**	**27.6**	**720**	**JY-12-H-K**	**$3.73**
18	**12.6**	**41.4**	**1620**	**JY-18-H-K**	**$3.73**
24	**16.8**	**55.2**	**2880**	**JY-24-H-K**	**$3.73**
JY Socket				JK-4N	$1.41

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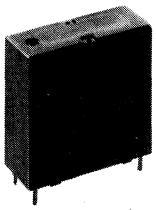
TAKAMISAWA ELECTRIC CO., LTD.

Sub Miniature General Purpose Relays

VG RELAY



L — 0.925″,
W — 0.386″,
H — 0.984″

CONTACT DATA

Arrangement — 1 Form C (SPDT)

Material & Rating —
VG-( )H, — Silver alloy 5A 24V DC or 120V AC resistive
VG-( ), VG-( )S — Silver alloy 3A 30V DC or 120V AC resistive
VG-( )L, VG-( )LS — Gold overlaid silver alloy 1A 30V DC or 120V AC resistive

Life Expectancy — Mechanical: 10 million operations
Electrical: 100,000 operations at rated load
30,000 operations at TV Rating

COIL DATA

Voltage — 5 to 48V DC (High sensitive type — to 24V DC)

Power (at 20°C) — Standard type: operate 0.18 ~ 0.2W
nominal 0.36 ~ 0.4W
High sensitive type: operate 0.1 ~ 0.13W
nominal 0.2 ~ 0.26W

Max. Operate (at 20°C) — 70% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — Min. 1000 MΩ at 500V DC

Dielectric Strength — 750V AC (50/60 Hz) between open contacts
4000V AC (50/60 Hz) between coil and contacts

Surge Strength — 7000V (1 × 40 μs)

Temperature Range (at Nominal voltage) —
Standard type −40°C to +75°C } Non-carrying condition
High sensitive type −40°C to +85°C } of contacts

Time Value (at Nominal voltage) — Operate Max. 8 ms
Release Max. 5 ms

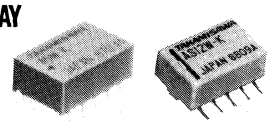
Mounting — For direct printed circuit mounting on grid spacing of 2.54 mm (0.1 in.) up to board thickness of 2 mm (0.08 in.)

Weight — 12 gr (Approx.)

Enclosure — PBT

Coil Data			Ordering Code Gold Overlaid Silver Alloy					
Nom. Coil Voltage	Coil Resist. in Ohm ±10% at 20°C	Must operate Voltage 20°C	5A 1 Form C	List Price	3A 1 Form C	List Price	1A 1 Form C	List Price
Standard Type								
5	69	3.5	VG- 5H	$3.60	VG- 5	$3.46	VG- 5L	$3.46
6	100	4.2	VG- 6H	$3.60	VG- 6	$3.46	VG- 6L	$3.46
9	225	6.3	VG- 9H	$3.60	VG- 9	$3.46	VG- 9L	$3.46
12	**400**	**8.4**	**VG-12H**	**$3.60**	**VG-12**	**$3.46**	**VG-12L**	**$3.46**
18	870	12.6	VG-18H	$3.60	VG-18	$3.46	VG-18L	$3.46
24	1450	16.8	VG-24H	$3.60	VG-24	$3.46	VG-24L	$3.46
48	6000	33.6	VG-48H	$4.44	VG-48	$4.31	VG-48L	$4.31
High Sensitive Types								
5	120	3.5			VG- 5S	$3.46	VG- 5LS	$3.46
6	150	4.2			VG- 6S	$3.46	VG- 6LS	$3.46
9	325	6.3			VG- 9S	$3.46	VG- 9LS	$3.46
12	575	8.4			VG-12S	$3.46	VG-12LS	$3.46
18	1400	12.6			VG-18S	$3.46	VG-18LS	$3.46
24	2230	16.8			VG-24S	$3.46	VG-24LS	$3.46

A/AS RELAY



L—0.551″,
W—0.354″,
H—0.197″

CONTACT DATA

Arrangement—2FormC (DPDT)

Material—Stationary...Gold overlaid silver palladium
Movable...Silver palladium

Resistance—Max. 100mΩ (Initial)

Rating—1A 30V DC or 0.5A 125V AC (Resistive)

Life expectancy—Mechanical: Min 100 million operations
Electrical: Min 500,000 operations at 1A 30V DC
: Min 200,000 operations at 0.5A 125V AC

COIL DATA

Voltages—4.5 to 48V DC

Power (at 20°C)—Operate 0.07W (0.11W for 24V coil)
Nominal 0.14W (0.2W for 24V coil)

Operate (at 20°C)—70% of nominal voltage

Duty—Continuous.

GENERAL DATA

Insulation resistance—Min. 1000MΩ at 500V DC

Dielectric strength—1000V AC between open contact, coil-contact, adjacent contact

Surge strength—1500V

Temperature range—−40°C -+85°C at nominal voltage

Time Value (at nominal voltage)—Operate Max. 6mS Release Max. 4mS

Vibration Resistance—10 to 55Hz amplitude 3mm...Unerring
10 to 55Hz amplitude 5mm...Destructive } Reference Value

Shock Resistance—50G (11 mS)...Unerring
100G (6mS)...Destructive } Reference Value

Enclosure—PBT

Notes:
- Since this is the polarized relay, confirm the relays performance in the actual circuit, prior to use. When relays are expected to be mounted very closely together or to be used under strong magnetic fields.

Single Winding Non-Latching — **Substitute AS Prefix for SMD Type**

Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance ± 10% at 20°C (Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
A—3W-K	3	64.3	+2.1	+0.3	5.11
A—4.5W-K	**4.5**	**145**	**+3.15**	**+0.45**	**5.11**
A—5W-K	**5**	**178**	**+3.5**	**+0.5**	**5.11**
A—6W-K	6	257	+4.2	+0.6	5.11
A—9W-K	9	579	+6.3	+0.9	5.11
A—12W-K	**12**	**1028**	**+8.4**	**+1.2**	**5.11**
A—18W-K	18	1620	+12.6	+1.8	5.11
A—24W-K	**24**	**2880**	**+16.8**	**+2.4**	**5.11**
A—48W-K	**48**	**7680**	**+33.6**	**+4.8**	**6.48**

Single Winding Latching

AL—3W-K	3	90	+2.1	−2.1	5.77
AL—4.5W-K	4.5	203	+3.15	−3.15	5.77
AL—5W-K	5	250	+3.5	−3.5	5.77
AL—6W-K	6	360	+4.2	−4.2	5.77
AL—9W-K	9	810	+6.3	−6.3	5.77
AL—12W-K	**12**	**1440**	**+8.4**	**−8.4**	**5.77**
AL—18W-K	18	2160	+12.6	−12.6	5.77
AL—24W-K	24	3840	+16.8	−16.8	6.66

Double Winding Latching

AL—D3W-K	3	P S	45 45	+2.1	+2.1	5.99
AL—D4.5W-K	4.5	P S	101 101	+3.15	+3.15	5.99
AL—D5W-K	**5**	**P** **S**	**125** **125**	**+3.5**	**+3.5**	**5.99**
AL—D6W-K	6	P S	180 180	+4.2	+4.2	5.99
AL—D9W-K	9	P S	405 405	+6.3	+6.3	5.99
AL—D12W-K	**12**	**P** **S**	**720** **720**	**+8.4**	**+8.4**	**5.99**
AL—D18W-K	18	P S	1080 1080	+12.6	+12.6	5.99
AL—D24W-K	**24**	**P** **S**	**1920** **1920**	**+16.8**	**+16.8**	**5.99**

P: Single Winding Coil, S: Double Winding Coil

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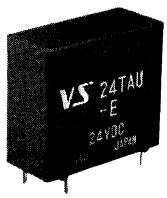
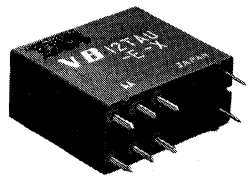
TAKAMISAWA ELECTRIC CO., LTD.

Miniature Power Relays

VB/VS RELAY

L — 1.150″
W — 0.508″
H — 0.996″





CONTACT DATA

Arrangement—1 Form A or C 15/10 Amp (VS)
2 Form C 5 Amp (VB)
Material—Silver Nickel (Standard), silver tin oxide (15A)
Rating—5 10/15 Amp at 24V DC or 240V AC
⅙ or ⅓ HP 120V AC motor load
Inrush Current — 51 or 78A at 120 V AC
Max. Carrying Current — SPDT 14A, DPDT 7A
Life Expectancy — Mechanical 5 million operations
Electrical: 100,000 operations at 5 or 10A 24V DC or 240V AC
200,000 operations at 5 or 10A 120V AC resistive
3.5 or 7A 24V DC or 240V AC
30,000 operations at ⅙ or ⅓ 120V AC motor load

COIL DATA

Nominal Voltage — 3 to 60V DC
Power (at 20°C) — Nominal: 0.72W Standard Type
0.53W High Sensitive Type
Operate: 0.35W Standard Type
0.26W High Sensitive Type
Maximum: 1.4W

GENERAL

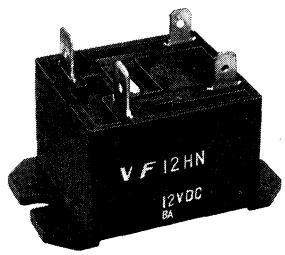
Dielectric Strength — Min. 1000V AC between open contact
Min. 5000V AC between all other conductors
Insulation Resistance — Min. 1000MΩ at 500V DC between conductors
Surge Strength — 10,000V.
Temperature Range — (TV types) −40°C to +50°C
Standard types) −40°C to +65°C
(Sensitive types) −40°C to +75°C
Enclosure — Polycarbonate

Standard Coil and Contact Combinations

Type	Nominal Voltage DC (V)	Coil Resistance —10% at 20°C (V)	Must Operate Voltage at 20°C (V)	Ordering Code	List Price
Standard types					
SPDT 16A	5	36	3.5	VSB- 5TB	$4.88
	6	50	4.2	VSB- 6TB	$4.88
	12	200	8.4	VSB-12TB	$4.88
	24	820	16.8	VSB-24TB	$4.88
SPDT 10A	5	36	3.5	VS- 5TBU-E	$3.46
	6	50	4.2	VS- 6TBU-E	$3.46
	12	200	8.4	VS-12TBU-E	$3.46
	24	820	16.8	VS-24TBU-E	$3.46
DPDT 5A	5	36	3.5	VB- 5TBU-E	$3.95
	6	50	4.2	VB- 6TBU-E	$3.95
	12	200	8.4	VB-12TBU-E	$3.95
	24	820	16.8	VB-24TBU-E	$3.95
High Sensitive Types					
SPDT 10A	5	47	3.5	VS- 5STBU-E	$3.69
	6	68	4.2	VS- 6STBU-E	$3.69
	12	270	8.4	VS-12STBU-E	$3.69
	24	1100	16.8	VS-24STBU-E	$3.69
DPDT 5A	5	47	3.5	VB- 5STBU-E	$4.17
	6	68	4.2	VB- 6STBU-E	$4.17
	12	270	8.4	VB-12STBU-E	$4.17
	24	1100	16.8	VB-24STBU-E	$4.17

VF RELAY

L — 1.968″
W — 1.268″
H — 0.949″



CONTACT DATA

Arrangement — 1 Form A
Material — Silver Alloy
Rating:

Classification	Rating		Maximum Inrush Current
	Resistive	Motor Load	
H	30A 250V AC	2HP 25A 250V AC	70A 200V AC
M	25A 250V AC	1.5HP 20A 250V AC	60A 200V AC
L	20A 250V AC	1HP 15A 250V AC	55A 100V AC

Maximum Carry Current — 30A
Life Expectancy — Mechanical: 5 million operations
Electrical: 200,000 operations at motor load
100,000 operations at resistive load

COIL DATA

Nominal Voltage — 3 to 60V DC
Power (at 20°C) — Nominal: 1.2W
Operate: 0.59W
Maximum: 3.0W

GENERAL DATA

Dielectric Strength — 1200V AC between open contacts
4000V AC between all other conductors
Insulation Resistance — 1000MΩ (min.) at 500V DC
Surge Voltage — 10,000V
Timing (approx.) — Operate: 15ms at nominal
Release: 3ms at nominal
Temperature Range — −40°C to +70°C
Weight — 55 gr
Vibration — 10 - 55Hz
Shock — 20G
Enclosure — Polycarbonate

Standard Coil and Contact Combinations

Coil Data at 20°C			Ordering Code		
Nominal Coil Voltage	Coil Resistance in Ohms ±10%	Must Operate Voltage	Quick Connect Terminals	PCB Coil Terminals	List Price
6	30	4.2	VF- 6HU	VFB- 6HU	$8.88
12	120	8.4	VF-12HU	VFB-12HU	$8.88
24	480	16.8	VF-24HU	VFB-24HU	$8.88
48	1920	33.6	VF-48HU	VFB-48HU	$8.88
6	30	4.2	VF- 6MU	VFB- 6MU	$8.17
12	120	8.4	VF-12MU	VFB-12MU	$8.17
24	480	16.8	VF-24MU	VFB-24MU	$8.17
48	1920	33.6	VF-48MU	VFB-48MU	$8.17
6	30	4.2	VF- 6LU	VFB- 6LU	$7.55
12	120	8.4	VF-12LU	VFB-12LU	$7.55
24	480	16.8	VF-24LU	VFB-24LU	$7.55
48	1920	33.6	VF-48LU	VFB-48LU	$7.55

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High Voltage Relays

KILOVAC, THE WORLD'S LEADING SUPPLIER OF HIGH VOLTAGE SWITCHING DEVICES.

THE WORLD'S LEADING SUPPLIER OF HIGH VOLTAGE SWITCHING DEVICES

For over two decades, Kilovac Corporation has been exclusively dedicated to the design and manufacture of vacuum and gas-filled high voltage relays, switching and power control devices.

Today Kilovac is recognized as the world's leading supplier of proprietary high voltage switching devices for a broad range of critical applications.

Kilovac pioneered the development of special high voltage relays for heart defibrillators and remains the leading supplier for relays in this market. Kilovac relays have been to the moon in the Lunar Rover Vehicle and to the depths of the sea on nuclear submarines.

KILOVAC CAN QUICKLY MEET YOUR REQUIREMENTS

The key to Kilovac's success has been its ability to respond quickly to customer requirements; to develop special relays or modifications to standard relays for unique requirements; and to deliver reliable products promptly.

Major advances in manufacturing technology allow Kilovac to provide high quality vacuum relays at an affordable price.

Kilovac designs and manufactures vacuum and gas-filled switching devices with ratings from 48V to 200,000V, in single, double and 4-pole styles.

A wide variety of special modifications can be made to Kilovac's existing product line allowing you to meet unique requirements at very competitive prices.

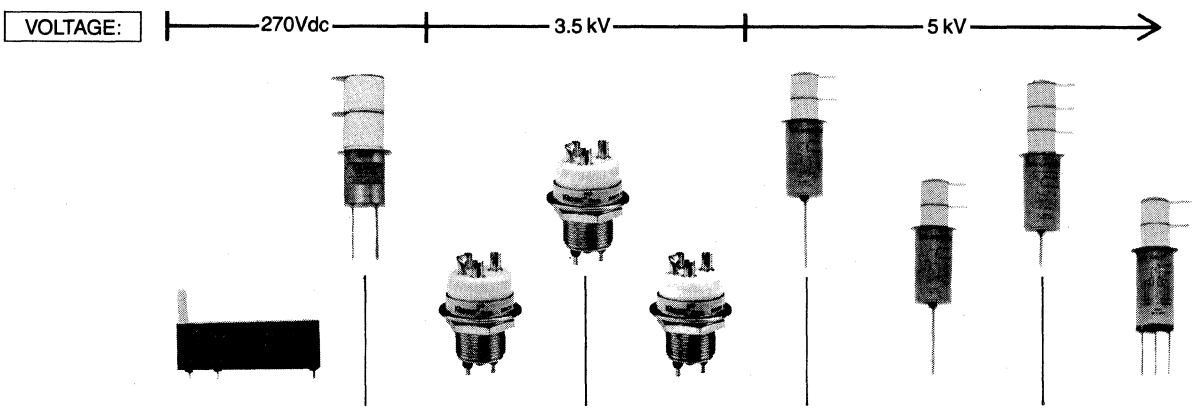
YOU CAN RELY ON KILOVAC TO MEET YOUR REQUIREMENTS

Kilovac's vertically integrated manufacturing facility allows it to quickly accommodate special modification and design, build, and test relays and other switching devices for unique applications.

Kilovac offers its customers a full twelve month warranty on all its products.

Engineering samples can frequently be supplied for test and evaluation in your circuits and for your use with your specific applications.

Don't experiment with high voltage switching devices . . . rely on the proven experience of Kilovac Corporation.



Kilovac Part No.	AP81A	AP44A	HC-1	HC-3	HC-5[2]	K41A	K41B	K41C	K41P
Contact Arrangement	SPST-NO	SPST-NO	SPDT	SPDT	SPDT	SPST-NO	SPST-NC	SPDT	LATCH
Rated Operating Voltage (kVdc or 60 Hz peak)	.270 Vdc	.270 Vdc	3.5	3.5	3.5	5	5	5	5
Test Voltage (kVdc)	1.5	1.5	5	5	5	6	6	6	6
Continuous carry current contacts closed, max (amps dc or 60 Hz peak)	5	45	25	18	8	15	15	15	15
Recommended for Power Switching	Y[1];5A	Y[1];15A	N	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	N
Contact Resistance, max (ohms)	.025	.025	.010	.020	.5[4]	.020	.020	.020	.020
Operate Time, max (ms)	10	15	6	6	6	10	10	10	6
Coil Resistance (ohms ±10% @ 20°C)	290	180	335	335	335	290	290	290	80
Coil Voltage[5] (Vdc, nominal)	28	28	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Nominal Dimensions (inches)	2.25 L × .75 H	.75 D × 2.5 H	.75 D × 1.5 H	.75 D × 1.5 H	.75 D × 1.5 H	.65 D × 1.7 H	.65 D × 1.7 H	.65 D × 2.1 H	.65 D × 1.7 H
Nominal Weight (oz)	3	1.8	1	1	1	1	1	1	1
Mounting Style	PC	Flange	Thr'ded Base	Thr'ded Base	Thr'ded Base	Flange	Flange	Flange	Flange

(1) Suitable for power switching. Contact factory for details.
(2) Gas filled for power switching on the "make".
(3) Operation in oil.
(4) Contact resistance in gas filled relays is tested at 28 Vdc and 1 amp.
(5) 12 Vdc and 115 Vdc coils available on request.
(6) When encapsulated, 35 kV operate, 37 kV test voltage.

Send for Kilovac catalog

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High Voltage Relays

KILOVAC, THE WORLD'S LEADING SUPPLIER OF HIGH VOLTAGE SWITCHING DEVICES.

TYPICAL APPLICATIONS

Typical high voltage relay applications are listed below:

COMMUNICATIONS–H.F. SSB radio, digital antenna couplers and tuners, transmit/receive switching.

TEST EQUIPMENT–Electrostatic discharge testing, dielectric testing, cable and harness testing.

AEROSPACE POWER SWITCHING–Aircraft, space systems, submarine and ground equipment where 48 Vdc, 155 Vdc, 270 Vdc and 20 KHz switching and control is required.

RADAR–Pulse forming networks, modulators/transmitters, TWT and klystron switching.

GENERAL–Safety interlock applications, high voltage power supplies, polarity reversal, nuclear instrumentation, switching in explosive or corrosive atmospheres.

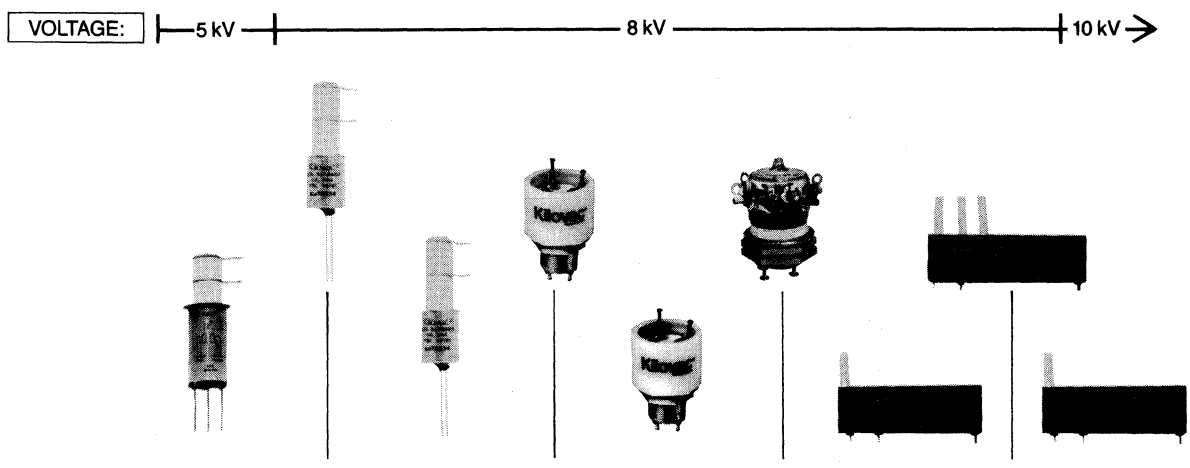
LASERS–Pulse forming network discharge, safety interlock, simmer circuit isolation, Pockels cell isolation.

SEMICONDUCTOR PROCESSING

PLASMA ETCHING–Multiple target switching.

HIGH INTENSITY LIGHTING SYSTEMS

MEDICAL INSTRUMENTS–Heart defibrillators, surgical lasers, magnetic resonance imaging (MRI), Electrophoresis.



Kilovac Part No.	K40P	K47A	K47B	HC-2	HC-4	H-18	K81B	K81C	K81A
Contact Arrangement	LATCH	SPST-NO	SPST-NC	SPDT	SPDT	DPDT	SPST-NC	SPDT	SPST-NO
Rated Operating Voltage (kVdc or 60 Hz peak)	5	8	8	8	8	8	8	8	10
Test Voltage (kVdc)	6	9	9	10	10	10	10	10	11
Continuous carry current contacts closed, max (amps dc or 60 Hz peak)	15	12	12	25	15	10	10	10	10
Recommended for Power Switching	N	Y[1]	Y[1]	N	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]
Contact Resistance, max (ohms)	.020	.030	.030	.010	.020	.020	.050	.050	.050
Operate Time, max (ms)	1	10	10	6	6	15	10	10	10
Coil Resistance (ohms ±10% @ 20°C)	80	920	920	335	335	250	290	290	290
Coil Voltage[5] (Vdc, nominal)	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Nominal Dimensions (inches)	.65 D × 1.7 H	.65 D × 1.82 H	.65 D × 1.82 H	1.13 D × 1.88 H	1.13 D × 1.88 H	1.5 D × 1.97 H	2.25 L × .75 H	2.5 L × .75 H	2.25 L × .75 H
Nominal Weight (oz)	1	.6	.6	1.25	1.25	4	1.5	2.0	1.5
Mounting Style	Flange	Flange	Flange	Thr'ded Base	Thr'ded Base	Thr'ded Base	PC	PC	PC

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(2) Gas filled for power switching on the "make".
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(4) Contact resistance in gas filled relays is tested at 28 Vdc and 1 amp.
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(6) When encapsulated, 35 kV operate, 37 kV test voltage.

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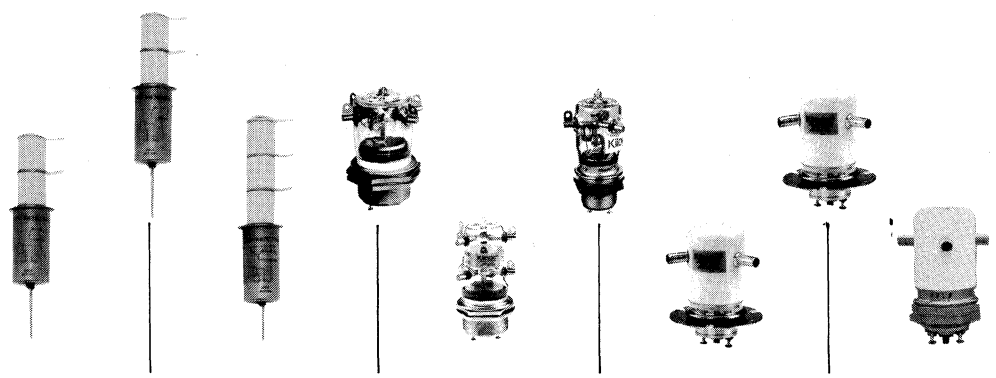
FEATURES OF VACUUM AND GAS-FILLED RELAYS

- Smaller size for a given voltage/ current rating
- Extremely low and stable contact resistance in vacuum relays
- No contact oxidation due to arcing
- Faster operate times
- High resistance to thermal and mechanical shock
- Capable of switching high inrush currents using gas filled relays
- Safe use in explosive or corrosive atmospheres
- No contact maintenance
- Usable at frequencies above 30 MHz
- Rapid arc extinguishment for power switching in vacuum relays
- Can be mounted in any orientation

VOLTAGE: 10 kV — 12 kV — 15 kV →



Kilovac Part No.	K43A	K43B	K43C	H-14	H-16	H-8	KC-2	KC-8	KC-11
Contact Arrangement	SPST-NO	SPST-NC	SPDT	DPDT	DPDT	SPDT	SPDT	SPDT	SPDT
Rated Operating Voltage (kVdc or 60 Hz peak)	10	10	10	12	12	15	15	15	15
Test Voltage (kVdc)	11	11	11	15	15	20	17	17	17
Continuous carry current contacts closed, max (amps dc or 60 Hz peak)	15	15	15	30	30	15	50	30	50
Recommended for Power Switching	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	N	Y[1]	N
Contact Resistance, max (ohms)	.020	.020	.020	.015	.030	.015	.012	.025	.012
Operate Time, max (ms)	10	10	10	20	20	15	15	15	15
Coil Resistance (ohms ±10% @ 20°C)	290	290	290	120	120	265	250	180	250
Coil Voltage[5] (Vdc, nominal)	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Nominal Dimensions (inches)	.65 D × 2.18 H	.65 D × 2.18 H	.65 D × 2.62 H	1.8 D × 2.77 H	1.03 D × 3.26 H	1 D × 3 H	1.37 D × 2.26 H	1.37 D × 2.26 H	1.37 D × 2.26 H
Nominal Weight (oz)	1	1	1	8	5	3	3	3	3
Mounting Style	Flange	Flange	Flange	Thr'ded Base	Thr'ded Base	Thr'ded Base	Flange	Flange	Thr'ded Base

(1) Suitable for power switching. Contact factory for details.
(2) Gas filled for power switching on the "make".
(3) Operation in oil.
(4) Contact resistance in gas filled relays is tested at 28 Vdc and 1 amp.
(5) 12 Vdc and 115 Vdc coils available on request.
(6) When encapsulated, 35 kV operate, 37 kV test voltage.

Send for Kilovac catalog

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Kilovac® Corporation

High Voltage Relays

KILOVAC, THE WORLD'S LEADING SUPPLIER OF HIGH VOLTAGE SWITCHING DEVICES.

All Kilovac relays have either a vacuum or gas dielectric. Both have the obvious benefit of providing high voltage isolation in a small package, but each has unique characteristics which should be considered.

VACUUM AS A DIELECTRIC

A vacuum is, in many ways, the ideal dielectric. Since most high voltage arcs are initiated by the ionization of the insulating medium, absence of any such media (i.e., a hard vacuum) produces the greatest possible isolation between contact electrodes. In a vacuum of 10^{-6} mm of mercury, dielectric strengths can be achieved on the order of 2000 V/mil. A vacuum dielectric has the additional advantage of providing an inert, non-oxidizing atmosphere in which high voltage contacts operate.

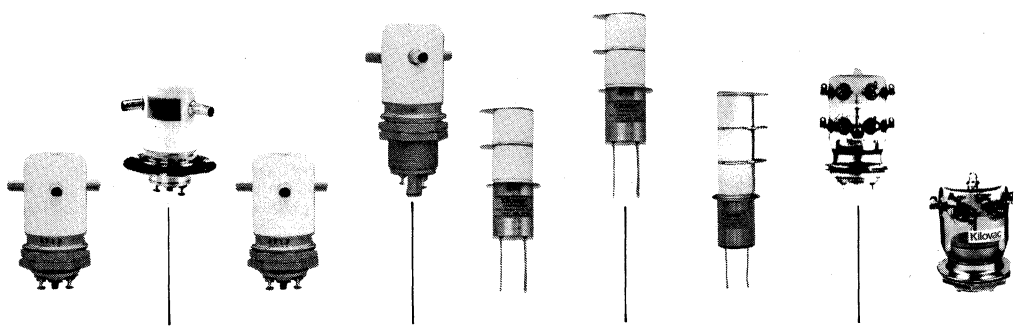
The chief advantage in using a vacuum relay is that it has low and stable contact resistance over the life of the relay.

GAS AS A DIELECTRIC

Because of the arc suppression characteristics of electronegative gas, gas-filled relays are generally more suitable for power-switching on the "make" or N.O. contacts, as used in the capacitive discharge of heart defibrillator circuits or pulsed lasers.

When the relay is switched, ionization of the gas causes electrical continuity to occur before mechanical continuity is achieved. Thus, contact bounce may occur without interruption of the circuit if circuit voltage is above 3500 volts. This phenomenon contributes to the long life gas-filled relays demonstrate in capacitive discharge circuits.

VOLTAGE: ——— 15 kV ——— 20 kV →



Kilovac Part No.	KC-12	KC-15[2]	KC-16[2]	K60C[2]	K46A	K46B	K46C	H-26	H-19
Contact Arrangement	SPDT	SPDT	SPDT	SPDT	SPST-NO	SPST-NC	SPDT	4PDT	DPDT
Rated Operating Voltage (kVdc or 60 Hz peak)	15	15	15	15[6]	15	15	15	15	20
Test Voltage (kVdc)	17	17	17	17	17	17	17	17	25
Continuous carry current contacts closed, max (amps dc or 60 Hz peak)	30	12	12	10	45	45	45	30	30
Recommended for Power Switching	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]
Contact Resistance, max (ohms)	.025	1.0[4]	1.0[4]	1.0[4]	.010	.010	.010	.020	.015
Operate Time, max (ms)	15	15	15	15	10	10	10	30	30
Coil Resistance (ohms ±10% @ 20°C)	180	180	180	125	290	290	290	130	225
Coil Voltage[5] (Vdc, nominal)	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Nominal Dimensions (inches)	1.37 D × 2.26 H	1.37 D × 2.26 H	1.37 D × 2.26 H	1.00 D × 2.50 H	.75 D × 2.5 H	.75 D × 2.5 H	.75 D × 3.17 H	2.3 D × 3.92 H	2.28 D × 3.25 H
Nominal Weight (oz)	3	3	3	3.3	1.8	1.8	2.2	16	7
Mounting Style	Thr'ded Base	Flange	Thr'ded Base	Thr'ded Base	Flange	Flange	Flange	Thr'ded Base	Thr'ded Base

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Kilovac® Corporation

High Voltage Relays

KILOVAC, THE WORLD'S LEADING SUPPLIER OF HIGH VOLTAGE SWITCHING DEVICES.

POWER SWITCHING

For proper relay performance in hot switching applications, the consequences of the circuit conditions must be assessed for each unique application. It is therefore essential that Kilovac be as fully informed as possible when recommending relays for hot switching applications. To select the proper relay, the following information should be supplied to the Kilovac Sales Engineer:

a. Type of Load

b. Current and voltage values to be switched. If capacitive discharge, peak current and RC time constant values are needed.

c. Repetition rate or frequency of operation desired

d. Expected life span

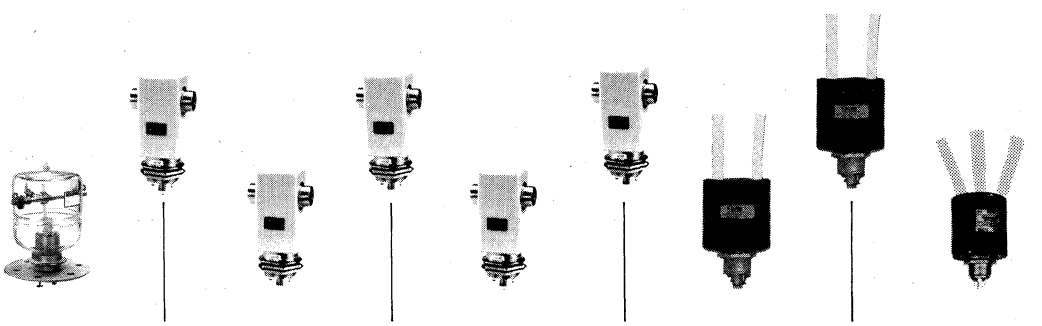
Frequently, the only way to determine whether a relay will survive a particular power switching application is to test it in the circuit. These tests ideally can be performed in the customer's circuit or, if that is not possible, in Kilovac's well-equipped test lab.

270 VDC APPLICATIONS

Not all high-voltage relays are used in truly high-voltage applications. Consider, for example, aerospace power distribution systems. Studies have shown that 270-volt dc systems offer improvements in reliability, maintenance cost, reduced fuel consumption, weight and life cycle cost compared to conventional 28 Vdc and 115/200 volt, 400-hertz ac systems.

Conventional switching devices currently used with 28-volt dc or 115/200 volt, 400-hertz ac systems will require major modifications in order to reliably switch 270-volt dc circuits. These modifications will result in undesirably large and heavy units, making them impractical for the intended application. The use of vacuum as an insulating medium to switch 270-volt dc loads provides a significant increase in performance and reliability without the penalty of increased size and weight.

VOLTAGE: ——— 25 kV ———→



Kilovac Part No.	H-17	KC-22	KC-32	KC-28[2]	KC-38[2]	KC-30	K62A	K62B	K62C
Contact Arrangement	SPDT	SPST-NO	SPST-NC	SPST-NO	SPST-NC	SPST-NO	SPST-NC	SPDT	SPST-NO
Rated Operating Voltage (kVdc or 60 Hz peak)	25	25	25	25	25	25	25	25	25
Test Voltage (kVdc)	30	28	28	28	28	28	30	30	30
Continuous carry current contacts closed, max (amps dc or 60 Hz peak)	30	65	45	30	15	55	30	30	30
Recommended for Power Switching	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	N	Y[1]	Y[1]	Y[1]
Contact Resistance, max (ohms)	.015	.005	.010	1.0[4]	1.0[4]	.010	.025	.025	.025
Operate Time, max (ms)	25	18	18	18	18	18	15	15	15
Coil Resistance (ohms ± 10% @ 20°C)	120	120	120	120	120	120	125	125	125
Coil Voltage[5] (Vdc, nominal)	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Nominal Dimensions (inches)	2.38 D × 3.57 H	1.31 Sq × 4.0 H	1.31 Sq × 4.0 H	1.31 Sq × 4.0 H	1.31 Sq × 4.0 H	1.31 Sq × 4.0 H	1.98 D × 2.8 H	1.98 D × 2.8 H	1.98 D × 2.8 H
Nominal Weight (oz)	5	10	10	10	10	10	12	12	12
Mounting Style	Flange	Thrd'ed Base	Thrd'ed Base	Thrd'ed Base	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base

(1) Suitable for power switching. Contact factory for details.
(2) Gas filled for power switching on the "make".
(3) Operation in oil.
(4) Contact resistance in gas filled relays is tested at 28 Vdc and 1 amp.
(5) 12 Vdc and 115 Vdc coils available on request.
(6) When encapsulated, 35 kV operate, 37 kV test voltage.

Send for Kilovac catalog

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P.O. Box 4422EM, Santa Barbara, CA 93140 USA
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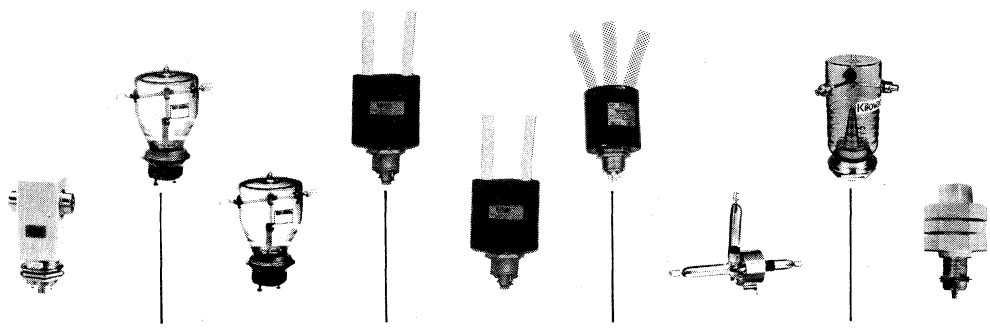
The small size and high reliability of Kilovac medical relays make them ideally suited for use in portable battery operated equipment.

Kilovac produces several models of patient, safety discharge, and ECG relays as well as multifunction relays capable of performing all of the switching requirements in defibrillators and other types of medical instrumentation. A variety of contact configurations is available: SPST-NO, SPST-NC, SPDT, and DPDT. This flexibility, coupled with Kilovac's extensive application experience and technical support capability, ensures design engineers of a relay suited to their precise requirement.

Kilovac maintains an on-going reliability test program to ensure that all relays continue to perform reliably time after time. Typically, relays are tested using a circuit with a 50 ohm load, an inductor, and discharging 360 joules of energy from a capacitor charged to 5000 volts. Subsequent analysis indicates a reliability of the patient relays of 99.9% at 5000 operations. They are pressurized with an electro-negative gas which provides the arc-quenching characteristics so important in capacative discharge applications.

It is Kilovac's policy to seek customer approval of any proposed changes relating to form, fit or function to a medical relay, as required by the FDA for Critical Components.

VOLTAGE: 28 kV — 30 kV — 35 kV — 50 kV — 100 kV →



Kilovac Part No.	KC-20	H-23	H-24	K61A[2]	K61B[2]	K61C[2]	H-35	H-25	K52C[2,3]
Contact Arrangement	SPST-NO	SPST-NC	SPST-NO	SPST-NO	SPST-NC	SPDT	SPST-NO	SPDT	SPST
Rated Operating Voltage (kVdc or 60 Hz peak)	28	30	30	35	35	35	35	50	100
Test Voltage (kVdc)	30	35	35	40	40	40	40	60	110
Continuous carry current contacts closed, max (amps dc or 60 Hz peak)	110	30	30	14	14	14	10	30	1
Recommended for Power Switching	N	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	Y[1]	N
Contact Resistance, max (ohms)	.005	.015	.015	.5[4]	.5[4]	.5[4]	.015	.015	2[4]
Operate Time, max (ms)	18	30	30	15	15	15	30	60	30
Coil Resistance (ohms ± 10% @ 20°C)	120	120	120	125	125	125	50	120	28
Coil Voltage[5] (Vdc, nominal)	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Nominal Dimensions (inches)	1.31 Sq × 4.0 H	2 D × 3.62 H	2 D × 3.62 H	1.98 D × 2.8 H	1.98 D × 2.8 H	1.98 D × 2.8 H	8.4 L × 6.03 H	3 D × 7.5 H	3.8 D × 6.0 H
Nominal Weight (oz)	10	7	7	12	12	12	15	30	28
Mounting Style	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base

(1) Suitable for power switching. Contact factory for details.
(2) Gas filled for power switching on the "make".
(3) Operation in oil.
(4) Contact resistance in gas filled relays is tested at 28 Vdc and 1 amp.
(5) 12 Vdc and 115 Vdc coils available on request.
(6) When encapsulated, 35 kV operate, 37 kV test voltage.

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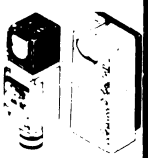
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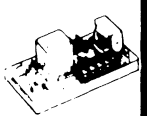
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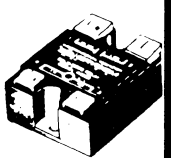
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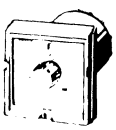
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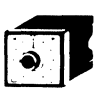
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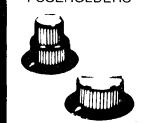
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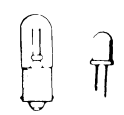
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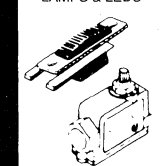
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SUBMINIATURE RELAYS

Quick Reference Guide

Leach products have been setting the standards in both technology and reliability for 70 years. Our products are aboard virtually every major U.S. airborne and commercial program involving aircraft, missiles, satellites and space launch vehicles as well as submarines, ships, tanks, and ground vehicles. This guide describes our relay product line ranging from 5 amp dry circuit subminiatures to 400 amp power contactors and time delay relays.

Dry Circuit to 12 Amp

LEACH® CORPORATION RELAY GROUP
SUBMINIATURE DIVISION
5915 AVALON BLVD., LOS ANGELES, CA 90003
FAX (213) 234-6461 ■ TWX (910) 321-2303
SALES DEPT. DIRECT LINE (213) 232-8228

	Contact Rating (Amps) 28 VDC Resistive	Inductive	Motor	Lamp	115/200 VAC 400 Hz, 3Ø (Case Grounded)	Nominal Coil Voltage(s)	Coil Resistance(s) — (Ohms)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Shock, Minimum, G	Sinusoidal Vibration, Minimum, G	Weight, Maximum, oz. (grams)
Low Level to 5A, 2PDT Non-Latch & Latch Series X, XL, XA Series III design. 5 mounting & 3 terminal types. 0.810″ × 0.410″ × 0.640″ Designed to MIL-R-6106. Sockets available: SO-1064-001 (Non-Latch) DC Coil SO-1064-003 (Latch) DC Coil SO-1064-0444 (Non-Latch) AC Coil	5	3	2	1	Same as DC except inductive is 5A and motor is 3A	DC Non-Latch 6 VDC 12 28 48 DC Latch 28 VDC AC Coil 400 Hz 115 50-400 Hz 115/28	30 125 500 1600 730 I, Max. .040 .024/.100	4	4	0.5	200	30 70 to 3000 Hz	.56 oz. (16 g)
Low Level to 5A, 4PDT Non-Latch & Latch Series Y, YL, YA Series III design. 5 mounting & 3 terminal types. 0.810″ × 0.810″ × 0.640″ Designed to MIL-R-6106. Sockets available: SO-1066-001 (Non-Latch) DC Coil SO-1066-003 (Latch) DC Coil SO-1066-10385 (Non-Latch) AC Coil	5	3	2	1	Same as DC except inductive is 5A and motor is 3A	DC Non-Latch 6 VDC 12 28 48 DC Latch 28 VDC AC Coil 400 Hz 115 50-400 Hz 115/28	25 100 400 1275 600 I, Max. .040 .030/.120	6	6	0.5	200	30 70 to 3000 Hz	1.06 oz. (30 g)
Low Level to 10A, 1PDT Non-Latch & Latch Series XC, XCL Series III design. 5 mounting & 3 terminal types. 0.810″ × 0.410″ × 0.640″ Designed to MIL-R-6106. Sockets available: SO-1064-10425 (Non-Latch)	10	6	4	2	Same as DC except inductive is 8A	DC Non-Latch 6 VDC 12 28 48 DC Latch 28 VDC	25 125 500 1600 730	6	6	1.0	200	30 70 to 3000 Hz	.56 oz. (16 g)
Low Level to 10A, 3PDT Non-Latch & Latch Series YC, YCL, YCA Series III design. 5 mounting & 3 terminal types. 0.810″ × 0.810″ × 0.640″ Designed to MIL-R-6106. Sockets available: SO-1065-001 (Non-Latch) DC Coil SO-1065-003 (Latch) DC Coil SO-1065-10392 (Non-Latch) AC Coil	10	6	4	2	Same as DC except inductive is 8A	DC Non-Latch 6 VDC 12 28 48 DC Latch 28 VDC AC Coil 400 Hz 115 50-400 Hz 115/28	25 100 400 1275 600 I, Max. .040 .030/.120	6 15	6 25	1.0	200	30 70 to 3000 Hz	1.09 oz. (31 g)
Low Level to 12A, 2PDT Non-Latch & Latch Series J, JA, JL Balanced Force* design. 5 mounting & 4 terminal types. DC — 1.015″ × 0.515″ × 1.000″ AC — 1.015″ × 0.515″ × 1.125″ Non-Latch applicable to MS27401. Latch applicable to MS27744, M6106/50. Sockets available: SO-1049-8309 (#16 Crimp) (Non-Latch) DC Coil SO-1049-8987 (#20 Crimp) SO-1049-8772 (#16 Crimp) AC-115 VAC SO-1049-8774 (#16 Crimp) 28 VAC SO-1055-8690 (#16 Crimp) (Latch) DC Coil	DC Coil 12 AC Coil 10	8	4	2	Same as DC Rating	DC Non-Latch 6 VDC 12 28 DC Latch 6 12 28 AC Coil 400 Hz 115/28 50-400 Hz 115/28	20 80 320 38 150 600 I, Max. .040/.240 .024/.100	10 10 15	10 N/A 50	1	200	30	1.4 oz. (40 g)

Dry Circuit to 25 Amp and 50 Amp

LEACH® CORPORATION RELAY GROUP

SUBMINIATURE DIVISION

5915 AVALON BLVD., LOS ANGELES, CA 90003
FAX (213) 234-6461 ■ TWX (910) 321-2303
SALES DEPT. DIRECT LINE (213) 232-8228

	Contact Rating (Amps) 28 VDC Resistive	Inductive	Motor	Lamp	115/200 VAC 400 Hz, 3Φ (Case Grounded)	Nominal Coil Voltage(s)	Coil Resistance(s) — (Ohms)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Shock, Minimum, G	Sinusoidal Vibration, Minimum, G	Weight, Maximum, oz. (grams)
Low Level to 12A, 4PDT Non-Latch & Latch Series K, KA, KL Balanced Force* design. 4 mounting & 3 terminal types. 1.015″ × 1.015″ × 1.000″ Non-Latch applicable to MS27400. Latch applicable to MS27745, M6106/51. Sockets available: SO-1048-8308 (#16 Crimp) (Non-Latch) DC Coil SO-1048-8518 (#20 Crimp) SO-1048-8776 (#16 Crimp) AC-115 VAC SO-1048-8779 (#16 Crimp) 28 VAC SO-1056-8691 (#16 Crimp) (Latch) DC	DC Coil 12 AC Coil 10	8	4	2	Same as DC Rating	DC Non-Latch 6 VDC 12 28	18 70 290	15	15	1	200	30	DC Coil 2.5 oz. (71 g) AC Coil 2.7 oz. (77 g)
						DC Latch 6 12 28	28 112 450	15	N/A				
						AC Coil 400 Hz 115/28 50-400 Hz 115/28	I, Max. .040/.225 .028/.120	20	50				
Low Level to 25A, 1PDT, Non-Latch & Latch Series JC, JCA, JCL[1]/JS, JSA [2] Balanced Force* design. 50 ADC & 80A, 400 Hz overload capabilities. JS Series 20A overload capabilities. Special Models available. 3 mounting & 3 terminal types. DC — 1.015″ × 0.515″ × 1.000″ AC — 1.015″ × 0.515″ × 1.125″ Non-Latch applicable to M6106/19. Latch applicable to M6106/20. Sockets available: SO-1063-9033 (Non-Latch) DC Coil SO-1063-9034 AC Coil SO-1063-9036 (Latch) DC Coil	(1) JC, JCA & JCL					DC Non-Latch 6 VDC 12 28	20 80 320	10	10	1	200	30	1.6 oz. (45 g)
	25	12	10	5	Same as DC Rating	DC Latch 6 12 28	38 150 600	10	N/A				
	(2) JS & JSA Series Only 115V, 60 Hz Case Grounded					AC Coil 400 Hz 115/28 50-400 Hz 115/28	I, Max. .040/.240 .024/.100	15	50				
	10	10	8	4	N/A								
Low Level to 25A, 3PDT Non-Latch & Latch Series KC, KCA, KCL Balanced Force* design. 50 ADC & 80A, 400 Hz overload capabilities. Special Models available. 3 mounting & 3 terminal types. 1.015″ × 1.015″ × 1.000″ Non-Latch applicable to MS27743. Latch applicable to MS27742. Sockets available: SO-1057-8912 (Non-Latch) DC Coil SO-1062-8917 AC Coil SO-1058-8913 (Latch) DC Coil	25	12	10	5	Same as DC except inductive 15A	DC Non-Latch 6 VDC 12 28	18 70 290	15	15	1	200	30	3.0 oz. (85 g)
						DC Latch 6 12 28	28 112 450	15	N/A				
						AC Coil 400 Hz 115/28 50-400 Hz 115/28	I, Max. .040/.225 .028/.120	20	50				
Low Level to 25A 3PST/NO, 2A 1PDT Aux. Non-Latch & Latch Series KD, KDA, KDL Balanced Force* design. Same design as Series KC with added auxiliary pole. Special Models available. 3 mounting & 2 terminal types. 1.015″ × 1.015″ × 1.000″ Non-Latch applicable to MIL-R-6106/13. Latch applicable to MIL-R-6106/12. Sockets available: SO-1059-8914 (Non-Latch) DC Coil SO-1061-8916 AC Coil SO-1060-8915 (Latch) DC Coil	25 Aux 2	12 Aux 1	10	5 Aux .05	Same as DC except inductive 15A	DC Non-Latch 6 VDC 12 28	18 70 290	15	15	1 Aux 4	200	30	3.0 oz. (85 g)
						DC Latch 6 12 28	28 112 450	15	N/A				
						AC Coil 400 Hz 115/28 50-400 Hz 115/28	I, Max. .040/.225 .028/.120	20	50				
50A 1PST-DB Non-Latch Series KM Balanced Force* design. Special models available. (For auxiliary contacts, etc., contact factory.)	50	20	20	10	N/A	DC Non-Latch 6 VDC 12 28	18 70 290	15	5	1	50	30	3.0 oz. (85 g)

*Patented and T.M. Leach Corp.

POWER AND CONTROL RELAYS

25 to 400 Amp

LEACH® CORPORATION RELAY GROUP

POWER AND CONTROL DIVISION

5915 AVALON BLVD., LOS ANGELES, CA 90003
FAX (213) 234-6461 ■ TWX (910) 321-2303
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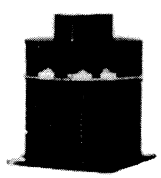
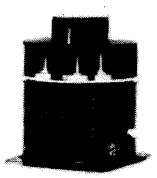
	Contact Rating (Amps)				Contact Configuration	Resistance, Ohms ± 10% @ 25°C for 28 VDC	Nominal Coil Voltage(s)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Sinusoidal Vibration, Minimum, G	Shock, Minimum, G	Weight, Maximum, oz/lbs.		
	Resistive	Inductive	Motor	Lamp											
25 Amp Series 9324 — 3PST/NO 25 A @ 28 VDC or 115/200 VAC, 60 or 400 Hz. 1.47″ × 2.50″ × 2.40″ Applicable to MS27418.	[1] 25	15	20	10	25	3PST/NO	160Ω	28 VDC 115, VAC, 400 Hz 115 VAC, 60 Hz	AC Coils 25 DC Coils 20	AC Coils 50 DC Coils 10	2	10G 55 to 1500 Hz	25	10.56 oz.
	[2] 25	25	20	10											
	[3] 25	25	12	10											
60 Amp Series "H," "HT" "HT" — Power Transfer Model Auxiliary contacts 5 amps. Repairable models available. Basic unit: 2.50″ Dia. × 3.13″ Applicable to MS27751. "HC" Center-Off version available. Applicable to MS27750. 	[1] 50	20	20	10	N/A	3PST/NO 3PDT 1PST/NO DB 1PST/NC DB 1 PDT DB Various Aux.	6 VDC, 12Ω 12 VDC, 50Ω 28 VDC, 200Ω 115 VAC, .09A	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	50	AC Coils 80 DC Coils 25	3	10G 70 to 1000 Hz	50	13.5 oz.
	[2] 60	60	40	15											
	[3] 30 Δ	30 Δ	30 Δ	N/A											
60 Amp Series "HL," "HLT" Magnetic Latch "HLT" — Power Transfer Model Repairable models availlable. Basic unit: 2.50″ Dia. × 3.13″ Applicable to MS27749. 	[1] 50	20	20	10	N/A	3PDT	6 VDC, 12Ω 12 VDC, 50Ω 28 VDC, 200Ω	6, 12, 28 VDC 15 VAC 400 Hz 115 VAC 60 Hz	35	—	3	10G 70 to 1000 Hz	50	14.0 oz.
	[2] 60	60	40	15											
	[3] 30 Δ	30 Δ	30 Δ	N/A											
100 Amp Series "ZC" Center-Off Repairable models available. Designed to MIL-R-6106. Basic unit: 3.65″ Dia. × 4.28″ Also available in magnetically latched model.	[1] 50	30	30	N/A	N/A	3PDT 1PDT DB NO	6 VDC, 9.3Ω 12 VDC, 38Ω 28 VDC, 150Ω 115 VAC, .09A	6, 12, 28 VDC 115 VAC 400 Hz 115 VAC 60 Hz	60	40	4	5G 70 to 500 Hz	15	2.0 to 2.7 lbs.
	[2] 100	100	60	N/A											
	[3] N/A	N/A	N/A	N/A											
120 Amp to 200 Amp Series, "Z," "ZG," "ZJ" Auxiliary contacts — 5 amp. Available in many models of contact configuration. Repairable models available. Designed to MIL-R-6106. Basic unit: 3.65″ Dia. × 4.28″ "ZL," magnetic latch version available.	[1] 50	30	30	N/A	N/A	3PDT DB 3PST/NO DB SPST/NO SPST/NC DB	6 VDC, 7Ω 12 VDC, 28Ω 28 VDC, 113Ω 115 VAC, .12A	6, 12, 28 VDC 115 VAC 400 Hz 115 VAC 60 Hz	60	40	4	10G 70 to 1000 Hz	50	2.0 to 2.7 lbs.
	[2] 120	120	80	N/A											
	[3] N/A	N/A	N/A	N/A											
300 Amp/400 Amp Series A/AJ Sealed Contactor SPST-NO. Auxiliary contacts — 5 amps. Applicable to MIL-R-6106/33. 3.64″ × 3.90″ × 2.80″	[1] 300	100	250	N/A	N/A	1PST/NO DB Various Aux.	60Ω	28 VDC	35	15	4	10G 70 to 500 Hz 5G 500 to 1500 Hz	25	1.75 lbs.
	[1] 400	150	250	N/A											
	[2] N/A	N/A	N/A	N/A											
	[3] N/A	N/A	N/A	N/A											

LEACH® CONTROL DEVICES DIVISION • TIME DELAY RELAYS

LEACH CPD, 6900 ORANGETHORPE AVE., BUENA PARK, CA 90620 • (714) 739-0770 • TWX 910-596-2867 • FAX (714) 739-1713

QPL CROSS REFERENCE — MILITARY P/N to LEACH P/N

Military P/N	Leach P/N	Operation Mode	Output	Timing Range (seconds)
M83726/3(1)	TD-1150/1151	Delay On Operate-Fixed Time	10A, 2PDT	0.1 to 300
M83726/4(1)	TD-1160/1161	Delay On Release-Fixed Time	10A, 2PDT	0.1 to 300
M83726/12	TD-1369	Delay On Release-Fixed Time	10A, 4PDT	0.1 to 300
M83726/14	TD-1370	Delay On Operate-Fixed Time	10A, 4PDT	0.1 to 300
M83726/20	TD-1435	Delay On Operate-Fixed Time	250MA, SPST	0.05 to 500
M83726/21	TD-1436	Delay On Operate-Adjustable (2)	250MA, SPST	0.05 to 500
M83726/22	TD-1412	Repeat Cycle Timer (Flasher)	250MA, SPST	1-600 cycles/min(3)
M83726/23	TD-1505	"True" Delay On Release-Fixed (4)	10A, 4PDT	0.1 to 75
M83726/24	TDH-1609	Delay On Operate-Fixed Time	150MA, SPST	0.05 to 500
M83726/25	TDH-1610	Delay On Release-Fixed Time	150MA, SPST	0.05 to 500
M83726/28	TDH-8050/8051	Delay On Operate-Fixed Time	10A, 2PDT	0.1 to 600 (5)
M83726/29	TDH-8070/8071	Delay On Release-Fixed Time	10A, 2PDT	0.1 to 600 (5)
M83726/30	TDH-8060/8061	Delay On Operate-Adjustable	10A, 2PDT	0.1 to 600 (5)
M83726/31	TDH-8080/8081	Delay On Release-Adjustable	10A, 2PDT	0.1 to 600 (5)

(1) Slash sheets 1, 2, 3, & 4 to MIL-R-83726 have been officially inactivated for new design. DLA specifies for new design, /28 replaces /1 and /3 and /29 replaces /2 and /4. Replacement units are smaller and lighter but are electrically and physically compatible with inactivated units.
(2) All adjustable timers use external resistor (not supplied) to adjust timing range. See Table II.
(3) Each cycle 50% on, 50% off.
(4) "True" time delay on release requires no external power during timing period.
(5) Timing ranges above 500 second not MIL qualified.

TABLE I. SPECIFYING A FIXED TIME DELAY PERIOD

LEACH and the Military identify the time delay period in the same manner. A four digit dash number specifies the delay period in milliseconds. The first three numbers are significant figures while the fourth indicates the number of zeros to follow the first three.

Examples: —1001 = 1,000 milliseconds (1 second)
—2502 = 25,000 milliseconds (25 seconds)
—5000 = 500 milliseconds (0.5 seconds)

In the case of a repeat cycle timer (flasher), a similar method is used. The dash number indicates the length of each cycle. (Note: each cycle is 50% on, 50% off).

Examples: —2500 = 250 milliseconds cycle or 4 cycles/sec.
—1001 = 1,000 milliseconds cycle or 1 cycle/sec.
—6002 = 60,000 milliseconds cycle or 1 cycle/min.

TABLE II. USE AND SELECTION OF ADJUSTABLE TIMERS

Adjustable timers are useful in system prototyping or breadboard circuits where the precise time delay period is unknown. By the use of an external resistor, these devices are adjustable over a specific DECADE RANGE. Although any decade range within the overall timing range can be supplied, the following ranges are offered as standards:

0.1 to 1 seconds (Specify -1001)
1.0 to 10 seconds (Specify -1002)
5 to 50 seconds (Specify -5002)
50 to 500 seconds (Specify -5003)

Note from the above that in specifying a decade range, the four digit dash number indicates the high or upper limit of the desired decade range.

The formula below provides the proper resistance value to achieve the desired time delay:

$$R_{ext} = \left(\frac{T_1}{T_0} - 1\right) 100{,}000 \text{ Ohms}$$

Where: R_{ext} = External resistance value (Ohms)
T_1 = Desired time in seconds
T_0 = Minimum time (low end of decade range) in seconds.

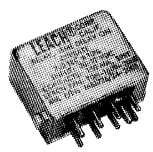
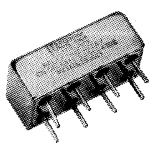
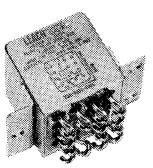
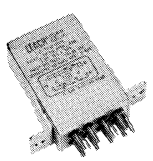
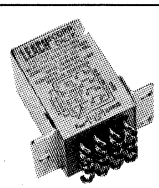
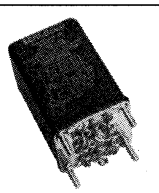
As an example, if using a 5 to 50 second adjustable timer and a 30 second delay is desired, the calculation is:

$$R_{ext} = \left(\frac{30}{5} - 1\right) 100{,}000 \text{ or } R_{ext} = 500 \text{ K Ohms}$$

Recommended resistors IAW MIL-R-55182 ⅛ WATT, 1% (RNC6OHXXXXFS).

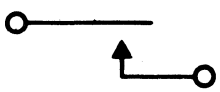
LEACH® CONTROL DEVICES DIVISION • TIME DELAY RELAYS

LEACH® CORPORATION
RELAY GROUP
CONTROL DEVICES DIVISION
6900 Orangethorpe Ave.
Buena Park, CA 90620
(714) 739-0770
FAX: (714) 739-1713 ■ TWX: 910-596-2867

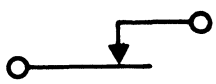
		CONTACT RATING—AMPS	OUTPUT CONFIGURATION	METHOD OF TIMING: ON OPERATE FIXED TIME	METHOD OF TIMING: ON OPERATE ADJUSTABLE	METHOD OF TIMING: ON RELEASE FIXED TIME	METHOD OF TIMING: ON RELEASE ADJUSTABLE	TIMING RANGE IN SECONDS	DIMENSIONS (L×W×H) / WEIGHT MAX OZ.
	**TDH-1609**	.150	SPST	✓				.05 TO 500	.810 × .410 × .640 0.56 oz.
	TDH-1610					✓			
	**TD-1435**	.250	SPST	✓				.05 TO 500	.810 × .410 × .310 0.5 oz.
	TD-1436				✓				
	TD-1412			REPEAT CYCLE (FLASHER)				1 TO 600 CYCLES/MIN	
	**TDH-8050**	10	2PDT	✓				0.1 TO 600	1.025 × 1.025 × 1.010 2.5 oz.
	TDH-8060				✓				
	TDH-8070					✓			
	TDH-8080						✓		
	**TDH-6050**	10	2PDT	✓				0.1 TO 600	1.025 × .525 × 1.520 1.9 oz.
	TDH-6060				✓				
	TDH-6070					✓			
	**TDH-7050**	10	4PDT	✓				0.1 TO 600	1.025 × 1.025 × 1.500 3.0 oz.
	TDH-7060				✓				
	TDH-7070					✓			
	**TD-1370**	10	4PDT	✓				0.1 TO 300	1.531 × 1.531 × 2.340 10.0 oz.
	TD-1369					✓			
	TD-1505	10	4PDT			✓ "TRUE"		0.1 TO 75	2.062 × 2.062 × 1.810 12.0 oz.

MINIGLOSSARY
RELAY CONTACT FORMS

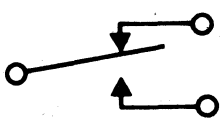
A
Make
SPST-NO



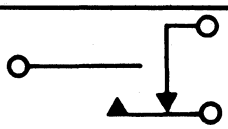
B
Break
SPST-NC



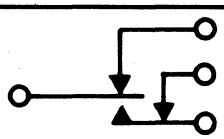
C
Break, Make
(Transfer)
SPDT



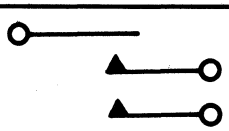
D
Make, Break
(Continuity
Transfer)



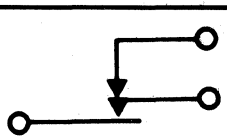
E
Break,
Make,
Break



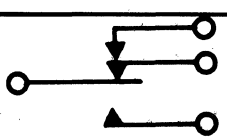
F
Make,
Make



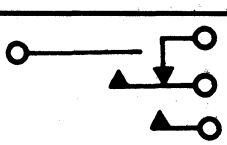
G
Break,
Make



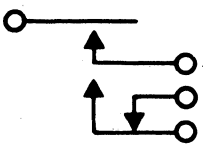
H
Break,
Break,
Make



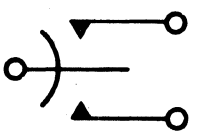
I
Make,
Break,
Make



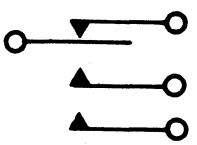
J
Make,
Make,
Break



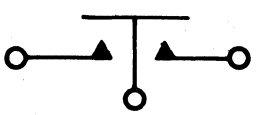
K
Center off
SPDT



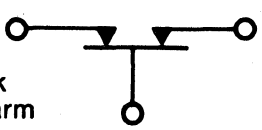
L
Break,
Make,
Make



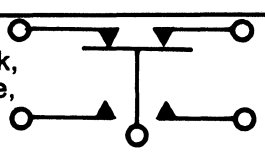
U
Double
make
Contact
on arm



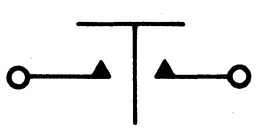
V
Double break
Contact on arm



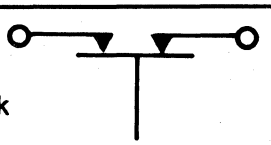
W
Double break,
Double make,
Contact
on arm



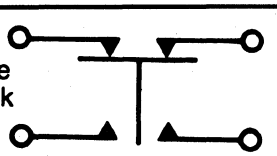
X
Double
make



Y
Double break



Z
Double make
Double break
SPDT-DB



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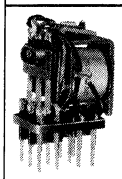
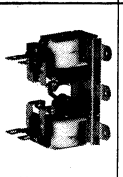
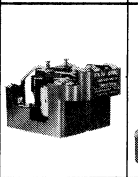
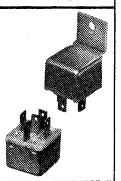
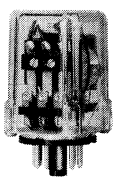
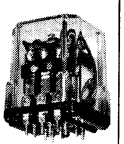
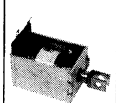
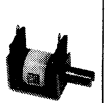
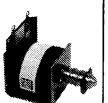
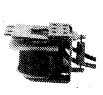
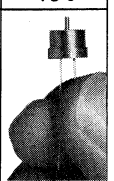
BASIC RELAY TYPE									
TYPICAL DIMENSIONS	W = 1.03 in. H = 1.22 in. L = 1.80 in.	W = 1.38 in. H = 2.16 in. L = 1.38 in. PINS	W = 1.52 in. H = 1.89 in. L = 1.40 in. PINS	W = 1.38 in. H = 2.19 in. L = 1.38 in. PINS	W = 1.75 in. H = 1.75 in. L = 2.75 in. OPEN	W = 1.63 in. H = 1.33 in. L = 2.16 in.	W = 1.47 in. H = 3.41 in. L = 2.63 in.	W = 2.50 in. H = 2.03 in. L = 2.31 in.	W = 1.02 in. H = 1.28 in. L = 1.02 in.
CONTACT ARRANGEMENT	SPST THRU 3PDT	SPST THRU 3PDT	SPST THRU 3PDT	SPST THRU 3PDT	1-6 PDT	SPST-NO-DB SPST-NC-DB	DPDT DPDT + 2NO DPDT + 1NO DPDT + 1NO,1NC 3PDT 2NO + 2NC	SPDT DPDT THRU SPST-NO-DM DPDT (2 AUX.)	SPST SPDT
CONT. RATING AVAILABLE (RESISTIVE)	5A 240VAC 10A 240VAC	5A 240VAC 10A 240VAC	5A 240VAC 10A 240VAC	5A 240VAC 10A 240VAC	15A TUNGSTEN 30A 120VAC 5A 120VAC 10A 120VAC	20A TUNGSTEN 30A 120VAC 1 H.P.	10 AMPS 15 AMPS	30A 277VAC 1 H.P.	30A RESISTIVE 24A IND AT 12VDC
COIL VOLTAGE	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-480 (DC) 6-110	6-24VDC

SENSITIVE RELAYS

	SENSITIVE DC COIL	
	MKF & MKC	SK
BASIC RELAY TYPE		
TYPICAL DIMENSIONS	W = 1.38 in. H = 2.16 in. L = 1.38 in.	W = 1.38 in. H = 1.90 in. L = 1.38 in.
CONTACT ARRANGEMENT	SPST THRU 3PDT	SPDT DPDT 3PDT
CONT. RATING AVAILABLE (RESISTIVE)	PILOT DUTY RATINGS 5A 240VAC 10A 240VAC	PILOT DUTY RATINGS 5A 240VAC 10A 240VAC
COIL VOLTAGE	1PDT-125mw 2PDT-250mw 3PDT-375mw	1PDT-60mw 2PDT-120mw 3PDT-180mw

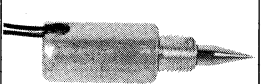
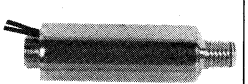
SOLENOIDS AND ACTUATORS

	D.C. OPERATED	U-FRAME	U-FRAME	U-FRAME	ACTUATOR	ACTUATOR	MINIATURE IMPULSE DUTY
	FA	DS	BR	KL	RC	RM	TO-5
BASIC SOLENOID TYPE							
OPERATING VOLTAGES	6, 12, 24, 48 AND 110VDC OTHERS AVAILABLE	ANY TO 110VDC ANY TO 240VAC	ANY TO 110VDC ANY TO 240VAC	ANY TO 110VDC ANY TO 240VAC	ANY TO 110VDC ANY TO 240VAC	ANY TO 110VDC ANY TO 240VAC	ANY TO 24VDC
DUTY Continuous	X	X	X	X	X	X	X
Intermittent	X	X	X	X	X	X	X
Pulse	X	X	X	X			X
DIMENSIONS IN INCHES	W = 1.640 H = 1.063 L = 2.125	W = 0.750 H = 1.406 L = 1.563	W = 1.000 H = 1.656 L = 1.563	W = 1.375 H = 2.063 L = 1.563	W = 0.859 H = 1.563 L = 1.375	W = 1.188 H = 1.563 L = 2.438	L = 0.500 D = 0.359
ACTION Push		X	X	X			
Pull	X	X	X	X	X	X	X

BUZZERS

	BUZZERS		
	MD	MA & MB	MC
BASIC RELAY TYPE			
TYPICAL DIMENSIONS	W = 0.88 in. H = 0.88 in. L = 1.66 in.	W = 1.03 in. H = 1.17 in. L = 2.16 in.	W = 2.84 in. H = 1.56 in. L = 3.47 in.
COIL VOLTAGE	6-240VAC	6-240VAC	6-240VAC

CYLINDRICAL SOLENOIDS

	SMALL	MEDIUM
	TYPE EL	TYPE EP
BASIC SOLENOID TYPE		
DUTY Continuous	YES	YES
Intermittent	YES	YES
Impulse	YES	YES
ACTION Push	X	X
Pull	X	X
MINIMUM DIMENSIONS IN INCHES	LENGTH = 1.813 DIAMETER = 0.484	LENGTH = 2.250 DIAMETER = 0.484

LOGITEK POWER PRODUCTS

THE LOGICAL CHOICE OF THE TECHNICAL MIND

POWER MONITORS/AC & DC VOLTAGE MONITORS

GENERAL INFORMATION

Logitek power monitoring equipment is utilized to monitor incoming power on AC or DC power systems. When the system voltage, frequency or phase characteristics deviate from the predetermined acceptable limits, the relay de-energizes to activate an alarm indicator or system shut-down contactors. Voltage sensing is accomplished with an "RMS" type detector that is relatively insensitive to line distortion.

EQUIPMENT TYPES

Individual units monitor AC or DC voltage and line frequency for both high and low limits, and phase rotation for reversal/loss. Power monitors are also available incorporating any combination of these functions into a single unit. This equipment is available with factory set limits or as field adjustable.

OPERATING CHARACTERISTICS

When the voltage and frequency of the input signal are within prescribed high and low limits, and the phase rotation is ABC, the output relay will energize after the specified "pick-up" time delay. If the high or low voltage limits of any phase are exceeded for a time greater than the specified "drop-out" time delay, the relay de-energizes and remains de-energized until all phase voltages return within limits and remain at normal levels for longer than the specified "pick-up" time delay. If the input frequency exceeds the high or low frequency limits for a time exceeding the "drop-out" time delay, the relay de-energizes and remains de-energized until the frequency returns within limits and remains at normal levels for longer than the "pick-up" time delay. The ouput relay will not energize if the phase rotation is other than ABC or if any phase is disconnected. When the output relay is energized, loss of any phase will cause the relay to drop out immediately, overriding the time delay circuits.

SPECIAL PRODUCTS

Logitek's engineering department is available to discuss your applications of our product or to design special equipment to satisfy your system requirements.

TYPICAL SPECIFICATIONS

ELECTRICAL

Input Voltage	115 VAC/208 VAC/ 230 VAC
Voltage Transients	MIL-STD-704, Limits 1, 2, 3
Input Frequency	50/60/400 Hz
Sense Voltage	As required
Sense Frequency	As required
Accuracy	±1%
Phase Sequence	ABC
Time Delay (Pick-Up and Drop Out)	250 milliseconds to 10 seconds factory set or field adjustable
Relay Contacts	DPDT, 3PDT
Contact Rating	2 amp, 10 amp
Contact Life	50,000 operations min.
Power Dissipation	6 watts maximum

PHYSICAL

Finish	Gloss Blue #15177, in accordance with MIL-F-14072
Connector	Glass to metal seal solder hooks, MS3113H-20-16PN Connector
Enclosure	Steel case, hermetically sealed and encapsulated

ENVIRONMENTAL

Temperature	−55°C to +125°C −40°C to +85°C −10°C to +70°C
Vibration	Per MIL-STD 810C, Method 514.2 Procedure I, 10-2000 Hz, 20g's
Shock	Per MIL-STD 810C, Method 516.2, Procedure I, 50g's 11 ±1 millisecond any axis
Acceleration	Per MIL-STD 810C, Method 513.2, Procedure I & II, 10g's
Humidity	Per MIL-STD 810C, Method 507.1, Procedure I
Altitude	Per MIL-STD 810C, Method 504.1, Category 6 equipment, sea level to 70,000 ft.

LOGITEK

THE LOGICAL CHOICE OF THE TECHNICAL MIND

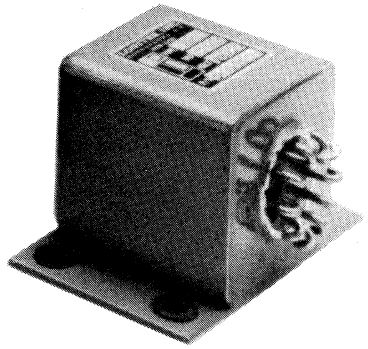
Logitek, Inc./101 Christopher St., Ronkonkoma, NY 11779-6922/Phone:516-467-4200/TWX: 510-224-6253/FAX: 516-467-4090

LOGITEK POWER PRODUCTS

THE LOGICAL CHOICE OF THE TECHNICAL MIND

FREQUENCY MONITORS/PHASE MONITORS

GENERAL INFORMATION



Frequency Monitors: Logitek Frequency Monitors are used in applications where electrical systems must be de-energized or alarm devices activated when the power line frequency departs from the predetermined normal range of operations.
Phase Monitors: Logitek Phase Monitors are used to protect three-phase loads, particularly rotating components, from damage resulting from phase reversals or the absence of phase. Contacts may be used to disconnect the load, to operate an alarm, or both.

OPERATING CHARACTERISTICS

Frequency Monitors: Signal voltage from the power line is applied to the designated terminals. If the line frequency is within the specified limits, the output relay energizes. If the frequency deviates from the preset limits for longer than the specified drop-out time delay, the unit de-energizes. After de-energizing, the frequency must return to within the pre-set band for longer than the pick-up time delay to re-energize the output relay.
Phase Monitors: Upon application of power, the output relay energizes if all phases are connected and the phase sequence is ABC. If any phase becomes disconnected, or if the phase rotation is abnormal, the relay immediately de-energizes.

SPECIAL PRODUCTS

Logitek's engineering department is available to discuss your applications of our product or to design special equipment to satisfy your system requirements.

TYPICAL SPECIFICATIONS

ELECTRICAL

Input Volage	115 VAC/230 VAC
Voltage Transients	MIL-STD-704, Limits 1, 2, 3
Input Frequency	50/60/400 Hz
Sense Frequency	As required
Accuracy	±1%
Phase Sequence	ABC
Phase To Phase Balance	±0.5%
Time Delay (Pick-Up and Drop Out)	250 milliseconds to 10 seconds factory set or field adjustable
Relay Contacts	DPDT, 3PDT
Contact Rating	2 amp, 10 amp
Contact Life	50,000 operations min.
Power Dissipation	4 watts maximum

PHYSICAL

Finish	Gloss Blue #15177, in accordance with MIL-F-14072
Connector	Glass-to-metal seal solder hooks, MS3113H-20-16PN Connector
Enclosure	Hermetically sealed and encapsulated or potted

ENVIRONMENTAL

Temperature	−55°C to +125°C −40°C to +85°C −10°C to +70°C
Vibration	Per MIL-STD 810C, Method 514.2 Procedure I, 10-2000 Hz, 20g's
Shock	Per MIL-STD 810C, Method 516.2, Procedure I, 50g's 11 ±1 millisecond any axis
Acceleration	Per MIL-STD 810C, Method 513.2, Procedure I & II, 10g's
Humidity	Per MIL-STD 810C, Method 507.1, Procedure I
Altitude	Per MIL-STD 810C, Method 504.1, Category 6 equipment, sea level to 70,000 ft.

LOGITEK
THE LOGICAL CHOICE OF THE TECHNICAL MIND

Logitek, Inc./101 Christopher St., Ronkonkoma, NY 11779-6922 / Phone: 516-467-4200/ TWX: 510-224-6253 / FAX: 516-467-4090

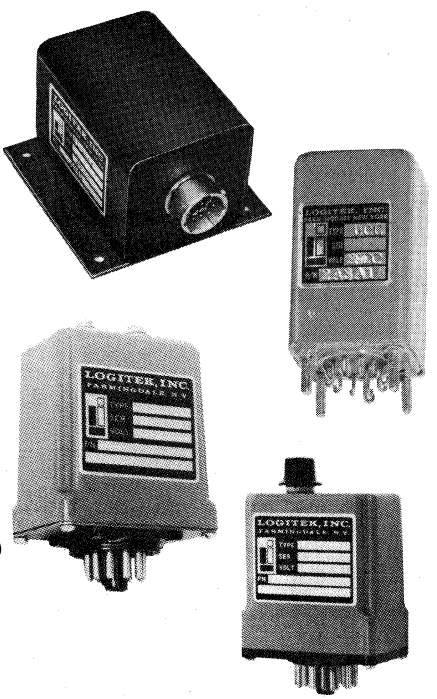
LOGITEK POWER PRODUCTS

THE LOGICAL CHOICE OF THE TECHNICAL MIND

TIME DELAY RELAYS • SOLID STATE FLASHERS REPEAT CYCLE & INTERVAL TIMERS

GENERAL INFORMATION

The design of complex electrical distribution systems often requires that certain operations be delayed or sustained for a precise interval of time from occurrence of a control or initializing signal. Combinations of various timing devices can be used for sequential startup or shutdown programs, load transfer or shedding, or delayed transfer to avoid race conditions. In addition, pulsers, interval timers, and flashers are used in applications, such as operating instrument panel warning lights or other annunciator devices, landing gear, door open indicators and navigation lights.



QUALITY ASSURANCE

Logitek's facilities are qualified under MIL-Q-9858A and maintains a MIL-I-45208 inspection system. These systems, along with Logitek's 100 hour burn-in cycle, contribute substantially to Logitek's uncompromising product integrity.

OPERATING CHARACTERISTICS

Logitek timing devices are generally CMOS integrated circuits appropriately protected from line transients and other line perturbations and either a solid state or electromechanical relay output circuit. Since there are no large capacitive timing or storage elements in these devices, recycle times (the time after control removal that will cause a new timing cycle within specified accuracy) are very short. In addition, the use of CMOS IC digital counting circuits allows the use of very stable timing elements resulting in excellent stability through wide temperature ranges.

APPLICATIONS

- Aircraft, Electrical Systems • Mobile Radar Systems • Equipment Test Stations
- Tanks • Mobile Missile Launchers • Offshore Drilling Rigs • Computer Systems
- Shipboard Electrical Systems • Hospital Auxiliary Power Systems

SPECIAL PRODUCTS

Logitek's engineering department is available to discuss your applications of our product or to design special equipment to satisfy your system requirements.

TYPICAL SPECIFICATIONS

ELECTRICAL

Input Voltage	115 VAC/208 VAC/ 230 VAC
Timing Range	50 milliseconds to 1000 seconds
Accuracy	±10%, ±5%, ±2%
Contacts	
Relay	DPDT
Solid State	
Radio Interference	Per MIL-1-26600

PHYSICAL

Finish	Gloss Blue #15177, in accordance with MIL-F-14072
Connector	Glass-to-metal seal solder hooks, solder pins, MIL connector, octal plug in
Enclosure	Hermetically sealed and encapsulated, Butyrate case

LOGITEK
THE LOGICAL CHOICE OF THE TECHNICAL MIND

ENVIRONMENTAL

Temperature	−55°C to +125°C −55°C to +85°C −55°C to +71°C −30°C to +30°C
Vibration	Per MIL-STD 810C, Method 514.2, Procedure I, 10-2000 Hz, 20g's
Shock	Per MIL-STD 810C, Method 516.2, Procedure I, 50g's 11 ±1 millisecond any axis
Acceleration	Per MIL-STD 810C, Method 513.2, Procedure I & II, 10g's
Humidity	Per MIL-STD 810C, Method 507.1, Procedure I
Altitude	Per MIL-STD 810C, Method 504.1, Category 6 equipment, sea level to 70,000 ft.

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MINIGLOSSARY TIMERS

Accuracy
The variation of unit performance, i.e., time delay, voltage trip point, etc., over the specified conditions of ambient temperature, input voltage range, and time between operations.

Adjustability
The changing of a unit set point, within the specified range of unit operation, by means of internal or external adjustment mechanism (i.e., changing time delay with potentiometer).

Contact Rating
The electrical power-handling capability of relay contacts under specified environmental conditions and for a prescribed number of operations.

Delayed Interval Timing Function
Input voltage is applied continuously. The timing cycle is started by momentarily actuating the control circuit. The functions of separate Delay-On-Operate and interval type timers are combined in one package providing a single OFF-ON-OFF output cycles

Also called: single shot.

Delay-On-Operate Timing Function
Application of the input voltage starts the time delay. At completion of the time delay, the relay contacts transfer.

Also called: Delay-On-Make, On-Delay, Delay Relay, Delay-On-Pickup.

Delay-On-Release Timing Function
Input voltage must be supplied continuously to timer. Actuation of control circuit causes relay contacts to transfer immediately. Time delay starts when control circuit is released. The relay remains energized for the duration of the time delay—then de-energizes.

Also called: Delay-On-Break, Off-Delay, Delay-On-Dropout, Delay-On-Energization.

Frequency Sensor
A device that monitors a predetermined overfrequency and/or underfrequecy condition, and changes output state when these conditions exist.

Hysteresis
The difference between the response of a unit or system to an increasing and a decreasing signal (example: a voltage sensor).

Interval Timer Timing Function
Application of input voltage causes relay contacts to transfer and time delay to begin. At completion of the time delay, the relay contacts return to de-energized state.

Also called: Delay Interval, One Shot.

Output Control
The switching device, either solid-state or electromechanical, used in the unit to control the load connected to the output terminal(s).

Phase Sensor
A device that monitors for proper phase rotation in 3-phase systems.

Programmability
Ability to modify function, time delay or input voltage of a timer.

Recovery Timer
(Delay-On-Operate/Interval Timer)
The minimum time that input voltage must be interrupted *prior* to time-out to insure a successive timing cycle within the specified limits.

(Delay-On-Release)
The minimum duration of time that control circuit must be re-actuated to insure a new timing cycle when the control circuit is released.

Recycle Time
(Delay-On-Operate or Interval Timer)
The minimum time that input voltage must be interrupted after the timing cycle is completed to assure a successive timing cycle within the repeatability specified.

(Delay-On-Release)
The minimum duration of time that control circuit must be actuated to insure a successive timing cycle within the repeatability specified when the control circuit is released.

Repeat Cycle Timer Timing Function
Application of power automatically initiates continuous off-on cycling of the output relay.
Also called: flasher, intervalometer

Reset Time
The time required for the contacts to return to normal position when power is removed.

Reverse Polarity Protection
Blocking circuitry arrangement within the timer to prevent damage or output actuation if reverse polarity input voltage is applied.

Tolerance
The difference between specified and actual timing or sense point (factory setup tolerance).

Transient Protection
Prevents damage to unit if positive or negative transients are applied to the unit. Insures proper operation of the unit during and after transient occurrence. Max. transients are usually specified as to amplitude and duration, i.e., 1000V for 1 second.

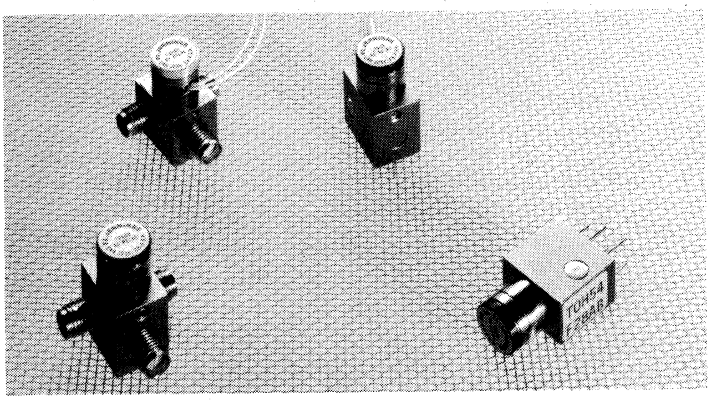
Trip Point
The predetermined point at which a sensing device is set to change the output state.

Voltage Sensor
A device that monitors for a predetermined overvoltage and/or undervoltage condition, and changes output state when these conditions exist.

JENNINGS MINIATURE MICROWAVE RELAYS

The FL Jennings TOH Series microwave relays are designed to operate from DC to 2.5 GHz and higher. They are used in coaxial transmission lines to open, close, and divert signal paths. Applications where stringent impedance matching and isolation are required include antenna switching, radar, communications, radio telephones, and cable TV systems. Our technology represents the latest developments in materials, performance and flexibility. The TOH series microwave relays are available in coil terminal, PCB terminal, flying lead, and solder lug configurations. Operating voltages of 6, 12, 24, and 28 VDC can be specified.

The TOH Series are built using a new patented method that offers efficiency in manufacture. The result provides reliable, proven relays at lower cost.



TYPICAL RF CHARACTERISTICS

MICROWAVE DATA TOH 55 SMA CONNECTOR VERSION

FREQUENCY RANGE (GHz)	DC-200 MHz	200-500 MHz	500-1 GHz	1-1.5 GHz	1.5-2.5 GHz*
VSWR (MAX.)	1.05:1	1.08:1	1.09:1	1.10:1	1.20:1
INSERTION LOSS (MAX. dB)	0.05 dB	0.05 dB	0.08 dB	0.1 dB	0.15 dB
ISOLATION (MIN. dB)	60 dB	55 dB	48 dB	45 dB	40 dB
IMPEDANCE	50 OHMS NOMINAL				

MICROWAVE DATA TOH 54 PC BOARD VERSION

FREQUENCY RANGE (GHz)	DC-200 MHz	200-500 MHz	500-1 GHz	1-1.5 GHz	1.5-2.5 GHz*
VSWR (MAX.)	1.05:1	1.1:1	1.17:1	1.22:1	1.3:1
INSERTION LOSS (MAX. dB)	0.05 dB	0.07 dB	0.11 dB	0.15 dB	0.24 dB
ISOLATION (MIN. dB)	60 dB	55 dB	48 dB	45 dB	40 dB
IMPEDANCE	50 OHMS NOMINAL				

*Frequency Range to 12 GHz Available on Special Order

ACTUATION DATA

COIL VOLTAGE (VDC)	6	12	24	28
RESISTANCE (OHMS ± 10%)	15	60	240	330
CURRENT (MA MAX @ 20° C)	445	230	115	95
SWITCHING TIME	20 MS (MAX)			

POWER HANDLING 50 WATTS CW @ 1 GH_z

MECHANICAL **SWITCHING SEQUENCE BREAK BEFORE MAKE**
OPERATING MODE: FAILSAFE

TEMPERATURE RANGE **OPERATING AMBIENT:** – 55°C TO + 85°C

LIFE **OPERATING LIFE:** 2.5 MILLION CYCLES

COAXIAL CONNECTORS MADE PER MIL-C-39012

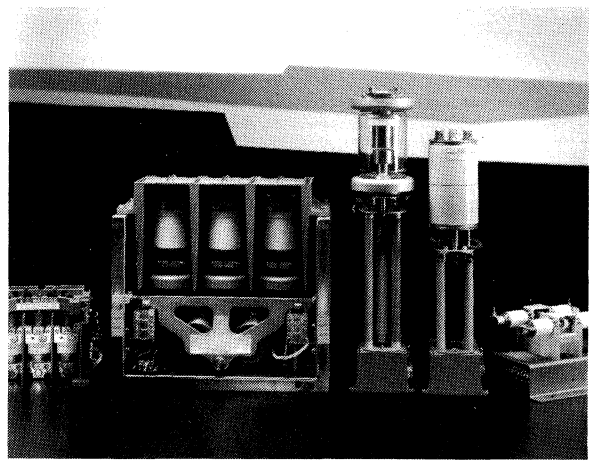
MATERIALS AND FINISHES
RF BODY, AL. ALLOY PER QQ-A-250/11 COND. T6 NICKEL PLATED PER MIL-C26074, CL4.
CONNECTOR SHELL, CRES OCMP. 303 Se, PER ASTM-A-582, COND A, PASSIVATED PER QQ-P-35
CONNECTOR DIELECTRIC, VIRGIN TEFLON PER MIL-P-19468, GROUP A.
CONNECTOR CONTACT, BERYLLIUM COPPER PER QQ-C-530, GOLD PLATED PER MIL-G-45204.
SOLENOID HOUSING, CARBON STEEL LEADED PER QQ-S-637, NICKEL PLATED PER MIL-C-26074, CL2.

PATENT PENDING.

JENNINGS A LEAR SIEGLER COMPANY
JENNINGS DIVISION
970 McLaughlin Ave., San Jose, CA 95122
(408) 292-4025

JENNINGS VACUUM CONTACTORS

Vacuum Contactors are used to control large amounts of DC power and RF currents with ratings up to 50 kv and currents up to 600 Amperes continuous. These contactors are recommended wherever high voltage capability, small size, and high speed operation with a long and low maintenance life are important. Applications include primary control of power supplies, industrial motors, and induction heating equipment, RF system tap changing, and fault protection of high power transmitters. The 18 page catalog provides complete specifications with a variety of specific applications for 3-pole, high voltage AC and DC, RF contactors and overcurrent relays actuated by solenoid, air or motor drives.



GENERAL PURPOSE

Model Number	Operate Voltage (Pk KV)	Continuous Current (Amps)	Max. Interrupt AC Current (Amps RMS)	Capacitor Discharge Decaying to 0 in 200 μS (KAmps Pk)	Contact Arrangement	Actuator Voltage (Volts)	Time to Close (Ms)	Break Time (Ms)	Weight (Lbs.)
RP101F4903D21B20 RP101F4904D21B20	30	200 DC	N/A	50	N/O N/C	115 60 Hz	60	50	15
RP101F4304D26B20 RP103F4304D26B20	30	200 DC 200 RMS	N/A 2000	50	N/C	100 DC	55	42	10
RP103F4903D21B20 RP103F4904D21B20	30	200 RMS	2000	50	N/O N/C	115 60 Hz	60 30	50 60	10
RP901K4903D21B30 RP901K4904D21B30	50	400 DC	N/A	100	N/O N/C	115 60 Hz	60 30	50 60	20
RP900K4601D26B30 RP900K4602D26B30	50	400 DC	4000	100	N/O N/C	100 DC	34 27	11 17	15
RP900K4903D21B30 RP900K4904D21B30	50	400 RMS	4000 at 13 KV RMS	100	N/O N/C	115 60 Hz	60 50	50 60	20
RT1G4201C22A10 RT1G4202C21A10	20	100	500	1	N/O N/C	230 AC 115 VAC 50/60	60 60	25 30	4
RT5C4202A21A10	15	30	100	0.5	N/C	115 AC	60	30	3

RF

Unit	Pk Operate Voltage 32 MHz	Contact Current 32 MHz RMS	Contact Resistance Ohms Max.	Contact Capacitance pF	Contact Inductance Nh	Contact Arrangement	Open Time	Close Time	Pull-in Current RMS	Hold Current RMS	Hold Power Watts	Actuating Voltage or Air Pressure	Approx. Weight	Life	Auxiliary Contacts Ratings Volt RMS Current RMS
RT224070A31NB (Solenoid Operated)	5*	25	.0005	2.5	n/a	Latching	< 300 Ms.	< 300 Ms.	.3	n/a	n/a	230 VAC	12 lbs.	2.5×10^5	Form C 230/15
RP233D1585 (Air Operated)	25	35	.0005	2	25	N/O	< 200 Ms.	< 200 Ms.	n/a	n/a	n/a	40 ± 5 psig	13 oz.	1×10^5	n/a
RF22-D2488 (Air Operated)	20	45	.00075	3	25	N/O	50 Ms.	100 Ms.	n/a	n/a	n/a	20 ± 10 psig	15 oz.	10×10^6	n/a
RF20B1586 (Air Operated)	20	100	.0004	10	2.5	N/O	< 200 Ms.	< 200 Ms.	n/a	n/a	n/a	35 ± 5 psig	2 lbs. 12 oz.	1×10^6	n/a

*Higher voltage ratings available at lower frequencies.

3-PHASE

Model Number	Operate Voltage V (RMS)	Continuous Current 60 Hz	Interrupt Current Amps RMS	Mechanical Life (Min.)	Actuator Voltage	Approx. Pull-in Current Amps Max.	Approx. Hold Current Amps Max.	Interrupt Time	Auxiliary Contacts	Approx. Weight
RP151B4541X44R20 RP151B4541X46R20	600	250	2000	2.5×10^5	26.5 VDC 100 VDC	4.6 1.7	.5 .07	Less than 2 Cycles	DPDT 115/230 VAC	16 lbs.
RP173-2310-00	7200	450	6000	1×10^6	115 VAC 50/60 110 VDC	3.5	.5	Less than 2 Cycles	3 N/O, 2 N/C	67 lbs.
RP173-2311-00	7200	450	6000	1×10^6	230 VAC 220 VDC	3.5	.5	Less than 2 Cycles	3 N/O, 2N/C	67 lbs.
RP133-2332-00	1500	450	4500	1×10^6	115 VAC 50/60, 110 VDC	3.5	.5	Less than 2 Cycles	3 N/O, 2 N/C	30 lbs.

JENNINGS®
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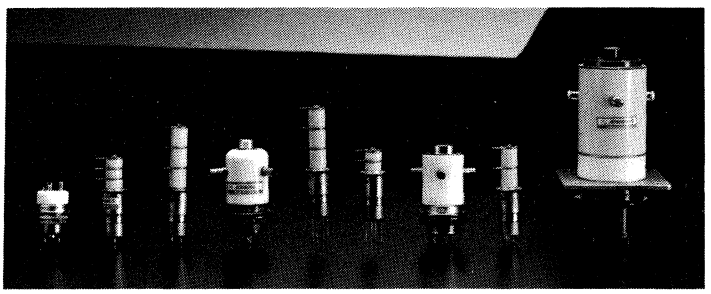
JENNINGS VACUUM/GAS RELAYS

Relay Testing

Jennings operates test facilities to provide all environmental, high voltage, and radio frequency (RF) test parameters. All relays are individually tested prior to shipment for pull-in voltage, timing characteristics, contact resistance, and dielectric strength.

Vibration, shock, humidity, salt spray, temperature effects, current load and reliability tests are regularly performed on a sampling basis.

Mechanical life reliability tests are performed on a sample basis with equipment that only passes relays which cycle with proper sequences of contact operation. Some relay types have been checked to more than 10^8 operations.



Peak Test Voltage (kV)	Model Number	Peak Working Voltage (kV) DC/60 Hz	Continuous Current Amps (RMS) DC/60 Hz	Maximum Capacitance Between Open Contacts or Contacts to Ground	Contact Configuration	Contact Resistance (ohms)	Operate Time (ms, Max)	Release Time (ms, Max)	Coil Resistance*	Expected Mech Life × 10^6	Connector Type	Weight Ozs. (Nom.)
SPST/VACUUM												
4	RF40(1)	3.6	12	1.6	Latch	.020	10	N/A	47	1	Sol.	1
4	RF41, RF42	3.6	12	1.6	N/C	.020	10	10	290	1	Sol.	1
4	RF44	3.6	12	1.6	Latch	.012	4	N/A	80	1	Sol.	1
8	RF5A	7.5	12	1.6	N/C	.050	12	12	920	1	Sol.	1
8	RF6A	7.5	12	1.6	N/O	.050	12	12	920	1	Sol.	1
9	RF43(1)	7.0	12	1.6	Latch	.020	10	N/A	47	1		
10	RF47	8.0	35	1.6	Latch	.004	4	N/A	80	1	Sol.	1
10	RF4A, RF4B(1)	8.0	30	4.0	N/C	.015	18	18	156	1	Sol.	2
12	RF50, RF51	10.0	12	1.6	N/C	.020	15	15	290	1	Sol.	1
12	RJ5	12.0	15	1.0	N/C	.030	10	10	180	1	S, N300, N400	3
15	RD5A, RF5B	12.0	15	1.0	N/O	.010	18	8	265	1	N300, N400	3
15	RD6A, RD6B	12.0	15	1.0	N/C	.010	18	8	265	1	N300, N400	3
30	RS8, RS10	28.0	75	1.5	N/O	.003	30	10	120	1	T	7
33	RJ8A	28.0	110	1.3	N/O	.003	18	8	120	2	T	10
33	RJ10	28.0	110	1.3	N/C	.003	18	8	120	2	T	10
SPDT/VACUUM												
4	RF1D, RF1E	2.0	8	2.0	SPDT	.050	10	10	920	2	Sol.	1
4	RF60(1), RF61	3.6	12	2.0	Latch	.020	10	N/A	47	1	Sol.	1
5	RJ1A	3.5	18	2.5	SPDT	.010	8	8	335	2	Sol.	1
5	RJ1H	2.5 Hot Switch	3	N/A	SPDT	.030	6	6	335	1	Sol.	1
9	RF62, RF63(1)	7.0	12	1.6	SPDT	.020	10	10	290	1	Sol.	1
9	RF63A	7.0	12	1.6	Latch	.020	10	N/A	47	1	Sol.	1
10	RF3A, RF3C(1)	8.0	30	4.0	SPDT	.015	18	18	156	1	Sol.	2
10	RF3D	8.0 Hot Switch	30	4.0	SPDT	.015	18	18	156	1	Sol.	2
15	RB1H, RB1J	12.0	15	1.0	SPDT	.012	18	9	265	1	S, N300, N400	3
15	RJ2B, RJ2C	12.0	50	1.0	SPDT	.012	18	9	270	.5	S, N300, N400	3
15	RJ4	12.0	50	1.0	SPDT	.012	18	9	270	1	S, N300, N400	3
18	RB1D, RB1E	12.0	15	1.0	SPDT	.012	18	8	265	1	S, N300, N400	3
20	RF10B	15.0	75	1.8	SPDT	.012	30	10	225	.1	Sol.	16
30	RE6B	25.0	25	2.5	SPDT	.012	25	10	120	.5	S, N300, N400	7
DPDT/VACUUM												
9	RB7A, RB7B	7.0	14	2.0	DPDT	.020	15	5	270	1	S, N300, N400	2
15/8(2)	RB3	12/6(2)	30	2.5	DPDT	.010	20	8	120	.5	S, N300, N400	6
22	RB2A	20.0	20	2.5	DPDT	.010	20	10	225	.5	S, N300, N400	8
4PDT/VACUUM												
17	RB4	15.0	20	2.5	4PDT	.010	45	10	131	.1	S, N300, N400	16
SPST/GAS FILLED												
70	RGH3	70.0	15	N/A	N/C	1.000	N/A	15	24	5	Solder/ Screw	16
DPDT/GAS FILLED												
14	RGD6	7.5	30	N/A	DPDT	.100	20	N/A	18(3)	.01(4)	Flex	11
20	RGD1	18.0	30	N/A	DPDT	.100	25	N/A	52	.01(4)	Sol.	16

* 26.5 VDC operate at 25°C (other coil voltages available)

S = Standard Nickel Tabs N300 = Copper N400 = Heavy duty copper Bolt Flex = Flying leads Sol. = Solder terminals T = Threaded mount

1 Latching Model 2 Lower Contacts 3 12 volt DC Coil 4 Rated Load Life

JENNINGS A LEAR SIEGLER COMPANY
JENNINGS DIVISION
970 McLaughlin Ave., San Jose, CA 95122
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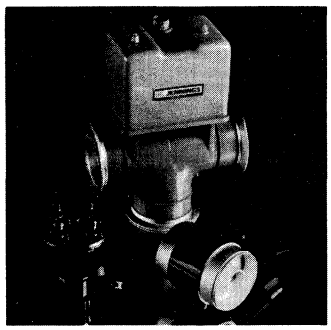
JENNINGS VACUUM/COAXIAL RELAYS

Applications for these units include high speed switching from omnidirectional to directional antennas, transmit-receive switching, and switching between transmitters for standby control.

Other applications include crossbar matrices and switching trees, CCTV, CATV, and microwave telemetry and data acquisition links, as well as general coaxial instrumentation.

Jennings vacuum coaxial relays have a recorded history of dependable, maintenance free operation. Because of this, they were chosen for ground and airborne applications for the tracking network of the Apollo program and the Atlantic Missile Range Communications.



Model Number	Power Rating (CW in KW)	Frequency Range† (MHz)	VSWR†	Crosstalk† (db Isolation)	Actuating Voltage	Insertion Loss† (Max)	Coil Resistance (Ohms ± 10•)	Contact Configuration	Connector size	Position Indicators Auxiliary Contacts	Operate Time†† (Max)	Weight Lbs. (Nom.)
GENERAL TRANSMITTER/RECEIVER SWITCH												
RC41E6000K440	3 @ 30 MHz	0-500	1.1:1 Max to 300 MHz	30 @ 300 MHz	26.5 VDC	0.1 dB	265	SPDT	C	None	25 ms	0.9
RC43E6050N440	5 @ 30 MHz	0-500	1.1:1 Max to 300 MHz	30 @ 300 MHz	26.5 VDC	0.1 dB	265	SPDT	LC	None	25 ms	3.3
CROSS OVER TYPE/4-PORT: 2 INPUT, 2 OUTPUT												
RC53A6300K24B	2.25 @ 30 MHz (connector limited)	0-600	1.1:1 Max to 300 MHz	75 @ 30 MHz	26.5 VDC	0.1 dB	19**	Transfer	N	DPDT	30 ms	2.8
RC54A6325H24B	7.5 @ 30 MHz	0-400	1.1:1 Max to 300 MHz	53 @ 500 MHz	26.5 VDC	0.1 dB	19**	Transfer	LC	DPDT	30 ms	6.4
1 5/8" LINE SIZE												
RC5A5101A24B	25 @ 30 MHz	0-100	1.05:1 Max to 60 MHz	70 @ 30 MHz	26.5 VDC	0.02 dB	Opening 19.9 Closing 18.7	SPST	1 5/8"	DPDT	30 ms	1.8
RC6A5126F14B	25 @ 30 MHz	0-400	1.1:1 Max to 150 MHz	65 @ 30 MHz	26.5 VDC Latching	0.01 dB	15.4	SPDT	1 5/8"	DPDT	50 ms	8.0
3 1/8" LINE SIZE												
RC10C5227A24B	90 @ 30 MHz	0-100	1.05:1 Max to 60 MHz	65 @ 30 MHz	26.5 VDC	0.02 dB	Opening 20.3 Closing 18.7	SPST	3 1/8"	DPDT	30 ms	3.8
RC21A5500F14B	90 @ 30 MHz	0-500	1.1:1 Max to 400 MHz	60 @ 30 MHz	26.5 VDC Latching	0.01 dB	4.8	SPDT	3 1/8"	DPDT	40 ms	14.0
SWITCH ASSEMBLY												
RC265552G24F	90 @ 30 MHz 2 MW Peak* Spec. Order	0-600	1.1:1 Max to 400 MHz	60 @ 30 MHz	26.5 VDC Latching	0.01 dB	19	SPDT	3 1/8"	DPDT	50 ms	14.0
ATTENUATOR												
RC275576G24F	90 @ 30 MHz 2 MW Peak* Spec. Order	0-600	1.1:1 Max to 400 MHz	60 @ 30 MHz	26.5 VDC Latching	0.01 dB	19	SPST	3 1/8"	DPDT	50 ms	13.0

* Power rating applies when connecting line pressurized 45 PSIA Dry Air or 31 PSIA Dry Nitrogen.
** ± 15%
† All measurements with a characteristic impedance of 50 ohms.
†† faster operate times can be obtained on most units by coil pulse circuits. Information available from factory.

NOTE: This power ratings is for the frequency at which the relay is most commonly used.
The power rating for any point in the frequency range of the unit other than that shown may be obtained by consulting factory.

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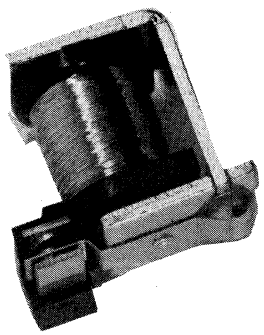
MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES
TECHNICAL INFORMATION
WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

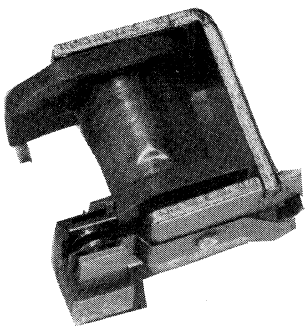
Abbreviations/Acronyms ..... **A**•1404, **B**•1090, **C**•1119 **D**•1156
AC Power Supplies, Product Selection Guide ..... **D**•2156
ASCII Code ..... **D**•1080
Batteries, Product Selection Guide .... **D**•1447
Batteries & Fuel Cells, Characteristics ..... **D**•1450
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide . **A**•1002
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1197
Conductors, Maximum Current Capacity of Copper & Aluminum ... **A**•2272, **C**•1316
Connectors, Miniglossary ..... **C**•1271
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1339
DC Power Supplies, Product Selection Guide ..... **D**•1537
Delay Lines, Product Selection Guide ..... **A**•1503
Dielectrics, Thermal Conductivity ..... **B**•1916
Discrete Semiconductors, Product Selection Guide ..... **A**•2154
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1041
EBCDIC Code ..... **D**•1086
Encapsulation, Miniglossary ..... **C**•1124
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide ..... **C**•1631
Fiber Optics, Miniglossary ..... **B**•1185
Fiber Optics, Product Selection Guide ..... B•1204
Filters, Power, Product Selection Guide ..... **A**•1642
Filters, Signal, Product Selection Guide ..... **A**•1683
IC Master ..... **A**•1740
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1210
Interconnection Systems, Product Selection Guide ..... **C**•1702
Keyboards & Keypads, Product Selection Guide ..... **B**•1854
Lamps, Lights, & Indicators, Product Selection Guide ..... **B**•1126
Logofinder & Trademark Directories ... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1776
Military Qualified Products List ..... **B**•1002
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1221
Opto Semiconductors, Miniglossary ..... **A**•2169
Oscilloscopes, Product Selection Guide ..... **D**•1426
Panel Hardware, Product Selection Guide ..... **C**•1583
Panel Meters, Analog & Digital, Product Selection Guide ..... **D**•1376
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide ..... **A**•2078
Power Supplies, Miniglossary ..... A•2276, **D**•1541
Power Supplies, AC, Product Selection Guide ..... **D**•2156
Power Supplies, DC, Product Selection Guide ..... **D**•1537
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1351
Relay Contact Forms ..... **B**•1450
Relays, Electromechanical, Miniglossary ..... **B**•1414
Relays, Product Selection Guide ..... **B**•1411
Resistor Color Codes ..... **A**•1952
Resistors, Product Selection Guide ... **A**•1867
Servo Components, Miniglossary ..... **B**•1266
SI Units, Basic Guide To, ... **A**•1434, **B**•1472, **C**•1692, **D**•1386
Solenoids, Product Selection Guide ... **B**•1655
Switches, Product Selection Guide .... **B**•1673
Symbols—International Authorities ..... **A**•1454, **B**•1064, **C**•1104, **D**•1166
Thermal Components, Product Selection Guide ..... **B**•1886
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1916
Thyristors/High Power Diodes, Miniglossary ..... **A**•2211
Timers, Miniglossary ..... **B**•1492, **D**•1140
Trademark & Logofinder Directories ... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1928
Transformers, Product Selection Guide ..... **A**•2215
Voltage Drop Nomograph ..... **A**•2262, **C**•1469, **C**•1960 **D**•1718
Wire & Cable, Product Selection Guide ..... **C**•1755
Wire Gauges—Diameter, Area, Copper Weight ..... **C**•1343, **C**•1759

MALLORY

SERIES PCM DC COIL RELAYS

The Mallory DC coil relay is designed for direct printed circuit board mounting. 1 FORM A (SPST-NO), 1 FORM B (SPST-NC) and 1 FORM C (SPDT) circuit arrangements are available in each of two styles. Style A is designed primarily for AC loads up to 30 amps, but can be utilized for DC applications as well. Style D is designed primarily for DC loads up to 30 amps and certain low-voltage AC loads. Each style has a distinct "footprint", shown at right. A snap-on dust cover is available. Mallory relays are suited to a variety of applications including appliances, automotive, load management and heating, ventilating and air-conditioning.



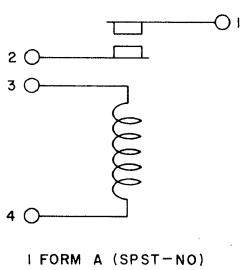


Switch Arrangements - 1 Form A (SPST-NO), 1 Form B (SPST-NC), 1 Form C (SPDT)

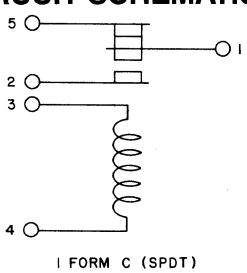
SWITCH RATINGS

Voltage	Load Type	Form A NO	Form B NC	Form C	
				NO	NC
AC	Inductive or Resistive	2-30 AMPS @ 12-240 VAC	2-15 AMPS @ 12-240 VAC	2-20 AMPS @ 12-240 VAC	2-10 AMPS @ 12-240 VAC
DC	Inductive	20 AMPS @ 5-28 VDC	15 AMPS @ 5-28 VDC	20 AMPS @ 5-28 VDC	10 AMPS @ 5-28 VDC
	Resistive	30 AMPS @ 5-28 VDC	20 AMPS @ 5-28 VDC	30 AMPS @ 5-28 VDC	10 AMPS @ 5-28 VDC

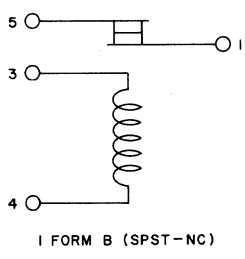
CIRCUIT SCHEMATICS



1 FORM A (SPST-NO)



1 FORM C (SPDT)



1 FORM B (SPST-NC)

U.L. approval may be required for some ratings. Inquire for details.

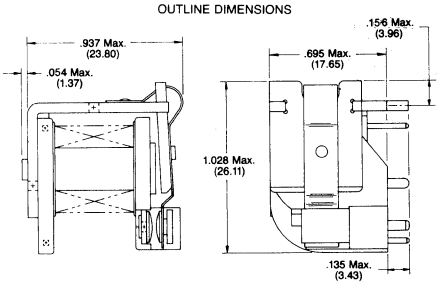
COIL DATA — Coil voltage ratings are available from 5 to 48 VDC. Consult Mallory for requirements regarding specific applications.

OPERATING DATA —
Must-Operate Voltage: Less than 70% of nominal voltage @ 25 degrees C.
Must-Release Voltage: More than 7% of nominal voltage @ 25 degrees C.

ENVIRONMENTAL DATA —
Storage: −55 to +105 degrees C.
Operating: −40 to +105 degrees C.

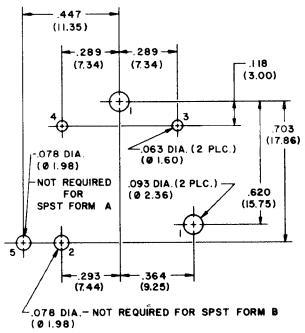
STYLE A

OUTLINE DIMENSIONS



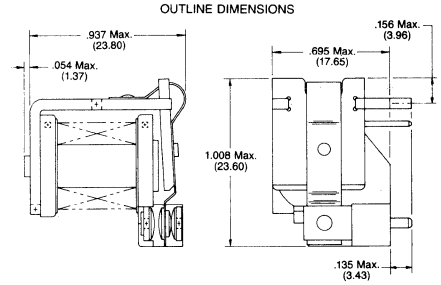
STYLE A

HOLE PATTERN



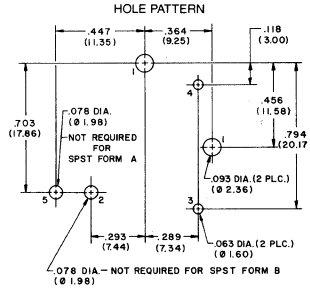
STYLE D

OUTLINE DIMENSIONS



STYLE D

HOLE PATTERN



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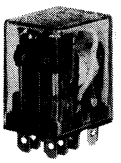
Phone: 317/261-1220

EMHART MALLORY

MEC MASTER ELECTRONIC CONTROLS
PHONE: (213) 452-1336

GENERAL PURPOSE AND POWER RELAYS

IMMEDIATE DELIVERY



SERIES	GV	GQ	GT	GF	GL	GM	GH	GW
Features	• Exceptionally reliable power relay • Octal type plug-in terminations • AC & DC coils • Optional indicator lamp • (SP) (UL)	• Power relay for use in control panels • Optional indicator lamp and push-to-test button • Unit with magnetic blowouts available • 15A unit available • (SP) (UL)	• 20A and 30A switching • Bracket mount package • 3,750 VRMS coil-to-contact breakdown • (SP) (UL)	• Magnetic latching relay • Single or dual coil input • Low power requirement • Good memory stability • (SP) (UL)	• Compact general purpose relay • Wide range of applications • Optional indicator lamp and push-to-test button • (SP) (UL)	• Versatile relay • Optional indicator lamp and push-to-test button • Optional hermetically sealed steel case • (SP) (UL)	• 30 amp contact rating • High in rush capacity • Optional magnetic blowouts and auxiliary switch • 50A unit available • (SP) (UL)	• Mercury displacement relay • 35A and 60A switching • Hermetically sealed • Ideal for adverse-environments • (SP) (UL)
Contact Arrangement	SPDT DPDT TPDT	SPDT DPDT TPDT	SPDT DPDT	SPDT DPDT	DPDT TPDT 4PDT	DPDT TPDT 4PDT	2A, 2B, 1C, 2C, 1X, 1Y	1A, 2A, 3A 1B, 2B, 3B
Contact Rating	10A @ 28 VDC or 230 VAC	10A @ 28 VDC or 240 VAC	• SPDT 30A @ 120/240 VAC 25A @ 28 VDC • DPDT 20A @ 120/240 VAC or 28 VDC	10A @ 28 VDC or 240 VAC	10A @ 24 VDC or 110 VAC	• DPDT, TPDT 5A @ 24 VDC or 220 VAC • 4PDT 3A @ 24 VDC or 220 VAC	30 Amps @ 300 VAC	• 35A model 35A @ 480 VAC • 60A model 60A @ 480 VAC
Contact Material	Ag Cd O	Ag Cd O	Ag Cd O	Ag Cd O	Ag Cd O	• DPDT, TPDT Ag • 4PDT Ag (Au Flash)	Ag Alloy (Au Flashed)	Liquid Mercury
Coil Voltage	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-220 VDC 6-480 VAC	5-250 VDC 6-480 VAC
Nominal Coil Power	(DC) 1.5W (AC) 2.3VA	(DC) 1.2-1.8W (AC) 2.0-2.75VA	(DC) 1.2W (AC) 2.7VA	(DC single coil) 1.2W (DC dual coil) 2.4W	• DPDT (DC) 0.9W (AC) 1.2VA • TPDT, 4PDT (DC) 1.4W (AC) 1.6-2.5VA	(DC) 0.9W (AC) 1.2VA	(DC) 2.0W (AC) 10.0VA	N.O. / N.C. AC (VA) 1 Pole 8.0 / 13.0 2 Pole 18.6 / 20.5 3 Pole 33.0 / 33.0 DC (W) 1 Pole 6.5 / 8.0 2 Pole 7.5 / 10.5 3 Pole 12.0 / 12.0
Mechanical Life	5,000,000 operations min.	10,000,000 operations	10,000,000 operations	10,000,000 operations	AC-50,000,000 operations DC-100,000,000 operations	AC-50,000,000 operations DC-100,000,000 operations	3,000,000 operations	3,000,000 operations
Approximate Dimensions (inches)	2.07″H x 1.36″L x 1.36″W	1.91″H x 1.53″L x 1.41″W	1.97″H x 1.53″L x 1.41″W	2.16″H x 1.53″L x 1.41″W	1.40″H x 1.10″L x 0.85″W (DPDT Unit)	1.42″H x 1.10″L x 0.85″W	2.3″H x 3.125″L x 2.5″W (DPDT Unit)	5.06″H x 3.365″L x 3.125″W (TPDT Unit)
Mounting	Plug-in	Plug-in Panel mount P.C. Mount	Panel mount Track mount	Plug-in Panel mount	Plug-in Panel mount P.C. Mount	Plug-in Panel mount P.C. Mount	Screws	Box Collar
Sockets	Screw terminal P.C. terminal	Screw terminal Solder terminal P.C. terminal Quick connect	—	Screw terminal Solder terminal P.C. terminal Quick connect	Screw terminal Solder terminal P.C. terminal Quick connect	Screw terminal Solder terminal P.C. terminal Quick connect	—	—

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TELEX: 182041 MASTER SNM • FAX: 213/392-9585

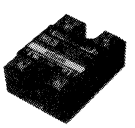
MEC MASTER ELECTRONIC CONTROLS
PHONE: (213) 452-1336

TIME DELAY RELAYS

IMMEDIATE DELIVERY

SERIES	DM	DI	DB	DS	RC
Features	• Reliable and accurate • Indicator lamp available in all voltages	• Precise timing cycles • Indicator lamp available in all voltages	• Wide range of industrial applications • Indicator lamp available in all voltages	• Reliable and accurate • Indicator lamp available in all voltages	• Independent on and off delays • Indicator lamp available in all voltages
Mode of Operation	Delay on make	Delay on interval	Delay on break	Delay on single-shot	Recycling timer
Contact Arrangement	DPDT TPDT	DPDT TPDT	SPDT DPDT	SPDT DPDT	DPDT TPDT
Contact Rating	10A @ 115 VAC	10A @ 115 VAC	10A @ 115 VAC	10A @ 115 VAC	10A @ 115 VAC
Input Voltage	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC	6-110 VDC 6-240 VAC
Delay Time (in seconds)	0.1-3600	0.1-3600	0.1-3600	0.1-3600	0.1-3600 on 0.1-3600 off
Type of Control	Fixed Knob Remote	Fixed Knob Remote	Fixed Knob Remote	Fixed Knob Remote	Knob Remote
Maximum Repeatability	± 1%	± 1%	± 1%	± 1%	± 1%
Mechanical Life	10,000,000 Operations	10,000,000 Operations	10,000,000 Operations	10,000,000 Operations	10,000,000 Operations
Approximate Dimensions (inches)	2.75″ H × 2.00″ L × 1.56″ W	2.75″ H × 2.00″ L × 1.56″ W	2.75″ H × 2.00″ L × 1.56″ W	2.75″ H × 2.00″ L × 1.56″ W	2.75″ H × 2.00″ L × 1.56″ W

SOLID STATE RELAYS



SS SERIES:
SSA — SCR's back to back with A.C. control.
SSD — SCR's back to back with D.C. control.

ST SERIES:
STA — TRIAC with A.C. control.
STD — TRIAC with D.C. control.

SPECIFICATIONS

1. Current Rating: 8 to 90 Amps.
2. Minimum load current: 50 ma.
3. Temperature Range:
   a. Operating: −30°c to +80°c
   b. Storage: −28°c to +100°c
4. Duty: Continuous
5. Contacts: 1 Form A (SPNO)
6. Input control: A.C. Models
   a. Control voltage range: 90 − 280 VAC
   b. Must operate voltage: 90 VAC Max.
   c. Must release voltage: 10 VAC Min.
   d. Input impedance: 40,000 OHMS Min.
   e. Input current: 2mA max @ 120 VAC
7. Input control: D.C. Models
   a. Control voltage range: 3-32 VDC
   b. Must operate voltage: 3 VDC Max.
   c. Must release voltage: 1 VDC Min.
   d. Input Impedance: 1,500 OHMS Min.
   e. Input current: 4mA max @ 5 VDC
8. Standard: Zero voltage turn on.
9. UL listed and CSA certified.

ORDERING INFORMATION:

SCR OUTPUT - SS SERIES

PART NUMBER		Line V ac (47-63 Hz)	Max. Load Current, Amps (RMS)	One-Cycle Surge, Amps (PK)
AC Input	DC Input			
SSA1210	SSD1210	24-140	10	120
SSA1225	SSD1225	24-140	25	250
SSA1240	SSD1240	24-140	40	625
SSA2410	SSD2410	48-280	10	120
SSA2425	SSD2425	48-280	25	250
SSA2440	SSD2440	48-280	40	625
SSA2450	SSD2450	48-280	50	625
SSA2475	SSD2475	48-280	75	1000
SSA4808	SSD4808	80-530	8	72
SSA4812	SSD4812	80-530	12	140
SSA4825	SSD4825	80-530	25	250
SSA4840	SSD4840	80-530	40	400
SSA4875	SSD4875	80-530	75	1000
SSA4890	SSD4890	80-530	90	1200

TRIAC OUTPUT - ST SERIES

STA1210	STD1210	24-140	10	100
STA1225	STD1225	24-140	25	250
STA2410	STD2410	48-280	10	100
STA2425	STD2425	48-280	25	250
STA4825	STD4825	80-530	25	250

MEC MASTER ELECTRONIC CONTROLS PHONE: 213/452-1336
P.O. BOX 25905 • LOS ANGELES, CALIFORNIA 90025-0662 USA
TELEX: 182041 MASTER SNM • FAX: 213/392-9585

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

MATRIX
SYSTEMS CORPORATION
5177 NORTH DOUGLAS FIR ROAD
CALABASAS, CALIFORNIA 91302
(818) 992-6776 • TWX 910-494-4975
FAX (818) 992-8521

Coaxial Relay Module 7000 Series

7100 — Standard

7200 — Self-terminating

7300 — High isolation

7400 — Highest isolation

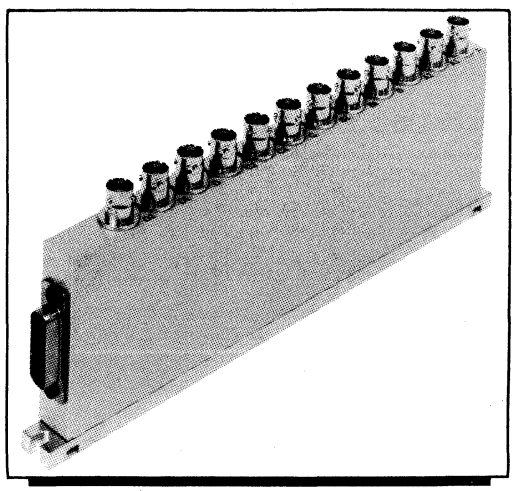
7500 — High power

7600 — Highest isolation self-terminating

7700 — Mercury wetted contacts

7800 — Twinax

7900 — Triax



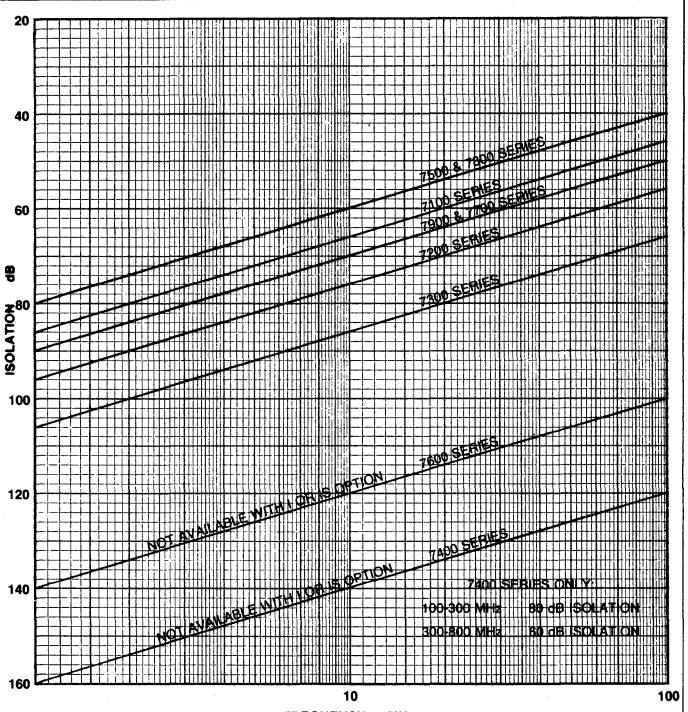
FEATURES:

- DC up to 800 MHz depending on number of throws
- Two to twenty-four throws
- Continuous shield continuity
- Rugged machined aluminum housing
- Crosstalk always lower than isolation
- Switchpoints individually field replaceable
- Extremely low EMI
- Low VSWR
- Matrix configuration easily assembled using 9000 series cross straps
- Signal circuits isolated from control circuitry

MATRIX 7000 Series Relay Modules are designed to maintain coaxial switching continuity over a wider range of critical and high environmental applications. The Relay housings are constructed of precision machined aluminum alloy for structural integrity and hard anodized for durability. All signal shield paths are silver plated with covers gasketed for maximum EMI protection. The basic reed switch elements are hermetically sealed in nitrogen filled gas envelopes and employ rhodium plated contacts to insure non-stick operation. Applications for MATRIX 7000 Series include:

— R.F. and I.F switching where a low VSWR is required.
— CCTV, base band video and pulse switching where low phase distortion and high pulse fidelity are required.
— Applications requiring a high degree of shielding integrity and low contact and induced noise such as pre amp input switching or the switching of high impedance operational amplifier inputs.

Matrix and hybrid switching systems are easily constructed by using Series 9000 (no output), 9100 (one output) or 9200 (two output) push-on cross straps which mate with the BNC connectors on the switch modules. The cross strap output connectors are BNC female type UG 1094/U. The model number of the cross strap is assigned by replacing the two zeros of the series number with the number of inputs desired. For example, a Model 9108 has eight inputs and one output.



MODEL NUMBER ASSIGNMENT

7 X XX — X

Series
Number of throws (N)
Options:
Coil suppression diodes with:
Coil common negative — D
Coil common positive — DR
TNC connectors — T
SMA connectors — S
Self-terminating — Ohms
Insulated shield — I
Insulated and
Switched shield — IS
Expander output — E
Chassis mount — C
Optional voltage — See Factory

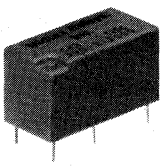
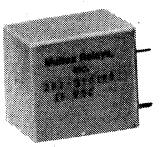
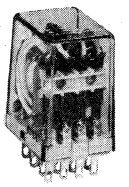
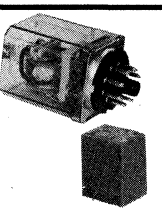
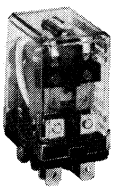
SPECIFICATIONS

FREQUENCY RANGE:	(−1dB) 1310 ÷ (N −.13) MHz where N = Number of Throws
FREQUENCY RANGE:	(−3dB) 1760 ÷ (N +.2) MHz where N = Number of Throws
CHARACTERISTIC IMPEDANCE:	50 ohms - 75 ohm optional
SWITCHING CONFIGURATION:	Single or double pole, two thru twenty-four throws
SWITCHING SPEED:	One mS dry contact, three mS mercury wetted
ISOLATION:	See graph See factory for -I or -IS option
CONTROL - CONNECTOR:	28 VDC, 30 mA- D type-mate supplied
SIGNAL CONNECTOR:	BNC, Twinax, Triax, TNC, SMA or F type optional
OPERATING TEMPERATURE AND HUMIDITY RANGE:	−30°F to +150°F, 0 to 98 percent R.H.
OPERATING SHOCK AND VIBRATION:	50 G's - 1 mS, 2 G's p-p 20-2000 Hz
DIMENSIONS:	.625" W × 3.25" H × 1.44" + (.625" × number of throws)
MOUNTING:	Three 6-32 tapped holes in base or option - C

Midtex Relays, Inc.

9B2 BUTTERFIELD TRAIL/EL PASO, TEXAS 79906
PHONE: 915-772-1061/FAX: 915-772-1116

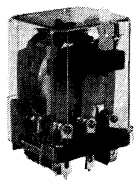
GENERAL PURPOSE RELAYS

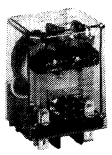
						
SERIES	**190**	**294**	**296**	**156**	**158**	**258**
FEATURES	"The Dipper" Low level switching up to 2 amps. 16 pin dip. Sealed for PC board mounting & immersion.	Economical 3 & 5 amp switching. Designed for economy printed circuit board switching. Meets FCC Part 68 1500 VDC surge.	Economical & reliable designed for low cost PCB switching such as industrial, communications, vending or commercial equipment.	Compact & versatile 2&4 pole industrial relay. Low level switching. Available with many options.	Designed for UL Component Recognition for Motor Controllers through 240 VAC in accordance with UL Std 508, Industrial Control Equipment. Available in Octal Plug-in version.	Economical 2PDT, 10 amp rated relay, available with printed circuit terminals or 3/16", .187 quick connect terminals for plug-in socket capability or direct wiring with flange mounting option.
EPOXY SEALED	YES	YES	YES	YES	YES	NO
CONTACT ARRANGEMENTS	2 Form C 1 Form C	1 Form C	1 Form C 1 Form A	2 Form C 4 Form C	1 Form C 2 Form C Form A Form B Form X Form Y Form C (1 & 2PDT) Octal	2 Form C
CONTACT MATERIAL RATINGS	Material -100 Pal./Sil. w/gold overlay 2.0 amp, 28 VDC, resistive 2.0 amp, 120 VAC, resistive -100 Pal./Sil. w/Gold Overlay 2.0 amp, 28 VDC, resistive -200 Pal./Sil./Gold Bifurcated 2.0 amp, 28 VDC, resistive 2.0 amp, 120 VAC, resistive	Material -100 Silver & Silver Cadmium Oxide -3 amps at 125 VAC or 30 VDC resistive -1 amp at 125 VAC or 30 VDC inductive -200 Silver Cadmium Oxide -5 amps at 125 VAC or 30 VDC resistive -1.5 amps at 125 VAC or 30 VDC inductive	Material -100 Silver/Gold flashed -3 amps at 24 VDC or 125 VAC resistive (UL) -1 amp at 24 VDC or 125 VAC inductive -1.5 amps at 250 VAC resistive -0.5 amps at 250 VAC inductive -200 Silver Cadmium Oxide 5 amps at 24 VDC or 125 VAC resistive (UL) -2 amps at 24 VDC or 125 VAC inductive -2.5 amps at 250 VAC resistive -1 amp at 250 VAC inductive -300 Silver Cadmium Oxide -10 amps at 24 VDC or 125 VAC resistive (UL) -4 amps at 24 VDC or 125 VAC inductive -5 amps at 250 VAC resistive -2 amps at 250 VAC inductive	Material -100 3/32" Silver (Gold flash) -*3 amp, 228 VDC/120 VAC, 80% pf -700 3/32" Pure fine Silver, Gold diffused -2 amp, 240 VAC, 80% pf -200 3/32" Silver Cadmium Oxide (Gold flash) -*5 amp, 28 VDC/120 VAC, 80% pf -3 amp, 24 VAC, 80% pf *1/10 horsepower, 125 VA, 120/240 VAC	Material 5/32" Silver Cadmium Oxide -10 amp, 28 VDC/120 VAC, 7 amp at 240 VAC; 80% pf 1/3 hp, 120/240 VAC 5/32" pure fine Silver (Gold flash) -10 amp, 28 VDC/120 VAC, 7 amp at 240 VAC; 80% pf 1/3 hp, 120/240 VAC	Material 5/32" Silver Cadmium Oxide -10 amps at 30 VDC, 120 or 240 VAC 1/3 hp at 120/240 VAC
COIL VOLTAGE	5, 6, 12, 24, 48 VDC	5, 6, 9, 12, 24, 48 DC	5, 6, 9, 12, 24, 48 DC	5, 6, 12, 24, 48, 90, 110 DC & 6, 12, 24, 48, 120, 240 AC and "Specials"	5, 6, 12, 24, 48, 90 110 (DC) 6, 12, 24, 48, 120, 240 (AC) and "Specials"	5, 6, 12, 24, 48, 110 (DC) 6, 12, 24, 120, 240 (AC) & Specials
POWER RATING	(DPDT) Nominal-550 mw Maximum continuous-1.0 w	Nominal-450 MW Maximum continuous-700 MW	Nominal-360 MW Maximum continuous-562 MW	Nominal (AC) 1.2 VA (DC) 0.9 watts Maximum continuous (AC) 2.0 VA (DC) 2.0 watts	Nominal 1.2 VA (AC) 0.9 watts (DC) Maximum continuous 2.0 VA (AC) 2.0 watts (DC)	Nominal 1.5 VA (AC), 0.9 watts (DC) Maximun continuous 2.0 VA (AC), 2.0 watts (DC)
DIELECTRIC	(Meets FCC Part 68) 1000 VAC coil to poles 1000 VAC between poles 1100 VAC across open contact (1500 VDC FCC surge)	2000 VAC coil to contacts 750 VAC across open contacts (1500 VDC FCC surge)	1500 VAC RMS 60 Hz all mutually insulated terminals (open contacts 750 VAC)	Greater than 500 VAC RMS 60 Hz across open contacts Greater than 500 VAC RMS 60 Hz all other mutually insulated elements	Greater than 500 VAC RMS 60 Hz across open contacts. Greater than 1500 VAC RMS 60 Hz all other mutually insulated elements.	Greater than 500 VAC RMS 60 Hz across open contacts. Greater than 1500 VAC RMS 60 Hz all other mutually insulated elements.
LIFE EXPECTANCY	**Mechanical**- in excess of 10 million operations. **Electrical**- 100,000 operations minimum at 1.0 amps.	**Mechanical**-in excess of 20 million operations **Electrical**-100,000 operations minimum at rated loads	**Mechanical**-in excess of 5 million operations **Electrical**-100,000 operations minimum at rated loads	**Mechanical**-in excess of 50 million operations **Electrical**-100,000 operations minimum at rated loads	**Mechanical**-in excess of 50 million operations **Electrical**-100,000 operations minimum at rated loads	**Mechanical**-in excess of 5 million operations **Electrical**-100,000 operations minimum at rated loads
MAX. SIZE IN INCHES (L×W×H)	.827×.410×.443	.906×.709×.575	.890×.642×.985	1.190×.859×1.281 (Dust Cover)	1.109×.859×1.281 (Dust Cover)	1.08×.830×1.36 (Plain Cover w/quick connect)
TERMINALS—PC SOLDER/PLUG-IN	Yes No	Yes No	Yes No	Yes Yes	Yes Yes	Yes Yes
OPTIONS				Opposite Polarity Barrier Push Button Diode across coil (DC only) Lamp across coil Lamp & Push Button	Opposite Polarity Barrier Push Button Actuator Diode Across Coil, DC only Lamp Across Coil Lamp & Push Button	Special Customer Requirements
AGENCY APPROVALS	UL	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA

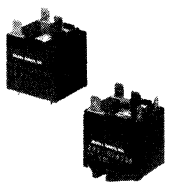
FOR ENGINEERING ASSISTANCE CALL TOLL FREE

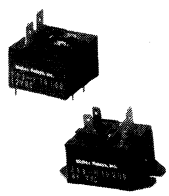
GENERAL PURPOSE RELAYS

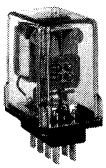
1-800-MIDTEX1











157	157	187	188	297	298	136
UL recognized for motor controllers up to 600 VAC. Magnetic latching version provides switchable core which cannot be falsely latched.	**MAGNETIC LATCHING SERIES** When there is a need to conserve power, retain logic function during power outages, or improve reliability by several order-of-magnitude over outdated mechanical latching relays, the Type 157 magnetic latching state-of-the-art relay is made to order for these applications. All of the superior electrical characteristics available in the standard Type 157 relays, including 1/4" through air and 3/8" over surface spacing, are offered in the magnetic latching version. Magnetic latching is achieved by a specially designed magnet core that makes it possible to maintain a substantial magnetic force of attraction after termination of the electrical pulse that energizes the core. There are no mechanical latches associated with the design, nor permanent magnets that can result in inadvertent operation. To restore the relay to its unoperated position, a short pulse of opposite polarity and lower magnitude than the operate pulse is applied to the coil or a second concentric wound coil. TIMING Latching time: 13 MS nominal with a one second pulse of nominal voltage. Unlatch time: 13 MS nominal with a one second pulse of nominal unlatch voltage after latching with a one second pulse of nominal latch voltage. A latch pulse of 50 MS min. at nominal voltage is recommended to insure positive latching. DESIGN & CONSTRUCTION Insulation material, weight, marking, shock, vibration, dielectric breakdown, insulation resistance and temperature range are identical to the Type 157 relay. UL/CSA	DPDT power relay is rated at 20 amps; DPST-NO and NC contact arrangements are rated at 25 amps. Open stud mounted or dust covered versions with 1/4" quick-connect terminals are available.	30 Ampere relay is an expanded version of the Type 187 20 amp 2PDT relay, utilizing a common coil/mates structure. The 188 is limited to single-pole switching, in order to provide for the 30 amp contact ratings.	A DPST-NO 15 amp economy power relay. Available in PC circuit & quick connect combination version. Recognized under UL #508.	A SPST-NO 15 or 25 amp economy power relay. PC and Quick Connect terminal combination. Recognized under UL #508.	A small power relay that will switch 20 amps for industrial use in multipole configuration and 30 amps in multipole configuration at 120 VAC or 240 VAC for appliance use under UL #508.
NO		NO	NO	NO	NO	NO
1 Form C 2 Form C 3 Form C 2 Form A 2 Form B 1 Form X 1 Form Y		2 Form C 2A, DPST 2B, DPST 1 Form X 1 Form Y	Form X Form Y Form Z	2 Form A	SPST-NO	1 Form C 2 Form C 2PST-NC 2PST-NO 1PST-NO-DM 1PST-NC-DB 3PST-NO
Material -100 1/8" Fine Silver (gold flash) 5 amp **Ratings** 5 amp, 28VDC/ 120/240 VAC, 80% pf 2 amp, 480/600 VAC, 80% pf 1/8 hp, 120 VAC 1/4 hp, 240 VAC -200 3/16" Silver Cadmium Oxide 10 amp 10 amp, 28 VDC/ 120/240 VAC, 80% pf 1/3 hp, 120 VAC 1/2 hp, 240/480/600 VAC 3 amp, 480/600 VAC, 80% pf -300 3/16" Silver Cadmium Oxide 15 amp (UL on 1 & 2PDT only) 15 amp, 120 VAC 10 amp, 240 & 277 VAC 28 VDC 3 amp, 480/600 VAC 1/3 hp, 120 VAC 1/2 hp, 240/480/600 VAC -700 1/8" Fine Silver Gold Diffused 5 amp, 28 VDC/ 120/240 VAC, 80% pf 2 amp, 480/600 VAC, 80% pf 1/8 hp, 120 VAC 1/4 hp, 240 VAC All hp ratings are single phase		Material -100 1/4" Diameter Fine Silver 20 amp, 28 VDC 20 amp, 120/240/277 VAC 10 amp, 480/600 VAC 3/4 hp, 120 VAC 1-1/2 hp, 240 VAC -200 1/4" Diameter Silver Cadmium Oxide 20 amp, 28 VDC 20 amp, 120/240/277 VAC 10 amp, 480/600 VAC 3/4 hp, 120 VAC 1 1/2 hp, 240 VAC -300 3/16" Diameter Silver Cadmium Oxide 10 amp, 28 VDC 15 amp, 120/240/277 VAC 3 amp, 480/600 VAC 1/3 hp, 120 VAC 1/2 hp, 240/480/600 VAC -400 3/16" Silver Cadmium Oxide High Conductivity Blade 10 amp, 28 VDC 10 amp, 120/240 VAC 3 amp, 480/600 VAC 1/3 hp, 120 VAC 1/2 hp, 240/480/600 VAC -600 1/4" Silver Cadmium Oxide (On contacts 2A & 2B only) 25 amp, 28 VDC 25 amp, 120/240/277 VAC 10 amp, 480/600 VAC 3/4 hp, 120 VAC 1-1/2 hp, 240 VAC	Material -100 1/4" Silver 30 amp 120/240/277 VAC 30 amp 28 VDC 15 amp 480/600 VAC 1 hp 120 VAC, 1 phase 1-1/2 hp 240 VAC, 1 phase -200 1/4" Silver Cadmium Oxide Ratings Identical for -100 & -200 contacts.	Material -200 Silver Cadmium Oxide 15 amp, 125 VAC, resistive (UL) 10 amp, 250 VAC, resistive 15 amp, 12 VDC, resistive 5 amp, 48 VDC, resistive 6 amp, 125 VAC, inductive 40% PF 4.8 amp, 250 VAC, inductive 40% PF 6 amp, 12 VDC, inductive 2 amp, 48 VDC, inductive 1 hp, 120 VAC 1½ hp, 240 VAC 50 amp, inrush 20 ms max	Material -100 Silver Cadmium Oxide 15 amp, 125 VAC, resistive (UL) 10 amp, 250 VAC, resistive 15 amp, 12 VDC, resistive 5 amp, 48 VDC, resistive 6 amp, 125 VAC, inductive 40% PF 4.8 amp, 250 VAC, inductive 40% PF 6 amp, 12 VDC, inductive 2 amp, 48 VDC, inductive 1 hp, 120 VAC 1-1/2 hp, 240 VAC 50 amp, inrush 20 ms max -200 Silver Cadmium Oxide 25 amp, 125 VAC, resistive 20 amp, 125 VAC, resistive (UL) 20 amp, 250 VAC, resistive 25 amp, 12 VDC, resistive 10 amp, 48 VDC, resistive 15 amp, 125 VAC, inductive 40% PF 10 amp, 250 VAC, inductive 40% PF 15 amp, 12 VDC, inductive 5 amp, 48 VDC, inductive 1 hp, 120 VAC 1-1/2 hp, 240 VAC 70 amp, inrush 20 ms max	Material -3/8" diameter Silver 20 amp, 120/240 VAC 20 amp, 28 VDC -3/8" diameter Silver Cadmium Oxide (UL recognized) Industrial Use 1/4 hp, 120 VAC 15 amp, 120 VAC 15 amp, 28 VDC 10 amp, 240 VAC 1 kw tungsten, 120 or 240 VAC Appliance Use 1/4 hp, 120 VAC 20 amp, 28 VDC 30 amp, 120 or 240 VAC 1 kw tungsten, 120 or 240 VAC
5, 6, 12, 24, 48, 110 (DC) & 6, 12, 24, 120, 240 (AC) & specials		5, 6, 12, 24, 48, 110, (DC) and 6, 12, 24, 120, 208, 240 (AC) and Specials	5, 6, 12, 24, 48, 110 (DC) 6, 12, 24, 120, 208, 240 (AC) Special customer requirements	6, 12, 24, 48 (DC)	6, 12, 24, 48 (DC)	6, 12, 24, 48, 110 (DC) 6, 12, 24, 120, 240 (AC) Special Customer Requirements
Nominal-1.7 VA (1 & 2 pole AC); 2.0 VA (3 pole AC); 1.2 watts (DC) Maximum continuous-2.7 VA (1 & 2 pole AC); 3.1 VA (3 pole AC); 1.9 watts (DC)		Nominal-2.7 VA (AC); 1.2 watts (DC) Maximum continuous-3.4 VA (AC); 1.9 watts (DC)	Nominal-2.0 VA (AC); 1.2 watts (DC) Maximum continuous-3.1 VA (AC); 1.9 watts (DC)	Nominal-1.0 watts Maximum continuous-1.30 watts	Nominal-0.9 watts Maximum continuous-1.1 watts	Maximum continuous-10 VA (AC); 2.9 watts max. (DC)
Greater than 750 VAC, RMS 60 Hz across open contacts. Greater than 2500 VAC, RMS 60 Hz all other mutually insulated elements.		Greater than 750 VAC RMS 60 Hz across open contacts Greater than 2500 VAC RMS 60 Hz all other mutually insulated elements.	Greater than 750 VAC RMS 60 Hz across open contacts Greater than 2500 VAC RMS 60 Hz all other mutually insulated elements.	1500 VAC coil to contacts and between poles; 600 VAC across open contacts.	1500 VAC coil to contacts 750 VAC across open contacts	
Mechanical 10 million operations **Electrical** 100,000 operations at rated load.		**Mechanical**-10 million operations **Electrical**-100,000 operations at rated load	**Mechanical**-10 million operations **Electrical**-100,000 operations at rated load	**Mechanical**-In excess of 500,000 operations **Electrical**-200,000 operations minimum at rated loads	**Mechanical**-In excess of 500,000 operations **Electrical**-200,000 operations minimum at rated loads	**Mechanical**-5 million operations **Electrical**-100,000 operations at rated load
1.400×1.525×1.905 (dust cover)	**MAGNETIC LATCHING OPTION ALSO AVAILABLE ON 187 AND 188 SERIES**	1.400×1.525×1.905	1.400×1.525×1.905	1.378×1.197×1.181	1.201×1.240×.787	2.375×1.75×2.80
YES YES		YES YES	YES YES	PC & Quick Connects In Combination	PC & Quick Connect terminal combination	NO YES
Lamp across coil Class B Coil Push Button Actuator Open style Varnished coil		Class B Coil Varnished Coil Lamp in Parallel with Coil Special Customer Requirements	Lamp in parallel with coil Class B Coil Varnished Coil Special Customer Requirements			Special Customer Requirements
UL/CSA		UL/CSA	UL/CSA	UL	UL	UL

Midtex Relays, Inc.

9B2 BUTTERFIELD TRAIL/EL PASO, TEXAS 79906
PHONE: 915-772-1061/FAX: 915-772-1116

TIME DELAY RELAYS

611 SERIES

An amplifier driven relay that allows an input signal as low as 12 microwatts to control a DPDT 10 amp output. This low control sensitivity permits direct interfacing with most types of logic.

ELECTRICAL/MECHANICAL CHARACTERISTICS
All ratings at 25°C ambient.
Sensitivity—12 microwatts, 60 microwatts
Operating time (nom voltage & temp.) 15 ms.
Release time (nom. voltage & temp.) 30 ms.
Max. input voltage or current—30 VDC or 1 ma.
Max. negative blocking voltage 50 VDC
Voltage—12, 24, 48 VDC (+10%)
Power—1.2 watts
Polarity protection—YES
Duty—Continuous
Switching action 2PDT
Switching rating
-Fine silver contacts (gold flash) 5 amp, 28 VDC, 120/240VAC 1/8 hp, 120 VAC
-Silver Cadmium Oxide 10 amp, 28 VDC, 120/240 VAC 1/3 hp, 120 VAC 1/2 hp, 240 VAC
TEMPERATURE RANGE
-10°C to +55°C
SHOCK
15 g's, 11±1 ms, 1/2 sinewave (non-operating test)
VIBRATION
0.06" DA or 10 g's, 10 to 55 Hz (non-operating test)

612 SERIES

Delay-on-release timer which utilizes an R-C solid state trigger circuit to drive a secondary solid state switch, which in turn controls the integral 10 amp output relay.

ELECTRICAL/MECHANICAL CHARACTERISTICS
All ratings at 25°C ambient.
Repeatability ±3%
Total timing variation ±10%
Operate time (max.) 100ms
Recycle time (max.) 100ms
Dial scale Ref. only
Input voltage limits—
AC ±10%
DC ±25%
Power requirements—
AC (approx.) 1.5 VA
DC (approx.) 1.2 watts
Switching action 2PDT
Switching rating (max.)
-Fine Silver contact (Gold flash) 5 amp, 28 VDC/120,240VAC; 80% pf 1/8 hp, 120 VAC
-Silver Cadmium Oxide 10 amp, 28 VDC/120,240 VAC; 80% pf, 1/3 hp, 120 VAC 1/2 hp, 240 VAC
Delay types Delay-on-release
Momentary transfer upon timing cycle interruption.....NO
TEMPERATURE RANGE
-operating: -10°C to +55°C
-storage: 40°C to +85°C
SHOCK
15 g's, 11±1 ms, 1/2 sinewave (non-operating test)
VIBRATION
0.06" DA or 10 g's, 10 to 55 Hz (non-operating test)
TIMING SET
Fixed
External Resistor
Knob Adjust

613 SERIES

Economy version **Delay-on-operate** timer, which utilizes a simple R-C solid state trigger circuit, which in turn controls the integral 10 amp output relay.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±3%
Total timing variation ±10%
Reset (release) time (max.) 200ms
Recycle time (max.) 200ms
Dial scale Ref. only
Input voltage limits
AC ±10%
DC ±25%
Power requirements—
AC (approx.) 3.0 VA
DC (approx.) 1.5 watts
Switching action 2PDT
Switching rating (max.)
-Fine silver contact (gold flash) 5 amp, 28 VDC/120/VAC, 3 amp, 240 VAC .80% pf 1/8 hp, 120 VAC
-Silver Cadmium Oxide 10 amp, 28 VDC, 120 VAC, 1/3 hp 120 VAC, 6 amp, 240 VAC .80% pf 1/2 hp, 240 VAC
Delay types Delay-on-operate
Momentary transfer upon timing cycle interruption.....YES
TEMPERATURE RANGE
-operating: -10°C to +55°C
-storage: 40°C to +85°C
SHOCK
15 g's, 11±1 ms, 1/2 sinewave (non-operating test)
VIBRATION
0.06" DA or 10 g's, 10 to 55 Hz (non-operating test)
TIMING SET
Fixed
External Resistor
Knob Adjust

614 SERIES

Identical to the 612 series, except it functions as a **delay-on-operate.** Available with "fixed", "external resistor" adjust time setting, or "knob adjust", through an overall range of 1 to 300 seconds delay.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±3%
Total timing variation ±10%
Reset (release) time (max.) 50ms
Recycle time (max.) 100ms
Dial scale Ref. only
Input voltage limits
AC ±10%
DC ±25%
Power requirements—
AC (approx.) 3.0 VA
DC (approx.) 1.2 watts
Switching action 2PDT
Switching rating (max.)
-Fine Silver contacts (Gold flash) 5 amp, 28 VDC/120 VAC, 3 amp, 240 VAC .80% pf 1/8 hp, 120 VAC
-Silver Cadmium Oxide (Gold flash) 10 amp, 28 VDC/120 VAC, 1/3 hp, 120 VAC, 6 amp, 240 VAC .80% pf 1/2 hp, 240 VAC
Delay types Delay-on-operate
Momentary transfer upon timing cycle interruption.....NO
TEMPERATURE RANGE
-operating: -10°C to +55°C
-storage: 40°C to +85°C
SHOCK
15 g's, 11±1 ms, 1/2 sinewave (non-operating test)
VIBRATION
0.06" DA or 10 g's, 10 to 55 Hz (non-operating test)
TIMING SET
Fixed
External Resistor
Knob Adjust

618 SERIES

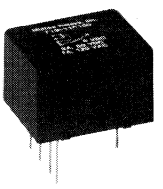
An electronic time delay module that provides a 0.5 or 2 amp SCR output to drive relays, solenoids or lamps. Units are fully encapsulated and are versatile and economic, especially when used in conjunction with power relays in the 30 amp rating category.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±3%
Total timing variation ±10%
Reset time (max.) 75ms
Recycle time (max.) 25ms
Input voltage limits
+25%. DC must be filtered, max. ripple 5% at nominal voltage
Switching action SPST Solid State Output, 1.5 V voltage drop max. when on
Switching rating (max.)
-Type 1-0.5 amp at +55°C
-Type 2-2.0 amp at +25°C
1.25 amp at +55°C
TEMPERATURE RANGE
-40°C to +55°C

619 SERIES

IMPULSE RELAY
An electronically controlled single input latching relay. Repetitive input pulses cause the relay to latch and unlatch alternately up to 1,200 total pulses per minute.

ELECTRICAL/MECHANICAL CHARACTERISTICS
All ratings at 25°C ambient
Pulse width 25 ms. min.
Pulse repetition rate 1200 pulses per minute max.
Duty Continuous
Input voltage 12, 24, 48, 110 VDC (±25%)
Power requirements 1.8 watts
Switching action 2PDT
Switching rating (max.)
-Fine Silver contacts (Gold flash) 5 amp, 28 VDC, 120/240 VAC 1/8 hp, 120 VAC
-Silver Cadmium Oxide 10 amp, 28 VDC, 120/240 VAC 1/3 hp, 120 VAC 1/2 hp, 240 VAC
TEMPERATURE RANGE
-10°C to +55°C
SHOCK
15 g's, 11±1 ms, 1/2 sinewave (non-operating test)
VIBRATION
0.06" DA or 10 g's, 10 to 55 Hz (non-operating test)



719 SERIES

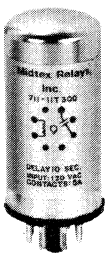
IMPULSE RELAY
Miniature PC style impulse relay that will alternately change states when pulsed at a common input, without changing polarity.

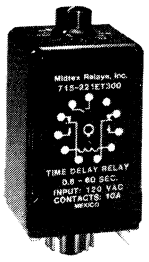
ELECTRICAL/MECHANICAL CHARACTERISTICS (25°C)
LIFE EXPECTANCY:
Mechanical—100 million operations min.
Electrical—100,000 operations min. at rated load
CONTROL VOLTAGES:
5 to 48 VDC standard
Set & Reset time 3ms typical
DIELECTRIC
1500 VAC input to contacts
1000 VAC across open contacts
TEMPERATURE
-40°C to +70°C
CONTACTS
-Silver/Gold bifurcated Rating
2.0 amp 30 VDC resistive
0.6 amp 110 VDC resistive
1.0 amp 125 VAC resistive

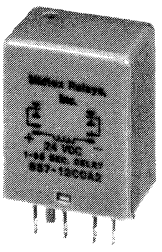
FOR ENGINEERING ASSISTANCE CALL TOLL FREE

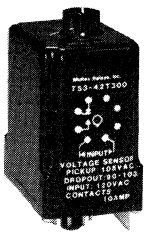
1-800-MIDTEX1 TIME DELAY RELAYS

LINE MONITORING DEVICES/CURRENT VOLTAGE • PHASE









711 SERIES

Superior replacement for plug-in thermal timers. The 711 series offers 5 amp SPST-NO or NC, and SPDT snap action switching, metal enclosure is standard, (encapsulated units available), long life, and solid state type timing performance.

ELECTRICAL/MECHANICAL CHARACTERISTICS
All ratings at 25°C ambient.
CONTACTS:
5 amps 120 VAC resistive
5 amps 30 VDC resistive
4 amps 240 VAC resistive
POWER REQUIREMENTS
0.75 watts typ.
TEMPERATURE:
Storage -40°C to +85°C
Operating -25°C to +65°C
(extended ranges available)
DIELECTRIC
1000 VAC min., 750 VAC across open contacts
TIMING
Accuracy: ±10%
Repeatability: ±3%
Reset & Recycle time: 50 ms typical, 100 ms max.
SHOCK 50 g's
(non-operating)
VIBRATION:
10 g's, 10-55 Hz min., without false contact action

715 SERIES

Multi-function time delay relay industry standard 8 and 11 pin octal, side terminal strip for flush mounting, and the 11 pin square base to fit the Midtex Type 157 relay sockets. UL/CSA approval.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±2%
Total timing variation ±10%
Reset time—25 ms typical, 50 ms max. (release of delay-on-operate)
Recycle time—50 ms typical.
100 ms. max. (minimum off time between timing intervals)
Input voltage limits
AC ±10%
DC ±25%
Power requirements
AC 2.5VA
DC 1.5watt
Switching action 2PDT
Switching rating (max.)
-Silver Cadmium Oxide
10 amp, 28 VDC/120 VAC; 1/3 hp, 120/240 VAC
Delay types
Delay-on-operate, Delay-on-release, Cycle, Interval and Interval-momentary start timing.
Momentary transfer upon timing cycle interruption: NO
TEMPERATURE RANGE
—operating -10°C to +55°C
—storage -40°C to +85°C
SHOCK
15 g's, 11 ±1 ms, 1/2 sinewave
(non-operating test)
VIBRATION
0.06" DA or 10 g's, 10-55 Hz
(non-operating test)

655 SERIES

Delay-on-operate timers which use solid state timing circuits to control an integral relay.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±3%
Total timing variation ±10%
Reset time 50 ms
Recycle time (max.) 100 ms
Input voltage limits
AC ±10%
DC ±25%
Power requirements
AC (approx.) 3VA at 120 VAC
DC (approx.) 1.2 watts
Switching action 1,2,4PDT
Switching rating
5 amp, 28 VDC, 120 VAC
10 amp, 28 VDC, 120 VAC
Delay types Delay-on-operate
Momentary transfer upon timing cycle interruption .NO
TEMPERATURE RANGE
—operating -10°C to +55°C
—storage -40°C to +85°C
SHOCK
15 g's, 11 ±1 ms, 1/2 sinewave
VIBRATION
10 g's; 10 to 55 Hz
TERMINALS-
Solder, PC, Plug-In.

657 SERIES

Delay-on-operate timer which uses solid state timing circuits to control an integral relay.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±5%
Total timing variation ±10%
Reset time (max.) 100 ms
Recycle time (max.) 100 ms
Input voltage limits
DC ±25
Power requirements
DC (approx.) 0.7 watt
Switching action 2PDT
Switching rating
2 amp, 28 VDC, 120 VAC
Momentary transfer upon timing cycle interruption .NO
TEMPERATURE RANGE
—operating -10°C to +55°C
—storage -40°C to +85°C
SHOCK
12 g's, 11 ±1 ms, 1/2 sinewave
VIBRATION
8 g's; 10 to 55 Hz
MAX SIZE IN INCHES
(L × W × H)
1.190 × .859 × 1.281
TERMINALS
Solder, PC, Plug-In

658 SERIES

Extremely accurate long range **delay-on-operate** with timing tolerance and timing variation of plus or minus 2%. Available in either a variable time range or fixed (factory preset) time range.

ELECTRICAL/MECHANICAL CHARACTERISTICS
Timing tolerance ±2%
Repeatability ±.1%
Total timing variation ±2%
Reset time (max.) 50 ms
Recycle time (max.) 150 ms
Timing ranges
*1-102.3 sec.
*1-409.5 sec.
*1-1023 sec.
*1-4095 sec.
*Factory preset
Power requirements (max.) 3VA
Operating temperature -10°C to +55°C
Switching action 2PDT
Delay function
Delay-on-operate
Contact rating
10 amp at 28 VDC, 120 VAC, 80% pf; 7 amp at 240 VAC 80% pf; 1/3 hp at 120/240 VAC
Contacts
5/32" Silver Cadmium Oxide
Expected life at rated load (min.) 100,000 operations
SHOCK
15 g's, 11 ±1ms, 1/2 sinewave (non-operating test, no mechanical damage)
VIBRATION
0.06" DA or 10 g's 10-55 Hz
(non-operating test)

753 SERIES

753 series voltage sensor is designed for use in monitoring voltage fluctuations. It is designed to energize and de-energize at predetermined voltage levels that may be fixed or set with adjusting knobs. Packages are available for either direct plug-in or terminal strip connection.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±1% max.
Response time 15 ms typical 25 ms maximum
Duty cycle is continuous, maximum input limit of 125% of nominal input voltage.
Switching action SPDT
Switching rating
—100 silver/gold flash
3 amps at 24 VDC or 125 VAC resistive;
1 amp at 24 VDC or 125 VAC inductive;
1.5 amps at 250 VAC resistive;
0.5 amps at 250 VAC inductive
—200 Silver Cadmium Oxide
5 amps at 24 VDC or 125 VAC resistive
2 amps at 24 VDC or 125 VAC inductive
2.5 amps at 250 VAC resistive
1 amp at 250 VAC inductive
—300 Silver Cadmium Oxide
10 amps at 24 VDC or 125 VAC resistive
4 amps at 24 VDC or 125 VAC inductive
5 amps at 250 VAC resistive
2 amps at 250 VAC inductive
TEMPERATURE RANGE
—operating -10°C to +55°C
—storage -40°C to +85°C
SHOCK
15 g's, 11 ±1 ms, 1/2 sinewave
(non-operating test)
VIBRATION
0.06" DA or 10 g's, 10-55 Hz
(non-operating test)

754 SERIES

3-Phase sequence sensor is designed to detect loss of power on one leg or reverse phase sequence in conventional 3-phase, 4 wire, wye connected or 3-wire Delta connected 60 Hz circuits. The delay will remain energized with power applied unless a loss or reverse is detected. The 654 is ideal for the protection of expensive motors and 3-phase equipment from failure due to phase problems.

FEATURES
—Reliability of solid state sensing
—Power output switching to 10 amps
—Form DPDT contact output
—Flexibility for variety of applications
—Available with plug-in or direct wire termination
—4-wire wye or 3-wire Delta connection
—Responds to line failure in 30MS typical
CONTACTS
—5/32" Silver Cadmium Oxide 10 amp, 28 VDC/120 VAC, 80% pf
LIFE EXPECTANCY
Mechanical—in excess of 50 million operations
Electrical—100,000 operations minimum at rated loads
DIELECTRIC BREAKDOWN
Greater than 500 VAC RMS 60 Hz across open contacts;
Greater than 1500 VAC RMS 60 Hz all other mutually insulated elements
TEMPERATURE RANGE
-10°C to +55°C
DUTY CYCLE
Continuous
RESPONSE TIME
15 MS operate, 30 MS release typical
OPERATE POWER
2 watts max.

Midtex Relays, Inc.

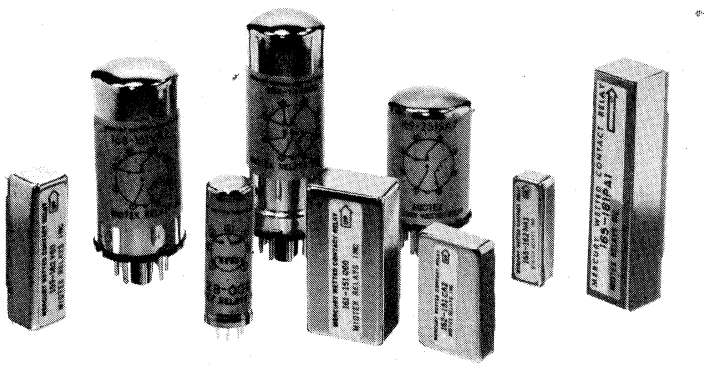
9B2 BUTTERFIELD TRAIL/EL PASO, TEXAS 79906
PHONE: 915-772-1061/FAX: 915-772-1116

FOR ENGINEERING ASSISTANCE CALL TOLL FREE

1-800-MIDTEX1

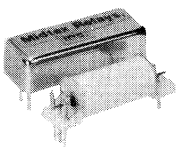
MERCURY RELAYS

Mercury-wetted contacts represent the nearest thing to the perfect contact yet developed, being characterized by such parameters as: Bounce-free operation; very low and stable contact resistance; hermetic protection; fast operating speeds; Form C or Form D contact action; contact life measured in billions of operations.



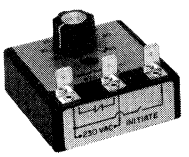
	TWO-AMPERE RATED RELAYS						FIVE-AMPERE RATED RELAYS		
PARAMETER	**TYPE 159**	**TYPE 160**	**TYPE 161**	**TYPE 162**	**TYPE 166**	**TYPE 169**	**163**	**164**	**165**
COILS									
Single wound—max. ohms	8,600	9,000	43,500	3,500	9,000	11,000	4,000	4,000	4,300
Double wound—max. ohms	4,275	4,500	21,700	1,750	4,275	5,500	2,000	2,000	8,000
Rating—watts continuous	2.0	1.75	3.0	3.0	1.5	2.0	4.0	4.0	4.0
Temp. rise—° C per watt	30°	35°	20°	30°	35°C	30°	20°	20°	20°
Dielectric breakdown —RMS, 60Hz	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Insulation resistance megohms—500 VDC	1,000	1,000	1K-10K	1K-10K	1,000	1,000	100	100	100
Capacitance—armature to coil pf, typical	9.0	9.0	9.0	9.0	9.0	7.0	12	12	14
Electrostatic shielding optional	yes	yes	yes	yes	yes	yes	yes	yes	yes
Typical operate times —MS, 2X must operate	1-3	1-3	1-3	1-3	1-3	1-3	3.5	3.5	3.0
Typical release times —MS 2X	2.5	2.5	3.0	3.0	2.8	3.0	4.5	4.5	4.2
Contact form available	C, D	C, D	2C, 2D	2C, 2D	C, D	C, D	D	D	D
Adjustments available									
Single-side-stable	yes	yes	yes	yes	yes	yes	yes	yes	yes
Bi-stable	yes	yes	yes	yes	yes	yes	yes	yes	yes
Polar 1% balance	yes	yes	no	no	yes	yes	yes	yes	yes
Temperature range Operating ° C Storage ° C	All types -38.8°C to +85°C All types -65°C to +100°C								
Weight—ounces	2.0	0.5	2.3	1.6	0.5	4.0	4	4	3
Encapsulant	Polyureth.	Polyureth.	Polyureth.	Polyureth.	Polyureth.	Wax	Wax	Wax	Polyureth.
Mounting method	PCB	PCB	PCB	PCB	PCB	Octal	Octal	Octal	PCB

REED RELAYS



The Midtex dry reed relay series offers hermetically sealed, non-position sensitive switching in a small size with rapid response and low actuate power requirements. Available contact forms include A, B, C and D with dry reeds and forms A and B with mercury wetted. Contact arrangements include 1 to 5 Form A, 1 to 4 Form C, and 1 to 3 Form B, or any combination within the 5 pole bobbin. Consult the factory for additional details.

CUSTOM CONTROL PRODUCTS & BOARD ASSEMBLIES



Midtex Relays, Inc. designs and manufactures custom control modules and board assemblies to specific customer applications. A few common applications are listed below:

- True Form D Relay
- 20–25 amp 3/4 hp time delay relay
- 12–96 Hour Timer
- Sequencing Module For Stagger Motor Start Up
- Impulse Relay That Transfers When Voltage Is Removed
- True Off Delay Timers
- Complete Control Systems (Board level, encapsulated & Cabinet)
- Wire Wrapped Relay Control Assemblies
- Interface Modules

Most designs are generated from customers requesting a "Black Box" to solve a system problem, improved performance, lower costs etc. Please call us on our Engineering Hot Line (1-800-MIDTEX1) to discuss your application directly with Midtex Engineering.

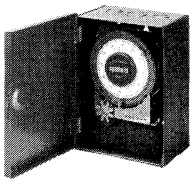
Midtex Relays, Inc.

9B2 BUTTERFIELD TRAIL/EL PASO, TEXAS 79906
PHONE: 915-772-1061/FAX: 915-772-1116

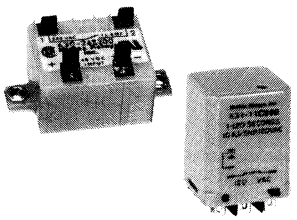
FOR ENGINEERING ASSISTANCE CALL TOLL FREE

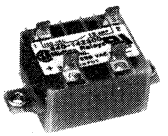
1-800-MIDTEX1

CYCLEMASTER 24-HOUR TIMER



SOLID STATE RELAYS





620 SERIES

Program Time Switch—up to 48 ON-OFF operations per day with timing intervals as low as fifteen minutes. 14-day wheel, with Sunday and Holiday Skipper, provides programming for two full weeks. Eliminates operations on unwanted days.

SWITCHING ACTION
SPDT (usable three ways: SPST open; SPST closed; SP transfer)
LOAD CAPACITY
20 amps at 125, 250, or 480 VAC (1 hp at 125 VAC; 2 hp at 250 VAC) (10 amps at 125 VAC inductive)
TERMINALS
Screw terminals conveniently located
METHOD OF PROGRAMMING
Trip pin (12 supplied)
TEMPERATURE RANGE
−40 F to +140 F
Dimensions
With enclosure 8.188″ H × 6.375″ W × 4.125″ D; without enclosure 6-5/8″ H × 4-1/2″ W × 2-13/16″ D

TIMING APPLICATIONS

- Lawn sprinkling
- Greenhouse misting
- Irrigation
- Program music
- Chime system
- Oil well pumping
- Programmed heating
- Air conditioning
- Traffic systems
- Industrial processing
- Power plant exercising
- Industrial lubrication systems
- Stoker hold-fire
- Battery charging
- Paint and enamel baking
- Laboratory testing
- Oven purging
- Automatic livestock and poultry feeding systems
- Conveyors, material handling systems
- Ventilating fans
- Elevators and stairways
- Pumps and motors
- Water softening control
- Bulk, milk cooler agitation
- Laundry equipment
- Heat treating
- Plastic molding
- Bakery machinery

630/631 SERIES

Solid State Hybrid Industrial Relay Applications are I/O interface, and switching difficult loads such as: solenoids, AC motors, lamps and other heavy industrial loads within device ratings.

Ratings are for both models, unless otherwise specified.
Current
Type 630 4, 7, 10 and 15 amps inductive or resistive.
Type 631 5 amps inductive or resistive.
Voltage drop
1.6 typical at rated current
Leakage current
6 MA max., 120 VAC/12 MA max., 240 VAC
Minimum load current
200 MA, RMS
Life
500 million operations
Contact type
1 Form A
Dielectric
1500 VAC, 60 Hz minimum between all mutually insulated terminals and mounting plate

634 SERIES

Hybrid Non Zero-Crossing Turn On PCB Relay Unit occupies less than one sq. inch of board space. This makes it ideal for applications where board space is at a premium.

Internal transient protection
Available with a snubber network to properly communicate inductive loads.
Excellent I/O isolation
Reed relay input provides input to output isolation in excess of 1500 VAC, 60 Hz dielectric breakdown.
Rapid response time
Relay will turn on in one millisecond. Turn-off occurs at the first zero amplitude current point after input power removal.
Dielectric
1500 VAC, 60 Hz minimum between input/output
Life
500 million operations
Contact type
1 Form A
Options
Input coil suppression diode; Thyristor to prevent false turn-on when transients on the line exceed the forward blocking voltage;
AC input version using an internal bridge and filter capacitor.
UL Approved

640 SERIES

Solid-State Zero-Crossing Industrial Relay Ideally suited for frame or panel mounting, and is assembled in a sturdy, compact package that is sealed against environmental conditions. The design will withstand severe shock and vibration. Applications are I/O interface and switching difficult loads such as: solenoids, AC motors, lamps and other heavy industrial loads within device ratings.

Excellent isolation
The LED input-Triac output circuitry in this pure solid-state device exhibits in excess of 1,000 VAC, 60 Hz dielectric breakdown isolation between input and output terminals.
Rapid response time
Basic circuit used will turn on at the first zero amplitude voltage point after power input (within plus or minus 15 volts).
Turn-off occurs at the first zero amplitude current point after input removal.
Dielectric breakdown
1,000 VAC, 60 Hz minimum between all mutually insulated terminals and mounting plate.
Life
Indefinite
Contact type
1 Form A
Options
Thyristor to prevent false turn-on when transients on the line exceed the forward blocking voltage;
AC input version using an internal bridge and filter capacitor.
UL/CSA approvals.

NEC Electronics Inc.
401 Ellis St., Mountain View, CA 94039 • 415/960-6000

World Products Inc. (North America Distributor)
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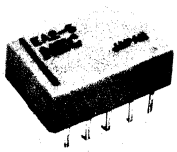
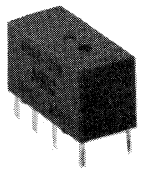
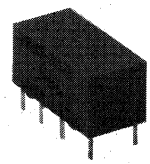
Miniature Relay—Signal

	EA2/EB2	MR62	MR62-Y	MR602	MR612
Type of relay					
Features	• Low Profile (H=5 mm) H=.197" • low power consumption • 1,500V FCC surge • 1000V AC FCC breakdown • Latching type available	• DIP terminal • sealed package for flow soldering • stable contact resistance at high temperature • 1500V FCC surge	• low power consumption • 1500V FCC surge	• low power consumption • 1500V FCC surge, 1000V AC FCC breakdown voltage • latching type available	• low power consumption • 1500V FCC surge, 1000V AC FCC breakdown voltage • latching type available
				Polarized Type	
Contact arrangement	2C	2C	2C	2C or 2D	2C or 2D
Contact material (standard)	silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay
Contact rating (resistive) (switching)	30W/62.5VA; 3A; 2A; 1A; 1.0A	60W/125VA; 2A; 2.0A	60W/125VA; 2A; 2.0A	60W/125VA; 2A; 2.0A	60W/125VA; 2A; 2.0A
Coil voltage	3~24V	5, 6, 9, 12, 24, 48V DC	5, 6, 9, 12, 24, 48V DC	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V DC	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V DC
Nominal operating power	STD/D-Latch (~12V) 140mW (24V) 200mW S-Latch (~12V) 100mW (24V) 150mW	500mW	400mW	200mW (latching type-single wound coil 100mW)	400mW (latching type-single wound coil 200mW)
Must operate voltage	75%	70%	70% (K type 80%)	70% (Form D type 80%)	70%
Must release voltage	10%	5%	5%	10%	10%
Operate time (typ.) (Excluding bounce)	2ms	3ms	4ms	3.5ms	3.5ms
Release time (typ.) (Excluding bounce)	1ms	2ms	2ms	1.5ms	1.5ms
Life (operations) Electrical	2×10^5 30V DC, 1A 1×10^5 125V AC, 0.5A	1×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A	1×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A	1.5×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A	1.5×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A
Mechanical	100×10^6	50×10^6	50×10^6	50×10^6	50×10^6
Breakdown voltage Between open contacts	1000V AC	500V AC	500V AC or 1000V AC*	1000V AC or 500V AC*	1000V AC or 500V AC*
Between adjacent contacts	1000V AC	1000V AC	1000V AC	1000V AC	1500V AC
Between contact and coil	1000V AC	1000V AC	1000V AC	1000V AC	1500V AC or 2000V AC**
Surge withstand voltage	1500V FCC	1500V FCC*	1500V FCC*	1500V FCC	1500V FCC
UL, CSA	*UL, CSA	UL, CSA	UL, CSA	UL, CSA	UL, CSA
Option	Latch (SMD)	—	—	latching type, Form D	latching type, Form D
Height inches (mm)	*.197(5)	.449 (11.4)	.449 (11.4)	.398 (10.1)	.398 (10.1)
Mounting space inches (mm)	.551×.354 (14×9)	.386×.796 (9.8×20.2)	.386×.796 (9.8×20.2)	.398×.800 (10.1×20.3)	.398×.800 (10.1×20.3)

*EA2

* 1500V FCC surge between coil and contacts and between adjacent contacts.

*KY type

* Form D type

* Form D type
**K type *

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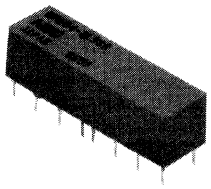
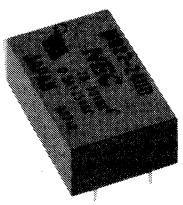
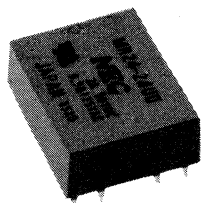
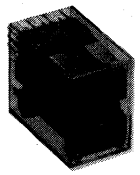
Miniature Relay—Signal

	MR604	MR614	MR22	MR24	MR10/MR11/ MR11-500
Type of relay					
Features	• low power consumption • 1500V FCC surge, 1000V AC FCC breakdown voltage • latching type available	• low power consumption • 1500 FCC surge, 1000V AC FCC breakdown voltage • latching type available	• long life • automatic wave soldering possible • latching type available	• long life • automatic wave soldering possible • latching type available	• long life • 12-pole contacts (up to 18 contacts) • flux tight base cap available
	Polarized Type				
Contact arrangement	4C	4C	2C or 2D	4C, 4D or 2C+2D	4C, 4D or 2C+2D 6C, 6D or 4C+2D 12A, 12B or 6C+6A or 6B
Contact material (standard)	silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay
Contact rating (resistive) (switching)	60W/125VA 3A 2A 2.0A 1A	60W/125VA 2.0A	60W/125VA 2.0A	60W/125VA 2.0A	30W/50VA 1.25A
Coil voltage	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V DC	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V DC	5, 6, 12, 24, 48 60V DC	5, 6, 12, 24, 48 60V DC	5, 6, 9, 12, 24, 48 60V DC/ *6, 12, 24, 48V DC
Nominal operating power	250mW (latching type-single wound coil 125mW)	400mW (latching type-single wound coil 200mW)	Approx. 280mW	Approx. 470mW	1.0 to 1.5W
Must operate voltage	70%	70%	80% (Y type 70%)	80% (Y type 70%)	55 to 80%
Must release voltage	10%	10%	10%	10%	—
Operate time (typ.) (Excluding bounce)	4ms (Latching 3.5ms)	4ms (Latching 3.5ms)	10ms	10ms	15ms/*20ms
Release time (typ.) (Excluding bounce)	2ms	2ms	3ms	3ms	6ms/*4ms
Life (operations) Electrical	1.5×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A	1.5×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A	1×10^6 30V DC, 1A	1×10^6 30V DC, 1A	50×10^6 115V AC, 0.25A with spark suppression
Mechanical	50×10^6	50×10^6	100×10^5	100×10^5	50×10^5
Breakdown voltage Between open contacts	1000V AC	1000V AC	1000V AC or 750V AC*	1000V AC or 750V AC*	Form C 1000V AC Form D 500V AC
Between adjacent contacts	1000V AC	1500V AC	1000V AC	1000V AC	1000V AC
Between contact and coil	1000V AC	1500V AC	1000V AC	1000V AC	1000V AC
Surge withstand voltage	1500V FCC	1500V FCC			
UL, CSA	UL, CSA	UL, CSA	UL, CSA	UL, CSA	
Option	latching type	latching type	latching type	latching type	
Height inches (mm)	.398 (10.1)	.398 (10.1)	.453 (11.5)	.453 (11.5)	1.182 (30.0)
Mounting space inches (mm)	.398×1.402 10.1×35.6	.398×1.402 (10.1×35.6)	.776×1.170 (19.7×29.7)	.957×1.170 (24.3×29.7)	.749×1.071/*.993×1.272 (19×27.2/*25.2×32.3)
			* Y type (Form D type: 500V AC)	* Y type (Form D type: 360V AC)	* for 500 series

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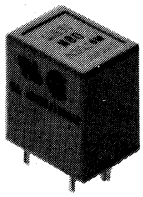
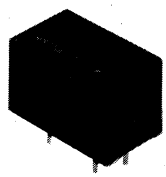
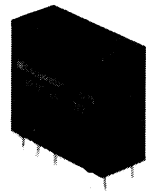
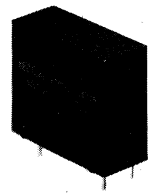
Miniature Relay—Power

Group / Type of relay	MR31	MR301	MR321A	MR71	MR72
					
Features	• large contact capacity • compact and light weight • general purpose power relay	• low profile • specially for automotive	• electric heater switching (up to 1.5KW/100V AC) • low profile • compact • flux tight	• TV-5 type available • high dielectric strength (MR71A) • withstanding 10,000V surge	• TV-3 type available • high dielectric strength (MR72A) • withstanding 10,000V surge
Contact arrangement	1A or 1C	1C	1A	1A, 1B or 1C	2A, 2B or 2C
Contact material (standard)	silver alloy	silver alloy	silver oxide complex alloy	silver oxide complex alloy	silver nickel alloy
Contact rating (resistive) (switching)	30W 120VA (G-type); 150W 600VA; 300W 1200VA (H-type); 10A; 8A; 6A; 4A; 2A; 5A; 1A	150W/600VA; 300W/1200VA (H-type); 10A; 5A	1200VA; 1600VA (H-type); 12A; 15A	300W/250VA; 10A	150W/125VA; 5A
Coil voltage	3, 5, 6, 9, 12, 24 48V DC	3, 5, 6, 9, 12, 24 48V DC	3, 5, 6, 9, 12, 24 48V DC	3, 5, 6, 12, 24, 48V DC	3, 5, 6, 12, 24, 48V DC
Nominal operating power	360mW	360mW	360mW	500mW	500mW
Must operate voltage	80%	70% (48V DC: 80%)	70% (48V DC: 80%)	70%	70%
Must release voltage	10%	10%	10%	10%	10%
Operate time (typ.) (Excluding bounce)	13ms	10ms	10ms	15ms	15ms
Release time (typ.) (Excluding bounce)	10ms	10ms	10ms	5ms	5ms
Life (operations) Electrical	0.1×10^6 100V AC, 5A*	0.1×10^6 100V AC, 5A*	0.5×10^6 100V AC, 12A*	0.1×10^6 100V AC, 10A	0.1×10^6 100V AC, 5A
Life (operations) Mechanical	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6
Breakdown voltage Between open contacts	750V AC	750V AC	750V AC	1000V AC	1000V AC
Breakdown voltage Between adjacent contacts	—	—	—	—	3500V AC
Breakdown voltage Between contact and coil	1500V AC	1500V AC	1500V AC	5000V AC	5000V AC
Surge withstand voltage				10,000V ($1\times40\mu s$)	10,000V ($1\times40\mu s$)
UL, CSA	UL, CSA	UL		UL, CSA, Australia Telecom	UL, CSA, Australia Telecom
Option	washable type	washable type		washable type	washable type
Height inches (mm)	.926 (23,5)	.650 (16.5)	.650 (16.5)	1.004 (25.5)	1.004 (25.5)
Mounting space inches (mm)	.650×.847 (16.5×21.5)	.650×.886 (16.5×22.5)	.650×1.024 (16.5×26.0)	.512×1.142 (13.0×29.0)	.512×1.142 (13.0×29.0)

* G type: 1A
H type: 10A

* H type: 7A

* H type
0.3×10^6 100V AC, 15A

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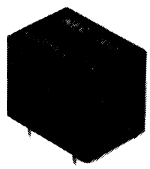
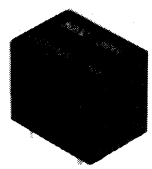
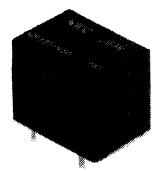
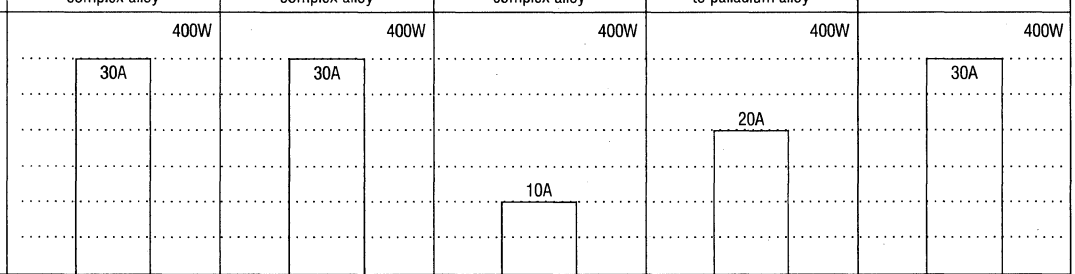
Miniature Relay—Power

	MR331-N10	MR331-N14	MR331-N20	MR331-N30	MR331-N40
Type of relay					
Features	• best for inductive load of car electronics • application specific version available • powerful contact capacity • compact, light weight • long life	• best for inductive load of car electronics • application specific version available • powerful contact capacity • compact, light weight • long life	• best for capacitive load of car electronics • application specific version available • powerful contact capacity • compact, light weight • long life	• best for lamp load of car electronics • application specific version available • powerful contact capacity • compact, light weight • long life	• best for lamp load of car electronics • application specific version available • powerful contact capacity • compact, light weight • long life
Contact arrangement	1C	1A	1A	1A	1A
Contact material (standard)	silver oxide complex alloy	silver oxide complex alloy	silver oxide complex alloy	silver nickel alloy to palladium alloy	silver alloy
Contact rating (resistive) (switching)					
Coil voltage	12V DC	12V DC	12V DC	12V DC	12V DC
Nominal operating power	800mW	450mW	450mW	800mW	450mW
Must operate voltage	8.0V DC	8.0V DC	8.0V DC	8.0V DC	8.0V DC
Must release voltage	1.2V DC	1.2V DC	1.2V DC	1.2V DC	1.2V DC
Operate time (typ.) (Excluding bounce)	10ms	10ms	10ms	10ms	10ms
Release time (typ.) (Excluding bounce)	15ms	15ms	15ms	15ms	15ms
Life (operations) Electrical	0.2×10^6 (door interlock system)	0.2×10^6 (car airconditioner)	0.1×10^6 12V DC 5A* capacitive 2200μF + 12000μF	2.0×10^6 lamp 23W/12V×5*	0.1×10^6 lamp 60W/12V
Life (operations) Mechanical	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6
Breakdown voltage Between open contacts	500V DC	500V DC	500V DC	500V DC	500V DC
Breakdown voltage Between adjacent contacts	—	—	—	—	—
Breakdown voltage Between contact and coil	500V DC	500V DC	500V DC	500V DC	500V DC
Surge withstand voltage					
UL, CSA					
Option					
Height inches (mm)	.709 (18.0)	.709 (18.0)	.709 (18.0)	.709 (18.0)	.709 (18.0)
Mounting space inches (mm)	.650×.886 (16.5×22.5)	.650×.886 (16.5×22.5)	.650×.886 (16.5×22.5)	.650×.886 (16.5×22.5)	.650×.886 (16.5×22.5)

* Technical Data Booklet Is Available.

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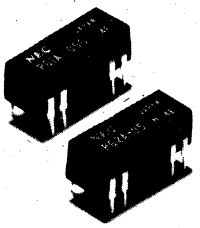
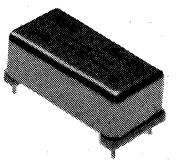
Reed Relay—Dry

		PG1A/PG2A	PG1C	PU	LR1A/LR2A	URA
Type of relay						
Features		• DIP terminal • high speed • glass encapsulated reed switch • 1 Form A • 2 Form A	• DIP terminal • high speed • glass encapsulated reed switch • 1 Form C	• single-in-line pin configuration (SIP) • high speed • 5.08mm pitch terminal	• compact • light weight • economy • tubular type • easy handling (plastic coated)	• high sensitivity (only 2mW) • high dielectric withstanding voltage
Contact arrangement		1A, 2A	1C	1A	1A, 2A	1A
Contact rating (resistive) (switching)	3A	10W/100V DC	3W/30V DC	10W/100V DC	10W/100V DC	10W/100V DC
	2A					
	1A	0.5A	0.2A	0.5A	0.5A	0.5A
Coil voltage		5, 12, 24V DC	5, 12, 24V DC	5, 12, 24V DC	5, 6, 12, 24V DC	(10 to 16mA)
Nominal operating power		50 to 270mW	180 to 385mW	50 to 290mW	160 to 360mW	1.5 to 2.0mW
Must operate voltage		75%	75%	75 to 80%	55 to 65%	(9 to 14.4mA)
Must release voltage		8 to 16%	8 to 10%	8 to 16%	7 to 8%	(2 to 3.2mA)
Operate time (typ.) (Excluding bounce)		0.1 to 0.3ms	0.2 to 0.5ms	0.1 to 0.3ms	0.2 to 0.9ms	3.0ms
Release time (typ.) (Excluding bounce)		0.05ms (0.65ms with diode)	0.25ms (1.25ms with diode)	0.03ms (0.65ms with diode)	0.05ms (0.65ms with diode)	1.5ms
Life (operations)	Electrical	100×10^6 5V DC, 5μA 10×10^6 24V DC, 5mA 1×10^6 30V DC, 0.1A	1×10^6 24V DC, 50mA	100×10^6 5V DC, 5μA 10×10^6 24V DC, 5mA 1×10^6 30V DC, 0.1A	100×10^6 5V DC, 5μA 10×10^6 12V DC, 5mA 0.5×10^6 48V DC, 0.1A	10×10^6 12V DC, 5mA 1×10^6 24V DC, 0.5A
	Mechanical	100×10^6	50×10^6	100×10^6	100×10^6	100×10^6
Breakdown voltage	Between open contacts	250V DC	200V DC	250V DC	250V DC	250V DC
	Between adjacent contacts	—	—	—	—	—
	Between contact and coil	500V DC	500V DC	1000V AC	1500V AC	1500 or 3500V AC*
Surge withstand voltage						
Insulation resistance		10^4MΩ (at 100V DC)	10^3MΩ (at 100V DC)	10^4MΩ (at 100V DC)	10^4MΩ (at 100V DC)	10^3MΩ (at 100V DC)
UL, CSA						
Option		electrostatic shield (1A type) magnetic shield (1A and 2A type) with a diode				
Height inches (mm)		.276 (7.0)	.276 (7.0)	.315 (8.0)	.355 (9.0)	.453 to .630 (11.5 to 16)
Mounting space	inches (mm)	.276×.768 (7.0×19.5)	.311×.768 (7.9×19.5)	.197×.749 (5.0×19.0)	.394×1..024/.473×1.024 (10.0×26.0/12.0×26.0)	.552 to .630 ×1.143 (14.0 to 16.0 ×29.0)

* High breakdown voltage type

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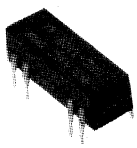
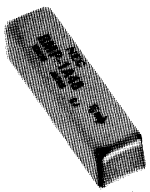
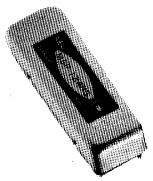
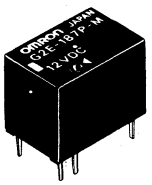
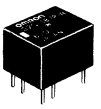
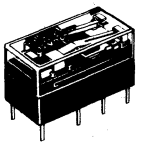
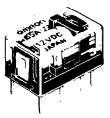
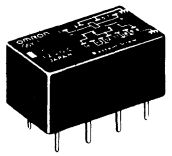
Reed Relay—Wet

		UMD	PTW	NMR	RMP-1, 2	MSP
Type of relay						
Features		• DIP terminal • compact • long life with wetted contact switch	• SIP terminal • long life with wetted contact switch	• low power consumption • low profile • high speed (200 pps) • low contact noise (±20μV)	• compact • light weight • high reliability and long life	• large contact capacity • high reliability • latching type available
		Non-polarized Type		Polarized Type	Non-polarized Type	Polarized Type
Contact arrangement		1A	1A	1C, 1C×2	1A or 1C (RMP-1) 2A or 2C (RMP-2)	1C or 1D
Contact rating (resistive) (switching)		50W/500V DC	50W/500V DC	50W/500V DC	50W/500V DC	100W/500V DC
	3A					
	2A					2A
	1A	1A	1A	1A	1A	
Coil voltage		5, 12, 24V DC	5, 12, 24V DC	5, 12, 24V DC	5, 12, 24, 48V DC	5, 12, 24, 48V DC
Nominal operating power		250 to 300 mW	420 to 480 mW	200 to 300 mW	300 to 380 mW	320 to 380 mW
Must operate voltage		80%	80%	70%	75%	40%
Must release voltage		10%	10%	10 ~ 13%	8%	7%
Operate time		1.0 to 2.0ms	1.0 to 2.0ms	1.2ms Max.	1.0 to 2.0ms	1.0 to 1.5ms
Release time		1.0 to 2.0ms (2.5ms with diode)	1.0 to 2.0ms (2.5ms with diode)	1.3ms Max. (with diode)	1.0 to 2.0ms (2.5ms with diode)	1.0 to 2.0ms (2.5ms with diode)
Life (operations)	Electrical	200×10^6 50V DC, 1A	200×10^6 50V DC, 1A	200×10^6 50V DC, 1A	200×10^6 50V DC, 1A	5×10^8 50V DC, 2A
	Mechanical	1×10^9	1×10^9	1×10^9	1×10^9	10×10^9
Breakdown voltage	Between open contacts	1000V AC	1000V AC	1000V AC	1000V AC	1000V DC
	Between adjacent contacts	—	—	—	1000 V AC (RMP-2)	—
	Between contact and coil	1000V AC	1000V AC	1000V AC	1000V AC	1000V AC
Surge withstand voltage						
Insulation resistance		10^3 MΩ (at 100V DC)	10^3 MΩ (at 100V DC)	10^3 MΩ (at 500V DC)	Between open contact: 10^2MΩ, others: 10^3MΩ (at 500V DC)	10^3 MΩ (at 500V DC)
UL, CSA					UL	
Option		magnetic shield, with a diode		electrostatic shield	—	latching type electrostatic shield
Height inches (mm)		.276 (7.0)	.315 (8.0)	.335 (8.5)	.394/.414 (10.0/10.5)	.402 (10.2)
Mounting space	inches (mm)	.351×.768 (8.9×19.5)	.256×.768 (6.5×19.5)	.355×.945/.650×.945 (9×24/16.5×24)	.374×1.280/.808×1.300 (9.5×32.5/20.5×33.0)	.552×1.599 (14×40.6)

OMRON Signal Control PC Board Relays

Model (Dimensions in inches)	**G2E**	**G2Q**	**G2VN**	**G5A**	**G5Y-1**
					
	0.45″H x 0.61″L x 0.43″W	G2Q-R 0.31″H x 0.51″ L x 0.39″ W G2Q-V 0.39″H x 0.47″L x 0.29″W (not shown)	0.43″H x 0.80″L x 0.40″W	0.31″H x 0.63″L x 0.39″W	0.35″H x 0.81″L x 0.45″W
Features	Small, low-cost relay for signal control and interface applications. High-sensitivity and high dielectric types available. Flux-tight or plastic sealed.	Subminiature relay for interface applications. Choose low-profile or slim-line versions. High-sensitivity type available. Flux-tight or plastic sealed.	Miniature relay for signal circuit and interface applications can be driven by an IC circuit. High sensitivity type available. Flux-tight or plastic sealed.	Subminiature relay with the same footprint as the G6G surface mount relay. Ideal for office automation and test and measurement. Flux-tight or plastic sealed.	Ultra-small RF relay with outstanding typical values for VSWR (1.8 max.), insertion loss (0.5 dB max.) and isolation (60 dB min.) at 900 MHz. Plastic sealed.
Contact Ratings					
Contact form	SPDT	SPDT	DPDT	DPDT	SPDT
Contact type	Bifurcated crossbar, single crossbar	Single crossbar	Bifurcated crossbar, single crossbar	Bifurcated crossbar	Twin
Contact material	AgPd with Au clad	AgPd with Au clad	AgPd with Au clad	Ag with Au clad	Au clad
Max. operating current under resistive load	1 A	1 A	2 A	1 A	0.1 A
Max. operating voltage	125 VAC, 60 VDC	125 VAC, 60 VDC	125 VAC, 125 VDC	125 VAC, 125 VDC	30 VAC, 30 VDC
Number of poles	1	1	2	2	1
Max. switching capacity under resistive load	120 VA, 30 W	60 VA, 30 W	60 VA, 30 W	37.5 VA, 33 W	1 VA, 1 W
Minimum permissible load	Consult factory	Consult factory	Consult factory	Consult factory	Consult factory
Rated load (under resistive load)	0.5 A at 100 VAC, 1 A at 24 VDC	0.5 A at 110 VAC, 1 A at 24 VDC	0.3 A at 110 VAC, 1 A at 24 VDC	0.5 A at 24 VAC, 1 A at 24 VDC	0.01 A at 24 VAC, 0.01 A at 24 VDC 1 W at 900 MHz at VSWR 1.2
Coil Ratings					
Rated voltage	1.5, 3, 5, 6, 9, 12, 24 VDC	5, 6, 9, 12, 24 VDC	3, 5, 6, 9, 12, 24, 48 VDC	3, 5, 6, 9, 12, 24, 48 VDC	5, 6, 9, 12, 24 VDC
Power consumption*	450 mW (standard), 200 mW (high sensitivity)	280 mW (standard), 200 mW (high sensitivity)	360 mW (standard), 150 mW (high sensitivity)	200 mW (standard and latching)	300 mW (SPDT)
Dielectric Strength (50/60 Hz for 1 minute)	500 VAC (standard)	500 VAC (standard)	1,000 VAC	1,000 VAC	1,000 VAC
Electrical Service Life (operations)	200,000 minimum	100,000 minimum	500,000 minimum (Bif.) 200,000 minimum (Sgl.)	100,000 minimum	300,000 minimum
Terminal Choices	PCB Terminal	PCB Terminal	PCB Terminal	PCB Terminal	PCB Terminal
Approved Standards	UL, CSA, FCC Part 68 Available	FCC Part 68 Available	UL, CSA, FCC Part 68	UL, CSA, FCC Part 68 Available	

Note: Relay height includes standoffs

Specifications subject to change without notice.

*All specifications measured at 23°C, 65% RH, unless indicated otherwise.

Moving Loop Relay

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OMRON ELECTRONICS, INC.
One East Commerce Drive
Schaumburg, IL 60173
TWX 910-291-0426

Call Omron toll free:
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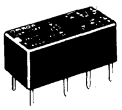
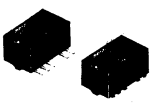
OMRON Signal Control PC Board Relays

Model (Dimensions in inches)	G6A	G6E	G6G	G6H
				
	0.33″H x 0.79″L x 0.39″W	0.33″H x 0.63″L x 0.39″W	0.315″H x 0.40″L x 0.63″ W (Actual color: Beige)	0.20″H x 0.55″L x 0.35″W
Features	Plastic sealed relay with high impulse withstand voltage, ideal for communication equipment. Latching type available. Plastic sealed.	Subminiature low signal switching relay has high sensitivity. Packed in a magazine for automatic insertion and soldering. Latching type available. Plastic sealed.	Surface mount relay maintains stable operating characteristics after being subjected to high heat mass soldering methods (i.e. vapor phase, IR and dual wave). Low profile and small size increase PC board capacity. Sealed construction of high-temperature resistant resins and sealing agents.	Compact, extremely low profile relay ideal for high-density mounting. Bifurcated contacts capable of switching 1A with very little power consumption. Plastic sealed construction.
Contact Ratings				
Contact form	DPDT	SPDT	DPDT	DPDT
Contact type	Bifurcated crossbar	Bifurcated crossbar, single crossbar	Bifurcated crossbar	Bifurcated crossbar
Contact material	Ag with Au clad / AgPd with Au clad	Ag with Au clad	Ag with Au clad	Ag with Au clad
Max. operating current	2 A / 2 A	3 A	2 A	1 A
Max. operating voltage	250 VAC, 220 VDC	250 VAC, 220 VDC	125 VAC, 125 VDC	125 VAC, 110 VDC
Number of poles	2	1	2	2
Max. switching capacity	125 VA, 60 W	50 VA, 60 W	50 VA, 60 W	62.5 VA, 33 W
Minimum permissible load	Consult factory	Consult factory	Consult factory	Consult factory
Rated load (under resistive load)	0.5 A at 125 VAC, 2 A at 30 VDC / 0.3 A at 125 VAC, 1 A at 30 VDC	0.4 A at 125 VAC, 2 A at 30 VDC	1 A, 24 VDC 0.5 A, 50 VDC 0.2A, 110 VAC	0.5 A at 125 VAC 1 A at 30 VDC
Coil Ratings				
Rated voltage	3, 5, 6, 9, 12, 24 48 VDC	3, 5, 6, 9, 12, 24, 48 VDC	5, 6, 9, 12, 24, 48 VDC	3, 5, 6, 9, 12, 24 VDC
Power consumption*	200 mW (DPDT std.), 100 mW (DPDT latch)	200 mW (bifurcated), 400 mW (single) standard and latching	200 mW**	140 mW (standard)
Dielectric Strength (50/60 Hz for 1 minute)	1,000 VAC	1,500 VAC	2,000 VAC	1,000 VAC
Electrical Service Life (operations)	500,000 minimum	500,000 minimum (DC) 100,000 minimum (AC)	100,000 minimum	100,000 minimum
Terminal Choices	PCB Terminal	PCB Terminal	PCB Terminals and "L" or "J" modified gullwing leads	PCB Terminal
Approved Standards	UL, CSA, FCC Part 68	UL, CSA, FCC Part 68	CSA, FCC Part 68 (UL approval pending)	UL, CSA

Note: Relay height includes standoffs

Specifications subject to change without notice.

*All specifications measured at 23°C, 65% RH, unless indicated otherwise.

Moving Loop Relay

**360 mW at 48 VDC

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Schaumburg, IL 60173
TWX 910-291-0426

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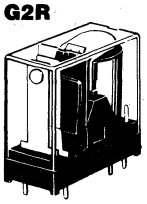
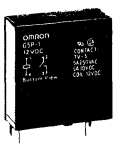
OMRON Power PC Board Relays

Model (Dimensions in inches)	G2R	G5L	G5P	G6B	G6C
					
	1.00″H x 1.14″L x 0.51″W	0.75″H x 0.89″L x 0.65″W	0.98″H x 0.95″L x 0.37″W	0.39″H x 0.79″L x 0.39″W	0.39″H x 0.79″L x 0.59″W
Features	Slim-styled power relay. 16 A high-capacity, bifurcated contact, sealed, Class B insulation and latching types available.	Low-profile relay for switching up to 5 A in appliances, security equipment, and environment control systems. Flux-tight or plastic sealed.	Slim styled power relay. TV 5 rated and switches up to 5 A. Flux-tight.	High capacity, subminiature relay switches 8 A loads with SPST-NO and 5 A loads with standard type. Latching type available. Plastic sealed.	High-capacity, subminiature relay switches 10 A loads with SPST-NO and 8 A loads with SPST-NO and SPST-NC. Flux-tight or plastic sealed. Latching type available.
Contact Ratings					
Contact form	SPDT, SPST-NO, SPST-NC, DPDT, DPST-NO, DPST-NC	SPDT, SPST-NO	SPST-NO	SPST-NO, SPST-NO+ SPST-NC, DPST-NO, DPST-NC	SPST-NO SPST-NO+ SPST-NC
Contact type	Single and bifurcated button	Single button	Single button	Single button	Single button
Contact material	AgCdO or AgInSn	AgCdO	AgInSn	AgCdO or AgInSn	AgCdO or AgInSn
Max. operating current under resistive load	16 A (high-capacity 1-pole) 10 A (general-purpose 1-pole) 5 A (general-purpose 2-pole) 5 A (bifurcated, 1-pole) 5 A (high sensitivity 1-pole) 3 A (high sensitivity 2-pole)	5 A	5 A	8 A, 5 A	10 A, 8 A
Max. operating voltage	380 VAC, 125 VDC	250 VAC, 30 VDC	250 VAC, 30 VDC	380 VAC, 125 VDC	380 VAC, 125 VDC
Number of poles	1 2	1	1	2	1
Max. switching capacity under resistive load	4,000 VA 1,250 VA 450 W 150 W	1,250 VA, 150 W	1,250 VA, 150 W	1,250 VA, 150 W	2,500 VA, 300 W
Minimum permissible load	Consult factory	Consult factory	Consult factory	Consult factory	Consult factory
Rated load (under resistive load)	16 A at 250 VAC, 30 VDC 5 A at 250 VAC, 30 VDC	5 A at 120 VAC, 30 VDC	5 A at 250 VAC, 30 VDC	8 A at 250 VAC, 8 A at 30 VDC 5 A at 250 VAC, 5 A at 30 VDC	10 A at 250 VAC, 10 A at 30 VDC 8 A at 250 VAC, 8 A at 30 VDC
Coil Ratings					
Rated voltage	6, 12, 24, 50, 100/110, 120, 200/220, 240 VAC 3, 5, 6, 12, 24, 48, 100, 110 VDC	3, 5, 6, 12, 24, 48 VDC	12, 24 VDC	3, 5, 6, 12, 24 VDC	3, 5, 6, 12, 24 VDC
Power consumption*	0.9 VA, 0.53 W	400 mW	530 mW	200 mW standard and latching	200 mW standard and latching
Dielectric Strength (50/60 Hz for 1 minute)	5,000 VAC	2,000 VAC	4,000 VAC	3,000 VAC	2,000 VAC
Electrical Service Life (operations)	100,000 minimum	100,000 minimum	100,000 minimum	100,000 minimum	100,000 minimum
Terminal Choices	PCB Terminal, plug-in and quick-connect	PCB Terminal	PCB Terminal	PCB Terminal	PCB Terminal
Approved Standards	UL, CSA, SEV, SEMKO, VDE, TUV	UL, CSA	UL, CSA	UL, CSA, FCC Part 68	UL, CSA, VDE

Note: Relay height includes standoffs

Specifications subject to change without notice.

*All specifications measured at 23°C, 65% RH, unless indicated otherwise.

Moving Loop Relay

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Schaumburg, IL 60173
TWX 910-291-0426

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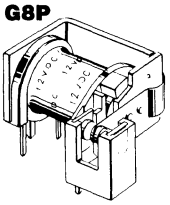
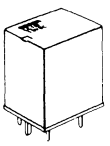
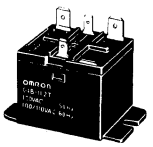
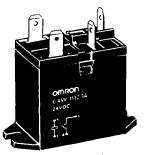
OMRON Power PCB and Power Relays

Model (Dimensions in inches)	**G8P**  0.66″H x 1.20″L x 0.95″W	**G5LE**  0.75″H x 0.89″L x 0.65″W	**G4B**  1.14″H x 2.00″L x 1.28″W	**G4W**  1.22″H x 1.77″L x 0.79″W
Features	Power relay breaks up to 30A load. Class B insulation, dust cover and sealed versions available.	Low profile for switching up to 10A for appliances and security equipment. Flux-tight.	Breaks 15 A, carries 20 A and withstands 55 A inrush. 25 A high capacity and Class B insulation types available.	Offers high impulse withstand voltage and dielectric strength. Ideal for power switching. Sealed type and Class B insulation available.
Contact Ratings				
Contact form	SPST-NO, SPDT	SPDT, SPST-NO	SPST-NO, SPDT	SPST-NO, DPST-NO
Contact type	Single button	Single button	Single button	Single button
Contact material	AgCdO or AgInSn	AgCdO	AgCdO or AgInSn	AgCdO
Max. operating current under resistive load	30 A (SPST-NO) 10 A (SPDT)	10 A	20 A 25 A (high capacity)	15 A (SPST-NO) 15 A (DPST-NO)
Max. operating voltage	250 VAC, 28 VDC	250 VAC, 30 VDC	250 VAC, 125 VDC	250 VAC, 125 VDC
Number of poles	1	1	1	1 2
Max. switching capacity under resistive load	7,500 VA	2,500 VA, 240 W	3,300 VA, 360 W	3,750 VA, 2,500 VA
Minimum permissible load	Consult factory	Consult factory	Consult factory	Consult factory
Rated load (under resistive load)	30 A at 250 VAC 20 A at 28 VDC	8 A at 30 VDC 10 A at 120 VAC	15 A at 220 VAC, 24 VDC 25 A at 220 VAC, 24 VDC (high capacity)	15 A at 250 VAC 15 A at 24 VDC
Coil Ratings				
Rated voltage	5, 6, 9, 12, 15, 18, 24, 48 VDC	3, 5, 6, 12, 24, 48 VDC	6, 12, 24, 50, 100, 120 VAC 6, 12, 24, 48, 100, 110 VDC	12, 24, 100 VDC
Power consumption*	0.9 W	400 mW	1.3 VA, 1.2 W	800 mW
Dielectric Strength (50/60 Hz for 1 minute)	1,500 VAC	2,000 VAC	2,000 VAC	4,000 VAC
Electrical Service Life (operations)	100,000 minimum	100,000 minimum	100,000 minimum	100,000 minimum
Terminal Choices	PCB Terminal	PCB Terminal	Quick-connect, PCB terminal, combination PCB + QC	PCB terminal, quick-connect, solder, combination PCB + QC
Approved Standards	UL, CSA	UL, CSA	UL, CSA	UL, CSA, VDE, SEMKO, SEV

Note: Relay height includes standoffs

*All specifications measured at 23°C, 65% RH, unless indicated otherwise.

Specifications subject to change without notice.

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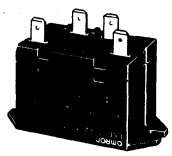
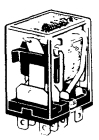
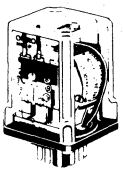
OMRON General Purpose Relays

Model (Dimensions in inches)	G5D	LY	MK	MY
				
	1.83″H x 2.07″L x 1.32″W	1.40″H x 1.10″L x 0.85″W	2.07″H x 1.36″L x 1.36″W	1.42″H x 1.10″L x 0.85″W
Features	Power relay has double-break contact arrangement. Class B insulation available.	Compact, general-purpose relay suitable for a wide range of applications up to 15 A. LED indicator, push-to-test button versions.	Exceptionally reliable power relay plugs into convenient octal pin sockets. Mechanical indicator and test button types available.	Versatile relay, ideal for power and sequence control applications, meets many application needs. Latching and hermetically sealed versions available.
Contact Ratings				
Contact form	SPST-NO, DPST-NO	SPDT, DPDT, 3PDT, 4PDT	DPDT, 3PDT	DPDT, 3PDT, 4PDT
Contact type	Single button	Single button, bifurcated button	Single button, bifurcated button	Single button, bifurcated button
Contact material	AgCdO	AgCdO	Ag	Ag or AgCdO
Max. operating current under resistive load	30 A (SPST-NO) 20 A (DPST-NO)	15 A (SPDT) 10 A (DPDT, 3PDT, 4PDT) 5 A (bifurcated contacts, DPDT and 4PDT)	10 A	5 A (DPDT, 3PDT unsealed) 3 A (4PDT unsealed) 3 A (4PDT hermetically sealed) 1 A (4PDT sealed)
Max. operating voltage	250 VAC	250 VAC, 125 VDC	500 VAC, 250 VDC	250 VAC, 125 VDC
Number of poles	1 / 2	1 / 2, 3 and 4	2 and 3	2 and 3 / 4
Max. switching capacity under resistive load	7,500 VA / 5,000 VA	1,700 VA / 1,100 VA 360 W / 240 W	2,500 VA/1250 VA 280 W/140 W	1,100 VA / 60 VA 120 W / 72 W
Minimum permissible load	Consult factory	Consult factory	Consult factory	Consult factory
Rated load (under resistive load)	30 A at 250 VAC / 20 A at 250 VAC	15 A at 110 VAC, 24 VDC / 10 A at 110 VAC, 24 VDC	250 VAC, 10 A (NO), 5 A (NC) 28 VDC, 10 A (NO), 5 A (NC)	5 A at 220 VAC, 24 VDC / 3 A at 220 VAC, 24 VDC
Coil Ratings				
Rated voltage	6, 12, 24, 50, 100, 110, 120, 200, 220, 240 VAC 6, 12, 24, 48, 100, 110 VDC	6, 12, 24, 50, 110/120, 220/240 VAC 6, 12, 24, 48, 100/110 VDC	6, 12, 24, 50, 100, 110, 120, 200, 220, 240 VAC 6, 12, 24, 48, 100, 110 VDC	6, 12, 24, 50, 100, 110, 110/120, 200/220, 220/240 VAC 6, 12, 24, 48, 100/110 VDC
Power consumption at 60 Hz for AC	3 VA, 1.9 W	1.1 VA, 0.9 W / 1.1 VA, 0.9 W (DPDT) 1.6 VA, 1.4 W (3PDT) 1.95 VA, 1.5 W (4PDT)	2.3 VA, 1.5 W	Approx. 1.1 VA, 0.9 W
Dielectric Strength (50/60 Hz for 1 minute)	4,000 VAC	2,000 VAC	1,500 VAC	2,000 VAC, unsealed 1,500 VAC, sealed
Electrical Service Life (operations)	100,000 minimum	200,000 minimum 500,000 min. (2P)	250,000 minimum 500,000	500,000 minimum 200,000 min. (4P)
Terminal Choices	Quick-connect	PCB terminal, plug-in	Octal pin	PCB terminal, plug-in
Approved Standards	UL, CSA, VDE, TÜV	UL, CSA, SEV	UL, CSA, SEV	UL, CSA, SEV

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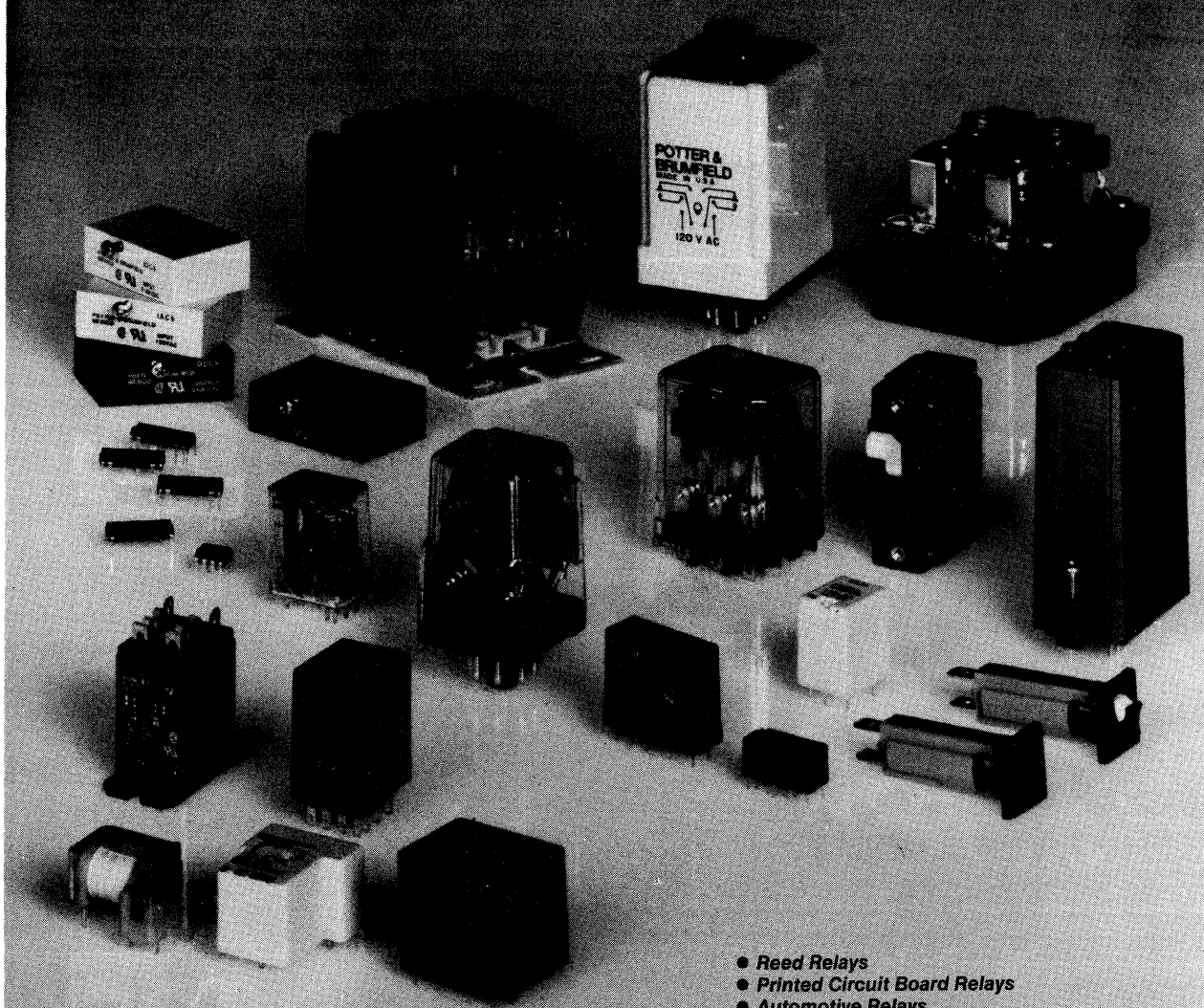
200 S. Richland Creek Dr., Princeton, Indiana 47671-0001 • 812/386-1000 • FAX 812-386-2335

Relays, Contactors and I/O Modules



The following pages provide an overview of stock items in Potter & Brumfield's extensive product line. For more information on any P&B product, contact your nearest authorized P&B distributor or sales representative. Call toll free **800/255-2550** *for the name of one near you. Note: Specifications and/or agency recognitions do not necessarily apply to all models within a particular series. When multiple ratings are listed, no individual rating may be exceeded by the combination of others.*

- *Reed Relays*
- *Printed Circuit Board Relays*
- *Automotive Relays*
- *Sensitive Relay*
- *General Purpose Socket/Panel Mount Relays*
- *Impulse and Latching Relays*
- *Power Relays*
- *Contactors*
- *High Reliability Relays*
- *Time Delay Relays*
- *Solid State Relays*
- *Solid State Input/Output Modules*

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Reed Relays

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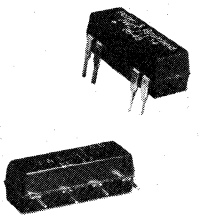

	JWD-JWS	JHV
Series	**JWD-JWS**	**JHV**
Features	• Low profile reed relay • DIP and SIP terminations • Immersion cleanable • Optional transient suppression diode	• High voltage dry reed relay • High dielectric strength
Approx. Dimensions Inch (mm)	.77 x .30 x .28h (19.6 x 7.6 x 7.0h)	4.5 x .88 x .75h (114 x 22.3 x 19.1h)
Contact Arrangement	1 Form A, 1 Form C 1 Form B, 2 Form A	1 Form A, 1 Form B
Contact Material	Rh	—
Contact Rating	(1A) 10W, 0.5A 200 VDC (1B)10W, 0.5A 100 VDC (1C)5W, 0.5A 100VDC (2A)10W, 0.5A 100 VDC	50W or 50VA, 3A, 5,000 VDC 50W or 50VA, 1A, 10,000 VDC
Minimum Mechanical Life (Operations)	$>10^9$	$>10^9$
Minimum Electrical Life at Rated Load (Operations)	10^6	10^6
Coil Voltage	5-24 VDC	6-24 VDC
Nominal Coil Power	50-480mW	200-1,500mW
Mounting	PC board Socket	Panel mount
Sockets	Fits 14-pin IC socket	Solder terminals

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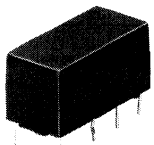
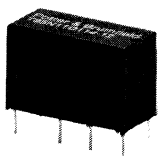
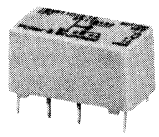
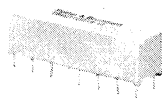
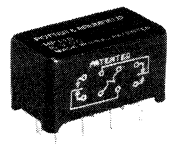
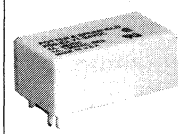
Printed Circuit Board Relays

						
T81	**T82**	**T85**	**T83**	**T84**	**HP**	**R50**
• Miniature, high density package • Immersion cleanable case • Sensitive coil available • DIP terminal arrangement • High dielectric model available • Meets FCC Part 68 isolation • ᵠᵠ	• Miniature, low profile package • Immersion cleanable case • DIP terminal arrangement • Meets FCC Part 68 isolation • ᵠᵠ	• Miniature, DIP relay • High sensitivity coil • Sealed case for immersion cleaning • Meets FCC Part 68 isolation • ᵠᵠ	• Miniature, telecom relay • Meets FCC Part 68 isolation • Latching and non-latching types • Sealed case • Sensitive coil available	• Miniature, telecom relay • Meets FCC Part 68 isolation • Latching and non-latching types • Sealed case • Sensitive coil available • ᵠᵠ	• Low profile • High density mounting • Immersion cleanable • Half-size crystal case • Hermetically sealed version available	• Switches to 5 amps • Economical • Low profile package • Immersion cleanable case • ᵠᵠ
.61 x .45 x .43h (15.4 x 11.4 x 11.0h)	.83 x .42 x .47h (21.1 x 10.7 x 11.9h)	.79 x .39 x .49h (20.1 x 10 x 12.4h)	.79 x .39 x .42h (20.1 x 10 x 10.6h)	1.4 x .40 x .40h (35.4 x 10.1 x 10.1h)	.88 x .48 x .49h (22.4 x 12.2 x 12.5h)	1.09 x .60 x .46h (27.7 x 15.7 x 11.7h)
1 Form C	2 Form C	2 Form C	2 Form C	4 Form C	2 Form C	1 Form C 2 Form C
Au overlay, Ag Pd	Au overlay, Pd Ag	Au overlay Pd Ag & Pd Ag	Au overlay, Ag & Pd Ag	Au overlay, Pd Ag	Au plated Ag Mg Ni	Ag Ag CD 0
1A @ 24 VDC 0.5A @ 120 VAC	(Single Contact) 2A AC or DC 150 VDC, 125 VAC 30W or 60VA (Bifurcated Crossbar) 1.25A AC or DC 100 VDC or 90 VDC 30W or 50 VA	1.25A, AC or DC 150 VDC or 200 VAC 24W or 60VA	2A, AC or DC 150 VDC or 125 VAC 35W or 60VA	2A, AC or DC 250 VDC or 220 VAC 35W or 60 VA	0.3 2A @ 28 VDC 0.1-0.5A @ 120 VAC	2A @ 28 VDC or 1A @ 120 VAC 5A @ 28 VDC or 2.5A @ 120 VAC
5×10^6	2×10^7	2×10^7	2×10^7	2×10^7	3×10^6	10^7
1.5×10^5 @ 1A, 24 VDC 10^5 @ 0.5A, 120 VAC	5×10^5 @ 1.25A, 24 VDC or 0.4A, 120 VAC (Single Contact)	5×10^5 @ 1A, 24 VDC 2×10^5 @ .5A, 120 VAC	3×10^5 @ 1.5A, 24 VDC 1×10^5 @ 1A, 120 VAC	5×10^5 @ 1A, 24 VDC 2×10^5 @ 0.5A, 120 VAC	10^5	10^5 @ 2A, 28 VDC and 1A, 120 VAC 6×10^5 @ 5A, 28 VDC and 2.5A, 120 VAC
1.5-24 VDC	5-48 VDC	4.5-48 VDC	5-48 VDC	3-48 VDC	5-48 VDC	5-48 VDC
(standard) 450mW (sensitive) 200mW	516-560mW	150-300mW	75-400mW	90-400mW	700mW	0.75-1.3W
PC board	PC board Socket	PC board	PC board	PC board	PC board Socket	PC board
Fits 12-pin IC socket	Fits 16-pin IC socket	Fits 16-pin IC socket	Fits 16-pin IC socket	Fits 28-pin IC socket	Solder terminal	—

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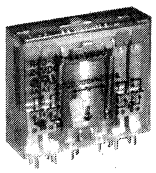
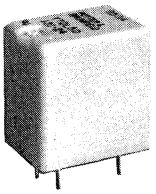
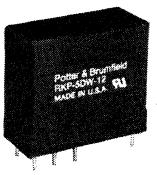
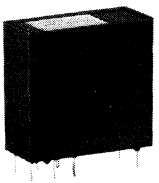
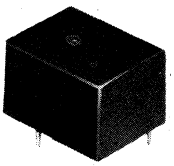
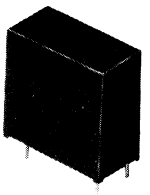
Printed Circuit Board Relays

						
Series	**R40**	**T70**	**RKP/RKS**	**RKA**	**T73**	**T74**
Features	• Flat pack case style • 0.450" (11.43mm) maximum thickness • IC logic compatible with TTL, HTL and CMOS •	• Low cost • Load switching to 10A • TV5 contact rating • 1,500 VRMS coil-to-contacts breakdown • Dust cover or immersion cleanable case •	• 0.6 cubic inch (10 cm^3) package • Dust cover or immersion cleanable case • 8mm contact to coil spacing • 4,000 VRMS insulation breakdown •	• 0.6 cubic inch (10cm^3) package • Immersion cleanable case • Meets 8mm spacing and 4kV isolation • TV-3 and TV-5 ratings •	• Low-profile relay • Less than .59" (14.7mm) tall • Sealed case • Ratings to 10A • UL478 and UL508 • Sensitive coil available •	• Requires only .33 square inch (2.15cm^2) of PC board area • High sensitivity coil • Sealed PBT case • DIP terminal configuration • 4kV surge strength •
Approx. Dimensions Inch (mm)	1.42 x .45 x 1.25h (36.1 x 11.4 x 31.6h)	.88 x .65 x .95h (22.4 x 16.4 x 24.0h)	1.18 x .51 x 1.07h (30.0 x 13.0 x 27.1h)	1.15 x .51 x 1.03h (29.2 x 13 x 26.2h)	.84 x .65 x .58h (21.3 x 10.7 x 14.7h)	.81 x .41 x .81h (20.6 x 10.4 x 20.6h)
Contact Arrangement	2 Form C 4 Form C	1 Form C	1 Form C	1 Form A, 2 Form A 1 Form C, 2 Form C	1 Form A 1 Form C	1 Form C 1 Form C
Contact Material	Ag Ag Cd 0 Au Ag Pt	Au plated Ag Ag Cd 0	Ag Cd 0	Ag Ni Ag Cd 0	Au overlay, Pd Ag Au overlay, Ag Ni Ag Sn	Ag Sn Ag Cd 0
Contact Rating	Dry circuit to 7.5A @ 28VDC or 115 VAC	5A @ 28 VDC or 120 VAC 10A @ 28VDC or 120 VAC 5A tungsten @ 120 VAC 5A @ 240 VAC 1/4 HP @ 120 VAC	5A @ 30 VDC or 277 VAC 10A @ 30 VDC or 277 VAC 20A @ 24 VDC or 277 VAC UL TV-5	5 to 10A @ 24 VDC or 240 VAC UL TV-3 and TV-5	1A to 10A @ 30 VDC or 120 VAC 10A @ 24 VDC or 120 VAC	2 to 5A @ 250 VAC
Minimum Mechanical Life (Operations)	5 x 10^7	10^7	10^6	5 x 10^6	2 x 10^7	1 x 10^7
Minimum Electrical Life at Rated Load (Operations)	7.5 x 10^4 to 5 x 10^5	7.5 x 10^4 @ 5A, 28 VDC, 120 VAC or 240 VAC 5 x 10^4 @ 10A, 28 VDC or 120 VAC 2.5 x 10^4 @ 5A tungsten	10^5 @ 5A, 30 VDC or 277 VAC 10^5 @ 10A, 30 VDC or 277 VAC 2 x 10^4 @ 20A, 277 VAC	1 x 10^5	1 x 10^5	1 x 10^5
Coil Voltage	6-48 VDC	3-48 VDC	4.5-48 VDC	3-48 VDC	3-48 VDC	5-48 VDC
Nominal Coil Power	450-720mW	360mW	524mW	530-720mW	330-600mW	360mW
Mounting	PC board Socket	PC board	PC board	PC board	PC board	PC board
Sockets	Solder terminal PC terminal	—	—	—	—	—

Call toll-free 800-255-2550 for the name and telephone number of your nearby P&B sales representative or authorized stocking distributor.

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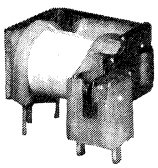
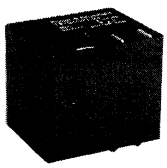
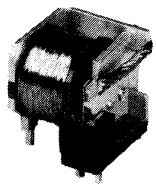
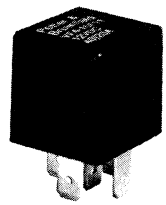
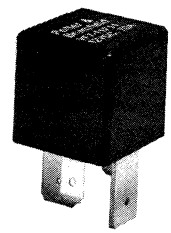
PC Board Relays		Automotive Relays			Sensitive Relay
					
T90	**T91**	**VKP**	**VF4**	**VF7**	**R10S**
• Switch loads up to 30A • Less than 1 watt coil power • Class B insulation • Class F available • Economically priced • Open, dust cover or immersion cleanable case • ᖘ Ⓢ	• Both quick connects and PC terminals for contacts • PC terminals for coil • Meet UL 873 and UL 508 spacings • Sealed or unsealed enclosure • Class B insulation • Class F available • Optional flanged case for panel mounting • AC and DC coils • ᖘ Ⓢ	• Compact package for PC board mounting • Open-frame design • Carries up to 40 amps • Internationally proven design	• Plastic enclosed relay • Various mounting options • Carries to 40 amps • Standard design for many U.S. autos	• Plastic enclosed relay • Various mounting options • Carries to 70 amps • Standard design for many U.S. autos	• Highly sensitive • 10mW coil power per pole • Opaque dust cover • Driven directly by TTL, CMOS, HTL and ECL • ᖘ
1.20 x .95 x .67h (30.5 x 24.1 x 16.9h)	1.27 x 1.07 x 1.10h (32.1 x 27.2 x 27.9h)	.91 x .75 x .72h (23.1 x 19 x 18.3h)	1.03 x 1.03 x .99h (26.2 x 26.2 x 25.1h)	1.03 x 1.03 x .99h (26.2 x 26.2 x 25.1h)	1.01 x .74 x 1.50h (25.7 x 18.7 x 38.1h)
1 Form A 1 Form C	1 Form A 1 Form C	1 Form A 1 Form C	1 Form A 1 Form C	1 Form A	1 Form C 2 Form C 4 Form C
Ag Ag Cd 0	Ag Cd 0	Ag Ni .15	Ag Ni .15	Ag Ni .15	Ag
30A @ 28 VDC or 240 VAC 6A @ 277 VAC 2 HP @ 240 VAC	30A @ 28 VDC or 240 VAC 6A @ 277 VAC 2 HP @ 240 VAC	40A @ 14 VDC (NO) 20A @ 14 VDC (NC)	40A @ 14 VDC (NO) 30A @ 14 VDC (NC)	70A @ 14 VDC	Dry circuit to 3A @ 28 VDC or 115 VAC
10^7	10^7	1×10^6	1×10^6	1×10^6	10^8
10^5	10^5	1×10^5	1×10^5	1×10^5	5×10^5
5-110 VDC	5-110 VDC 12-240 VAC	6-24 VDC	6-24 VDC	6-24 VDC	6-12 VDC
870-930mW	(DC) 870-930mW (AC) 2.0 VA	1.6W	1.6W	2W	(1C) 10mW (2C) 20mW (4C) 40mW
PC board	PC board Panel mount	PC board	PC board, Socket Mtg. Bracket	PC board, Socket Mtg. Bracket	Socket PC board
—	—	—	Sockets available	Socket available	Screw terminal Solder terminal PC terminal

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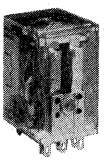
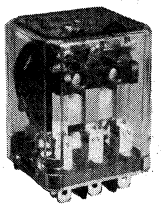
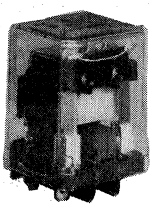
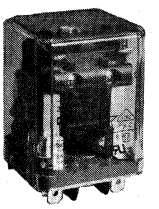
General Purpose Socket/Panel Mount Relays

						
Series	**R10**	**KHA**	**K10**	**KUP**	**KUEP**	**KUIP-KUGP**
Features	• Up to 8 pole contacts • Dust cover or immersion cleanable case • Sensitive coils available • Optional indicator lamp • Optional octal plug base (up to 3 pole • ᵠᵠ	• Compact, approx. 1 in³ (16cm³) package • 4DPDT, 5 amp switching • AC and DC coils • Smoked dust cover • Optional flange-top case for panel mounting • Indicator lamp available • ᵠᵠ	• Compact, approx. 1 in³ (16cm³) package • DPDT, 15 amp switching capability • Smoked dust cover • Optional flange-top case for panel mounting • AC and DC coils • ᵠᵠ	• Open or enclosed • Plain and bracket mount dust covers • Optional flange-top case for panel mounting • Optional indicator lamp and push-to-test button • Several socket styles • ᵠᵠ	• Switches DC currents • Magnetic blow-outs • Clear dust cover • Optoinal flange-top case for panel mounting • Several socket styles • ᵠᵠ	• VDE approved design • Class B insulation • 8mm coil-to-contact spacing (KUIP) • 3mm open contact gap (KUGP) • Plain and bracket mount dust covers • Optional flange-top/ panel mount case • ᵠᵠ
Approx. inch Dimensions (mm)	1.17 x .74 x 1.18h (29.6 x 18.7 x 30.2h)	1.11 x .85 x 1.36h (28.2 x 21.6 x 34.5h)	1.11 x .86 x 1.38h (28.2 x 21.8 x 34.9h)	1.53 x 1.41 x 1.91h (38.9 x 35.7 x 48.4h)	1.53 x 1.41 x 1.91h (38.9 x 35.7 x 48.4h)	1.53 x 1.41 x 1.91h (38.9 x 35.7 x 48.4h)
Contact Arrangement	1 Form C to 8 Form C	2 Form C 4 Form C	2 Form C	1 Form C, 2 Form C 3 Form C, 4 Form C	1 Form X 2 Form A 2 Form C	1 Form C, 2 Form A 2 Form C, 3 Form C
Contact Material	Au overlay, Ag Ag Ag Cd O	Ag Ag Cd O Au Ag Ni Au overlay, Ag Au diffused, Ag	Ag Cd O	Ag Ag Cd O	Ag Cd O	Ag Cd O
Contact Rating	Dry circuit to 7.5A @ 28 VDC or 115 VAC 1/8 HP @ 110-120 VAC 1/6 HP @ 220-240 VAC	Dry circuit to 5A @ 28 VDC or 240 VAC 1/10 HP @ 120-240 VAC	15A @ 120 VAC 10A @ 28 VDC or 277 VAC 1/3 HP @ 120 VAC 1/2 HP @ 240 VAC	5A @ 28 VDC or 240 VAC 10A @ 28 VDC or 240 VAC 1/3 HP @ 120 VAC 1/2 HP @ 250-600 VAC 3A @ 600 VAC	(1X) 10A @ 150 VDC (2A) 5A @ 150 VDC (2C) 3A @ 150 VDC	5A tungsten @ 120 VAC 10A @ 28 VDC or 240 VAC 1/2A @ 120 VDC 1/3 HP @ 120 VAC 1/2 HP @ 250-600 VAC
Minimum Mechanical Life (Operations)	10^8	10^7	10^7	10^7	10^7	10^7
Minimum Electrical Life at Rated Load (Operations)	2×10^4 to 6×10^5	10^5	10^5	10^5	10^5	10^5
Coil Voltage	3-115 VDC 24-115 VAC	5-120 VDC 6-120 VAC	6-110 VDC 6-120 VAC	5-110 VDC 6-240 VAC	12-110 VDC 24-120 VAC	12-24 VDC 120 VAC
Nominal Coil Power	(DC) 0.036-1.6W (AC) 1.5VA	(DC) 900mW (AC) 1.2VA	(DC) 900mW (AC) 1.2VA	(DC) 1.2-1.8W (AC) 2.0-2.75VA	(DC) 1.2W (AC) 2.0VA	(DC) 1.2-1.8W (AC) 2.0-2.7VA
Mounting	Socket Panel mount PC board	Socket Panel mount PC board	Socket Panel mount PC board	Socket Panel mount	Socket Panel mount	Socket Panel mount
Sockets	Screw terminal Solder terminal PC terminal	Screw terminal Solder terminal PC terminal	Screw terminal Solder terminal PC terminal	Screw terminal Solder terminal PC terminal Quick connect terminal	Screw terminal Solder terminal PC terminal Quick connect terminal	Screw terminal Solder terminal PC terminal Quick connect terminal

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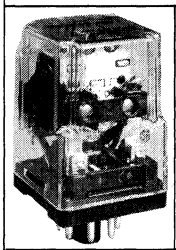
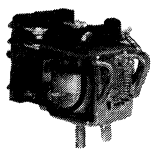
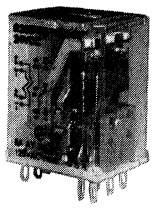
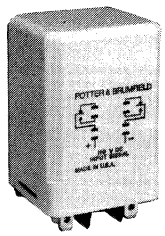
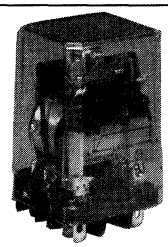
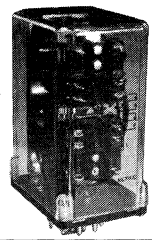
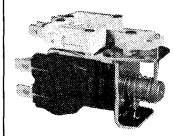
Impulse & Latching Relays

						
KRPA	**KA**	**R30D**	**KUR**	**KUL**	**KBP**	**S89R-S90R**
• Octal-type plug termination • AC and DC coils • Optional indicator lamp • Clear dust cover • Hermetically sealed available • UL CSA	• Small package • Ruggedly constructed • Cost effective • AC or DC operation • Highly efficient for switching light power loads • UL CSA	• Dual coil magnetic latching • Fast operate and reset time • Low level contacts available • 4 pole switching capability • UL CSA	• Permanent memory • Holds mode with or without power • Hybrid latching circuitry • Pulse or alternate action operation • Dust cover is standard	• Magnetic latching • Single or dual coil input • Good memory stability • Low power requirement • Various sockets available • UL CSA	• Dual coil mechanical latching • Coils operate on same or different voltages • Up to 5 pole switching • Clear dust cover with octal plug base • Sockets available for all configurations • UL	• Bistable, impulse operation • Cost effective • Conserves power • Optional dust cover with octal plus base • UL CSA
1.41 x 1.41 x 2.00h (35.7 x 35.7 x 50.8h)	1.92 x 1.47 x 1.38h (48.8 x 37.3 x 34.9h)	.95 x .74 x 1.19h (24.1 x 18.7 x 30.2h)	1.53 x 1.41 x 2.13h (38.9 x 35.7 x 54.0h)	1.53 x 1.41 x 2.16h (38.9 x 35.7 x 54.8h)	1.78 x 2.41 x 3.56h (45.2 x 61.1 x 90.4h)	2.70 x 2.00 x 2.42h (68.6 x 50.8 x 61.5h)
1 Form C 2 Form C 3 Form C	1 Form C 2 Form C 3 Form C	2 Form C 4 Form C	2 Form C	1 Form C 2 Form C	2 Form C 4 Form C 5 Form C	1 Form C 2 Form C 4 Form C
Ag Ag Cd O	Ag Ag Cd O	Ag Ag Cd O	Ag	Ag Cd O	Ag Ag Cd O	Ag Cd O
10A @ 28 VDC or 250 VDC 1/6 HP @ 120 VAC 1/3 HP @ 250 VAC	10A @ 28 VDC or 120 VAC 6A @ 240 VAC 1/6 HP @ 120 VAC 1/3 HP @ 240 VAC	Low level to 5A @ 28 VDC or 115 VAC	5A @ 28 VDC or 240 VAC	10A @ 28 VDC or 240 VAC	5A @ 120 VAC 10A @ 110 VAC	(S89R) 15A @ 250 VAC 1/2 HP @ 240 VAC (S90R) 20A @ 277 VAC 2 HP @ 250 VAC
10^7	10^7	10^7	10^7	10^7	5×10^5	10^5
10^5	10^5	10^5	10^5	10^5	5×10^4	5×10^4
6-110 VDC 6-240 VAC	6-110 VDC 12-240 VAC	12-24 VDC	12-24 VDC 120 VAC	12-24 VDC 12-120 VAC	12-24 VDC 120 VAC	6-24 VDC 6-240 VAC
(DC) 1.2W (AC) 2.0VA	(DC) 1.2W (AC) 2.0VA	0.36-1.44W	—	(DC single coil) 1.2W (DC dual coil) 2.4W	(DC) 2.7W (AC) 5.0-7.8VA	(DC) 6.33W (AC) 9.0VA
Socket	Panel mount	Socket Panel mount	Socket	Socket	Socket	Panel mount Socket (w/dust cover)
Screw terminal	—	Screw terminal Solder terminal PC terminal	Screw terminal Solder terminal PC terminal Quick connect terminal	Screw terminal Solder terminal PC terminal Quick connect terminal	Solder terminal Screw terminal	Screw terminal (w/dust cover)

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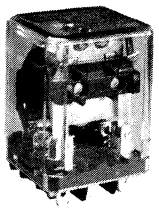
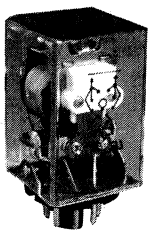
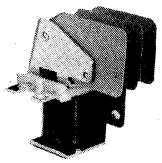
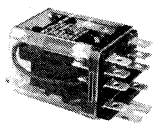
Power Relays

					
Series	**K20**	**KUMP**	**KRP-3-H**	**S86R-S89R**	**KUHP**
Features	• Identical to K10 except contacts rated to switch 20A • Plain and bracket mount dust covers • Optional flange-top case for panel mounting • AC and DC coils • Sockets available	• KUP package with 15A contact rating • Plain or bracket mount dust cover • Optional flange-top case for panel mounting • Several socket types • ᵁᴸ ᶜˢᴬ	• 20A switching capacity • Enclosed with octal-type plug • Heavy duty construction • Small space requirement • Optional open version • ᵁᴸ	• Economical • 20A switching capacity in compact package • Optional sensitive DC coil • Two mounting styles • ᵁᴸ ᶜˢᴬ	• 20A and 30A switching in bracket mount KUP package • 3,750 VRMS coil-to-contacts breakdown • Meets VDE and BSI requirements • Optional flange-top case for panel mounting • ᵁᴸ ᶜˢᴬ
Approx. Dimensions Inch (mm)	1.11 x .86 x 1.38h (28.2 x 21.8 x 39.4h)	1.53 x 1.41 x 1.91h) (38.9 x 35.7 x 48.4h)	1.53 x 1.41 x 2.28h (38.9 x 35.7 x 57.9h)	2.42 x 2.07 x 1.31h (50.0 x 38.9 x 35.7h)	1.97 x 1.53 x 1.41h (50.0 x 38.9 x 35.7h)
Contact Arrangement	1 Form C	2 Form C 3 Form C	1 Form X	1 Form C 2 Form C	1 Form C 2 Form C
Contact Material	Ag Cd O	Ag Cd O	Ag Cd O	Ag Cd O	Ag Cd O
Contact Rating	20A @ 240 VAC 1 HP @ 120 VAC 2 HP @ 240 VAC	15 A @ 277 VAC 1/3 HP @ 120 VAC 1/2 HP @ 250-600 VAC 3A @ 600 VAC	20A @ 120 VAC 3/4 HP @ 120 VAC	20A @ 277 VAC 1 HP @ 125 VAC 2 HP @ 250 VAC	(1C) 30A @ 120/240 VAC 1 HP @ 120 VAC 25A @ 28 VDC (2C) 20A @ 120/240 VAC 3/4 HP @ 120 VAC 20A @ 28 VDC
Minimum Mechanical Life (Operations)	10^7	10^7	2.5×10^6	10^6	10^7
Minimum Electrical Life at Rated Load (Operations)	10^5	10^5	10^5	5×10^4	(DC) 5×10^4 (AC) 10^5
Coil Voltage	6-110 VDC 6-120 VAC	5-110 VDC 6-240 VAC	12-110 VDC 12-120 VAC	12-24 VDC 24-240 VAC	6-110 VDC 6-120 VAC
Nominal Coil Power	(DC) 900mW (AC) 1.2VA	(DC) 1.2W (AC) 2.74VA	(DC) 1.2W (AC) 2.0VA	(DC) 1.13-4.5W (AC) 4.0VA	(DC) 1.2W (AC) 2.7VA
Mounting	Socket Panel mount	Socket Panel mount	Socket (w/dust cover) Panel mount	Panel mount	Panel mount
Sockets	Screw terminal	Screw terminal Solder terminal PC terminal Quick connect terminal	Screw terminal	—	—

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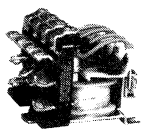
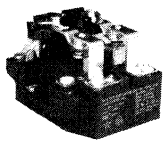
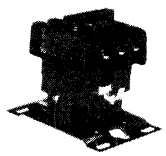
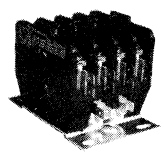
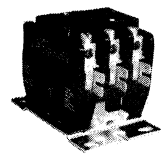
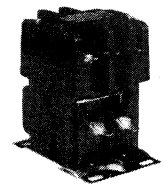
Power Relays		Contactors			
					
PM	**PRD**	**P25**	**P41**	**P31**	**P30-P40**
• 4 pole, 25A contacts • High dielectric strength • Screw or quick connect terminals • Dust cover available • Adaptable to PRD mounting holes • ᴿᵁ Ⓢ Ⓤ	• 30A contact rating • High inrush capacity • IC logic compatible • Available with magnetic blowouts • Optional auxiliary switch • ᴿᵁ Ⓢ Ⓤ	• 25A magnetic contactor • Control 3ϕ motor loads • Field replaceable contacts • Optional auxiliary switch and universal mounting plate • ᴿᵁ Ⓢ	• Four pole magnetic contactor • Control 1ϕ and 3ϕ circuits • Switch motor loads to 25A • Class B coil • Universal mounting plate • Dual quick connects for auxiliary wiring • ᴿᵁ Ⓢ	• Two and three pole magnetic contactor • Control 1ϕ and 3ϕ circuits • Switch motor loads up to 40A • Class B coil • Universal mounting plate • Dual quick connects for auxiliary wiring • ᴿᵁ	• Heavy duty magnetic contactors • P30 switches to 40A • P40 switches to 50A • Field replaceable contacts • Universal mounting plate • Optional auxiliary switch • ᴿᵁ Ⓢ
3.39 x 2.66 x 2.72h (86.2 x 67.5 x 69.1h)	3.38 x 2.51 x 2.50h (85.7 x 63.8 x 63.5h)	2.55 x 3.80 x 3.47h (64.8 x 96.5 x 88.1h)	2.63 x 3.80 x 2.73h (66.8 x 96.5 x 69.3h)	2.55 x 3.80 x 2.87h (64.8 x 96.5 x 72.9h)	2.65 x 3.80 x 3.98h (67.3 x 96.5 x 101.1h)
4 Form C	1 Form A, 1 Form X 1 Form C, 2 Form A 2 Form C	3 Form X	4 Form X	2 Form X 3 Form X	3 Form X 4 Form X
Ag Cd O	Ag Ag Cd O	Ag Cd O	Ag Cd O	Ag Cd O	Ag Cd O
25A @ 277 VAC 10A @ 28 VDC 1 HP @ 240 VAC	30A @ 277 VAC 2 HP @ 250 VAC 20A @ 125 VDC	25 FLA, 150 LRA @ 240 VAC 30A res. @ 600 VAC	25 FLA, 150 LRA @ 240 VAC 35A res @ 600 VAC	40 FLA, 240 LRA @ 240 VAC 50 A res. @ 600 VAC	(P30) 30 FLA, 180 LRA @ 240 VAC; 40A res. @ 600 VAC (P40) 40 FLA, 240 LRA @ 240 VAC; 50A res. @ 600 VAC
10^7	(1A, 1C, 1X) 2 x 10^6 (2A, 2C) 10^7	(DC) 5 x 10^6 (AC) 2 x 10^6	5 x 10^5	5 x 10^5	(DC) 10^7 (AC) 2 x 10^6
10^5	10^5	5 x 10^5	2 x 10^5	2 x 10^5	2 x 10^5
6-110 VDC 6-480 VAC	6-110 VDC 6-480 VAC	12-120 VDC 24-240 VAC	12-120 VDC 24-480 VAC	12-120 VDC 24-240 VAC	12-120 VDC 24-240 VAC
(DC) 4.4W (AC) 18.0VA	(DC) 2.0W (AC) 9.8VA	(DC) 4.8W (AC) 10VA	10VA	10VA	(DC) 7.5W (AC) 12VA
Panel mount	Panel mount	Panel mount	Panel mount	Panel mount	Panel mount
—	—	—	—	—	—

Call toll-free 800-255-2550 for the name and telephone number of your nearby P&B sales representative or authorized stocking distributor.

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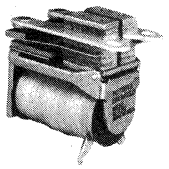
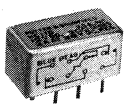
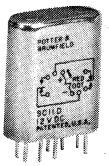
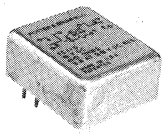
Contactors

High Reliability Relays

				
Series	**MB**	**HC-HL**	**SC-SL**	**FC-FL**
Features	• Miniature DC contactor • 60A, double-make switching • Heavy duty construction	• Half-size crystal case • Withstand 150g shocks and 20 g vibrations to 2,000 Hz • Hermetically sealed • Meet MIL-R-39016 • Less than 4 millisecond operate time • HL is latching version	• Crystal case • Withstand 200g shocks and 30g vibrations to 2,000 Hz • Hermetically sealed • Meet MIL-R-5757 • Less than 4 millisecond operate time • SL is latching version	• Flat crystal case • Withstand 150g shocks and 30g vibrations to 2,000 Hz • Hermetically sealed • Meet MIL-R-5757 and MSFC-SPEC-339 • Less than 4 millisecond operate time • FL is latching version
Approx. Dimensions **Inch (mm)**	1.41 x .88 x 1.53h (35.8 x 22.4 x 38.9h)	.81 x .41 x 41h) (20.6 x 10.4 x 10.4h)	.80 x .36 x .90h (20.3 x 9.1 x 22.9h)	1.10 x .93 x .49h (27.9 x 23.5 x 12.3h)
Contact Arrangement	1 Form X	2 Form C	2 Form C	2 Form C
Contact Material	Ag	Au plated Ag Mg Ni	Triclad Au	Au plated Ag Mg Ni
Contact Rating	60A @ 28 VDC	Dry circuit to 2A @ 28 VDC 0.3A @ 120 VAC	2A @ 30 VDC 1A @ 120 VAC	Dry circuit to 3A @ 28 VDC Dry circuit to 5A @ 28 VDC
Minimum Mechanical Life (Operations)	10^6	3×10^6	3×10^6	3×10^6
Minimum Electrical Life at Rated Load (Operations)	5×10^4	10^5	10^5	10^5
Coil Voltage	6-110 VDC	12-24 VDC	24 VDC	12-24 VDC
Nominal Coil Power	2.7W	720mW	(SC) 1.0W (SL) 0l9W	650mW
Mounting	Panel mount	PC board Socket Panel mount	PC board Socket Panel mount	PC board
Sockets	—	Solder terminal	Solder terminal	—

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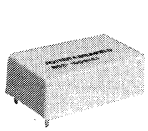
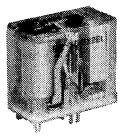
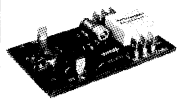
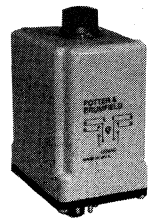
Time Delay Relays

						
Series	**R52**	**R12**	**R16**	**CR**	**CW**	**CB**
Features	• Makes TDR of most DC coil relays • Immersion cleanable • Cost effective	• Small, R10-type package • Choice of mountings	• Open board time delay relay	• Independent ON and OFF delays • Time as low as 0.1 second • ℛ Ⓢ	• Field programmable • Precision timer • LED "ON" indicator • ℛ Ⓢ	• Economical for volume applications • Various timing ranges • ℛ Ⓢ
Approx. inch Dimensions (mm)	1.29 x .80 x .50h (32.6 x 20.2 x 12.7h)	1.38 x .74 x 1.19h (34.9 x 18.7 x 30.2h)	3.63 x 2.13 x .55h (92.2 x 54.1 x 14.0h)	2.43 x 1.78 x 3.56h (61.7 x 45.2 x 90.4h)	2.41 x 1.78 x 2.94h (61.1 x 45.2 x 74.6h)	2.41 x 1.78 x 2.94h (61.1 x 45.2 x 74.6h)
Contact Arrangement	1 Form A	2 Form C	2 Form C	2 Form C	2 Form C	2 Form C
Contact Rating	0.35A	5A @ 28 VDC or 115 VAC	2A @ 28 VDC 1A @ 120 VAC	10A @ 240 VAC	10A @ 30 VDC or 240 VAC	10A @ 240 VAC
Mode of Operation	Delay on operate	Delay on operate	Delay on operate	Recycle timer	Switch programmable: Delay on operate Delay on release Interval on	Delay on operate Delay on release Interval on
Delay Time	0.2 sec. to 100 sec.	0.1 sec. to 120 sec.	0.2 sec. to 100 sec.	0.1 sec. to 180 sec.	0.5 sec. to 100 min.	0.1 sec. to 100 min.
Type of Control	External resistor adjustable	Potentiometer adjustable	Potentiometer adjustable	Potentiometer adjustable	Four toggle switches and adjustable potentiometer	Fixed Potentiometer adjustable External resistor adjustable
Maximum Repeatability	±3%	±3%	±3%	±2%	(AC) ±0.5% (DC) ±0.1%	±2%
Maximum Delta Time	±10%	±10%	±10%	±10%	±5%	±10%
Tolerance	±25% plus the tolerance of the fixed external timing resistor	Min. specified or less @ min. setting +60%, −0 @ max. setting	Set to any range within specified range	Min. specified or less @ min. setting +20%, −0 @ max. setting	+0, −20% @ min. setting +10%, −0 @ max. setting	±10% (fixed only)
Temperature Range	−10°C to +55°C	−10°C to +55°C	−10°C to +55°C	−10°C to +55°C	−10°C to +55°C	−10°C to +55°C
Input Voltage	4.5-30 VDC	12-24 VDC	24-120 VAC	24 VDC 24-120 VAC	12-110 VDC 24-240 VAC	12-110 VDC 24-240 VAC
Mounting	PC board	Plug-in Panel mount Sockets available	Panel mount	Plug-in Sockets available	Plug-in Sockets available	Plug-in Sockets available

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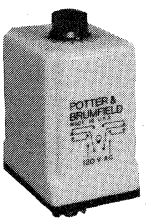
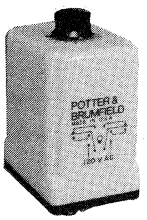
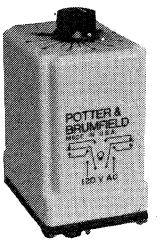
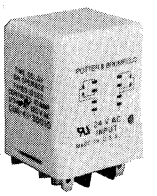
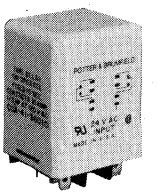
Time Delay Relays

						
Series	**CK**	**CH**	**CG**	**CD**	**CL**	**CU**
Features	• Broad line • Wide choice of functions • Extremely versatile • ᵁᴸ Ⓒᵁᴸ	• Wide range of industrial applications • Dependable timing cycles • ᵁᴸ Ⓒᵁᴸ	• Top of the line • Encapsulated electronics • Extended timing ranges • ᵁᴸ Ⓒᵁᴸ	• Encapsulated electronics • Ideal for many demanding applications • ᵁᴸ Ⓒᵁᴸ	• No timing cycle interrupt transfer • Quick-connect terminals • Two case styles • ᵁᴸ Ⓒᵁᴸ	• Contacts may transfer momentarily • Quick-connect terminals • Two case styles • ᵁᴸ Ⓒᵁᴸ
Approx. inch Dimensions (mm)	2.41 x 1.78 x 2.94h (61.1 x 45.2 x 74.6h)	2.41 x 1.78 x 2.94h (61.1 x 45.2 x 74.6h)	2.41 x 1.78 x 2.94h (61.1 x 45.2 x 74.6h)	2.41 x 1.78 x 2.94h (61.1 x 45.2 x 74.6h)	1.53 x 1.41 x 1.91h (38.9 x 35.7 x 48.4h)	1.53 x 1.41 x 1.91h (38.9 x 35.7 x 48.4h)
Contact Arrangement	2 Form C	2 Form C	2 Form C	2 Form C	2 Form C	2 Form C
Contact Rating	10A @ 240 VAC	10A @ 240 VAC	10A @ 240 VAC	10A @ 240 VAC	10A @ 28 VDC or 240 VAC	10A @ 28 VDC or 240 VAC
Mode of Operation	Delay on operate Delay on release Delay on dropout Interval on	Delay on operate Delay on release Interval on	Delay on operate Delay on release Interval on	Delay on operate Delay on release	Delay on operate	Delay on operate
Delay Time	0.1 sec. to 180 sec.	1 sec. to 180 sec.	0.5 sec. to 100 min.	0.1 sec. to 180 sec.	0.1 sec. to 120 sec.	1 sec. to 120 sec.
Type of Control	Fixed Potentiometer adjustable External resistor adjustable	Fixed Potentiometer adjustable	Potentiometer adjustable	Fixed Potentiometer adjustable External resistor adjustable	Fixed Potentiometer adjustable External resistor adjustable	Fixed Potentiometer adjustable External resistor adjustable
Maximum Repeatability	±2%	±2%	(AC) ±0.5% (DC) ±0.1%	±1%	±3%	±3%
Maximum Delta Time	±10%	±10%	±5%	±5%	–	–
Tolerance	±5% (fixed only)	±5% (fixed only)	+0, −10% @ min. setting +10%, −0 @ max. setting	±5% (fixed only)	±5% (fixed only)	±5% (fixed only)
Temperature Range	−10°C to +55°C	−10°C to +55°C	−10°C to +55°C	−40°C to +55°C	−10°C to +40°C	−10°C to +40°C
Input Voltage	12-24 VDC 24-120 VAC	24 VDC 24-240 VAC	24 VDC 120 VAC	24-48 VDC 24-120 VAC	24 VDC 24-120 VAC	24 VDC 24-120 VAC
Mounting	Plug-in Sockets available	Plug-in Sockets available	Plug-in Sockets available	Plug-in Sockets available	Plug-in Panel mount Sockets available	Plug-in Panel mount Sockets available

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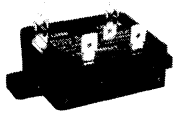
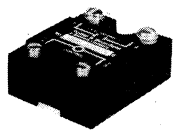
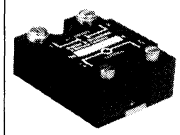
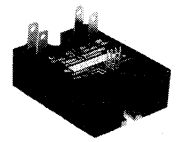
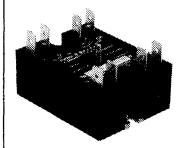
Solid State Relays

						
Series	**OZ16**	**EOTZ**	**SSR**	**SSRT**	**SSRD**	**SSRQ**
Features	• Relay in 16 pin IC package • DIP, auto insertable termination • High transient noise immunity • Current or voltage operation • Logic compatible • ᵁᴸ ⓒˢᴬ	• Low profile package • Economically priced • High transient noise immunity • Logic compatible • High inrush current capability • Internal dv/dt snubber • Zero voltage turn-on • ᵁᴸ ⓒˢᴬ	• "Hockey puck" package • Inverse parallel SCR output • AC & DC input • Ratings from 25 to 110 amps • ᵁᴸ ⓒˢᴬ	• "Hockey puck" package • Lost cost, triac output • AC & DC input • 25 & 50A ratings • ᵁᴸ ⓒˢᴬ	• Two independent units in one package • Inverse parallel SCR outputs • Ratings of 25 and 40 amps/output • ᵁᴸ ⓒˢᴬ	• Four independent units in one package • Triac outputs • Each output rated 20 amps • ᵁᴸ
Approx. Dimensions Inch (mm)	.77 x .30 x .17h (19.4 x 7.6 x 4.3h)	1.81 x 1.50 x .66h (46.0 x 38.1 x 16.8h)	(25 & 50A models) 1.75 x 2.25 x .8h (44.4 x 57.2 x 21h)	1.75 x 2.25 x .8h (44.4 x 57.2 x 21h)	1.75 x 2.25 x .8h (44.4 x 57.2 x 21h)	1.75 x 2.25 x .93h (44.4 x 57.2 x 23.6h)
Switch Arrangement	1 Form A	1 Form A	1 Form A	1 Form A	(2) × 1 Form A	(4) × 1 Form A
Coupling	Optical	Optical	Optical	Optical	Optical	Optical
Input	5 VDC 5mA DC 10mA DC	3-32 VDC	3-32 VDC 3.5-26 VDC 90-280 VAC	3-32 VDC 90-280 VAC	4-15 VDC	4-15 VDC
Output Switching	Zero	Zero	Zero & Random	Zero	Zero	Zero
Minimum Output Current	.005A	.020A	.050A	.050A	.050A	.050A
Maximum Output Current	1A	15A	110A	25A	40A	20A
Minimum Output Voltage	12V	24V	24V	24V	24V	24V
Maximum Output Voltage	280V	280V	280V	280V	280V	280V
Output Type	AC	AC	AC	AC	AC	AC
Terminals	Printed circuit	Quick connect	Screw	Screw	Quick connect	Quick connect
Mounting	PC board Plug-in	Panel mount	Panel mount	Panel mount	Panel mount	Panel mount

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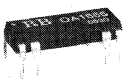
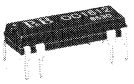
Solid State Input/Output Modules

						
Series	**IA8**	**IA16**	**OA16**	**OD16**	**IAC**	**OAC**
Features	• Mini-DIP, AC/DC input module • 8 pin IC-type package • Also function as DC output module • Auto insertable • High transient noise immunity • Exceeds FCC Part 68 surge test • MOSFET output • ᵁᴸ Ⓒᵁᴸ	• DIP AC/DC input module • 16 pin IC package • Auto insertable • High transient noise immunity • TTL compatible • Meets VDE spacing and voltage requirements • MOSFET output • ᵁᴸ Ⓒᵁᴸ	• DIP AC output module • 16 pin IC package • Auto insertable • Zero voltage turn-on • High transient noise immunity • TTL compatible • Meets VDE spacing and voltage requirements • ᵁᴸ Ⓒᵁᴸ Ⓒ	• DIP DC output module • 16 pin IC package • Auto insertable • High transient noise immunity • TTL compatible • Meets VDE spacing and voltage requirements • MOSFET output • ᵁᴸ Ⓒᵁᴸ	• AC input module • High transient noise immunity • Series operation compatible • ᵁᴸ Ⓒᵁᴸ Ⓒ	• AC output module • High transient noise immunity • Series operation compatible • Internal dv/dt snubber • ᵁᴸ Ⓒᵁᴸ Ⓒ
Approx. Inch Dimensions (mm)	.38 x .30 x .18h (9.5 x 7.6 x 4.5h)	.77 x .30 x .17h (19.4 x 7.6 x 4.3h)	.77 x .30 x .17h (19.4 x 7.6 x 4.3h)	.77 x .30 x .17h (19.4 x 7.6 x 4.3h)	1.70 x .60 x 1.28h (43.2 x 15.2 x 32.5h)	1.70 x .60 x 1.28h (43.2 x 15.2 x 32.5h)
Switch Arrangement	1 Form A (Sinking)	1 Form A (Sinking)	1 Form A	1 Form A	1 Form A (Sinking)	1 Form A 1 Form B
Coupling	Optical	Optical	Optical	Optical	Optical	Optical
Input	2.5mA AC/DC 5mA AC/DC	2.5mA AC/DC 5mA AC/DC	5 VDC 5mA DC 10mA DC	5 VDC 5mA DC 10mA DC	10-36 VAC/VDC 90-140 VAC/VDC 180-280 VAC/VDC	5 VDC 15 VDC 25 VDC
Output Switching	Random	Random	Zero	Random	Random	Zero
Minimum Output Current	>0	>0	.005A	>0	.0001A	.020A
Maximum Output Current	.200A	.200A	1A	1A	.100A	3A
Minimum Output Voltage	>0	>0	12V	>0	.400V	24V
Maximum Output Voltage	60V	30V	280V	60V	30V	280V
Output Type	DC	DC	AC	DC	DC	AC
Terminals	Printed circuit	Printed circuit	Printed circuit	Printed circuit	Printed circuit	Printed circuit
Mounting	PC board Plug-in	PC board Plug-in	PC board Plug-in	PC board Plug-in	Mounting board	Mounting board

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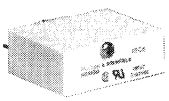
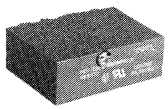
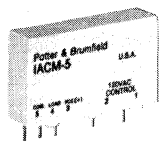
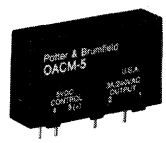
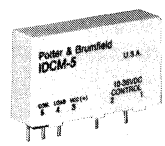
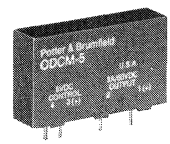
Solid State Input/Output Modules

					
IDC	**ODC**	**IACM**	**OACM**	**IDCM**	**ODCM**
• DC input module • High transient noise immunity • Series operation compatible • ᖰᒪ Ⓒ	• DC output module • High transient noise immunity • Series operation compatible • ᖰᒪ Ⓒ	• Slim line AC intput module • Only .4" (10.2mm) thick package • Series operation compatible • High transient noise immunity • ᖰᒪ Ⓒ	• Slim line AC output module • Only .4" (10.2mm) thick package • Zero voltage turn-on • Series operation compatible • High transient noise immunity • ᖰᒪ Ⓒ	• Slim line DC input module • Only .4" (10.2mm) thick package • Series operation compatible • High transient noise immunity • ᖰᒪ Ⓒ	• Slim line DC output module • Only .4" (10.2mm) thick package • Series operation compatible • High transient noise immunity • ᖰᒪ Ⓒ
1.70 x .60 x 1.28h (43.2 x 15.2 x 32.5h)	1.70 x .60 x 1.28h (43.2 x 15.2 x 32.5h)	1.7 x .4 x 1.0h (43.2 x 10.2 x 25.4h)	1.7 x .4 x 1.0h (43.2 x 10.2 x 25.4h)	1.7 x .4 x 1.0h (43.2 x 10.2 x 25.4h)	1.7 x .4 x 1.0h (43.2 x 10.2 x 25.4h)
1 Form A (Sinking)	1 Form A	1 Form A (Sinking)	1 Form A	1 Form A (Sinking)	1 Form A
Optical	Optical	Optical	Optical	Optical	Optical
3-32 VDC 4-16 VDC 10-36 VDC	5 VDC 15 VDC 24 VDC	90-140 VAC/VDC 180-280 VAC/VDC	5 VDC 3-15 VDC	± 10-36 VDC	5 VDC
Random	Random	Random	Zero	Random	Random
.0001A	.020A	>0	.020A	>0	.020A
.100A	3A @ 60 VDC 1A @ 200 VDC	.100A	3A	.100A	3A
.400V	5V; 10V	>0	12V	>0	5V
30V	60V; 200V	30V	280V	30V	60V
DC	DC	DC	AC	DC	DC
Printed circuit	Printed circuit	Printed circuit	Printed circuit	Printed circuit	Printed circuit
Mounting board	Mounting board	PC board Plug-in	PC board Plug-in	PC board Plug-in	PC board Plug-in

Call toll-free 800-255-2550 for the name and telephone number of your nearby P&B sales representative or authorized stocking distributor.

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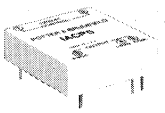
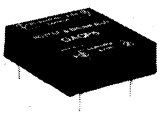
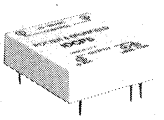
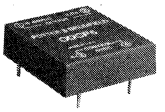
Solid State Input/Output Modules

				
Series	**IACP**	**OACP**	**IDCP**	**ODCP**
Features	• Flat pack AC input module • Permits .500" (12.70mm) PC board spacing • Series operation compatible • High transient noise immunity • Competitive footprint •	• Flat pack AC output module • Permits .500" (12.70mm) PC board spacing • Series operation compatible • Zero voltage turn-on • High transient noise immunity • Competitive footprint •	• Flat pack DC input module • Permits .500" (12.70mm) PC board spacing • Series operation compatible • High transient noise immunity • Competitive footprint •	• Flat pack DC output module • Permits .500" (12.70mm) PC board spacing • Series operation compatible • High transient noise immunity • Competitive footprint •
Approx. Dimensions **Inch (mm)**	1.41 x 1.51 x .43h (35.8 x 38.4 x 10.8h)	1.41 x 1.51 x .43h (35.8 x 38.4 x 10.8h)	1.41 x 1.51 x .43h (35.8 x 38.4 x 10.8h)	1.41 x 1.51 x .43h (35.8 x 38.4 x 10.8h)
Switch Arrangement	1 Form A (Sinking)	1 Form A	1 Form A (Sinking)	1 Form A
Coupling	Optical	Optical	Optical	Optical
Input	10-36 VAC/VDC 90-140 VAC/VDC 180-280 VAC/VDC	5 VDC	10-36 VDC 18-60 VDC	5 VDC
Output Switching	Random	Zero	Random	Random
Minimum Output Current	>0	.020A	>0	.020A
Maximum Output Current	.100A	3A	.100A	3A @ 60 VDC 1A @ 200 VDC
Minimum Output Voltage	>0	12V	>0	5V; 10V
Maximum Output Voltage	30V	280V	30V	60V; 200V
Output Type	DC	AC	DC	DC
Terminals	Printed circuit	Printed circuit	Printed circuit	Printed circuit
Mounting	PC board Plug-in	PC board Plug-in	PC board Plug-in	PC board Plug-in

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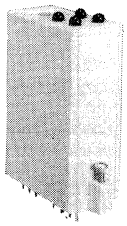
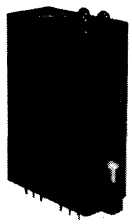
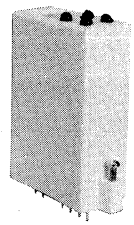
Solid State Input/Output Modules

			
IACQ	**OACQ**	**IDCQ**	**ODCQ**
• Quad AC input module • Four I/O channels in one package • Series operation compatible • High transient noise immunity •	• Quad AC output module • Four I/O channels in one package • Series operation compatible • Internal dv/dt snubber • High transient noise immunity •	• Quad DC input module • Four I/O channels in one package • Series operation compatible • High transient noise immunity •	• Quad DC output module • Four I/O channels in one package • Series operation compatible • High transient noise immunity •
1.87 x 1.06 x 2.88h (47.5 x 26.9 x 73.2h)	1.87 x 1.06 x 2.88h (47.5 x 26.9 x 73.2h)	1.87 x 1.06 x 2.88h (47.5 x 26.9 x 73.2h)	1.87 x 1.06 x 2.88h (47.5 x 26.9 x 73.2h)
(4) x 1 Form A (Sinking)	(4) x 1 Form A	(4) x 1 Form A (Sinking)	(4) x 1 Form A
Optical	Optical	Optical	Optical
10-36 VAC/VDC 90-140 VAC/VDC 180-280 VAC/VDC	5 VDC	4-16 VDC 10-36 VDC	5 VDC
Random	Zero	Random	Random
.0001A	.020A	.0001A	.020A
.100A	3A	.100A	3A @ 60 VDC 1A @ 200 VDC
.400V	12V	.400V	5V; 10V
30V	280V	30V	60V; 200V
DC	AC	DC	DC
Printed circuit	Printed circuit	Printed circuit	Printed circuit
Mounting board	Mounting board	Mounting board	Mounting board

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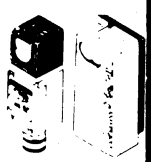
PHOTOELECTRICS

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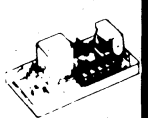
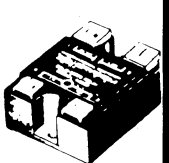

LIQUID LEVEL CONTROLS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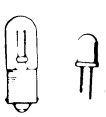
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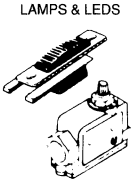
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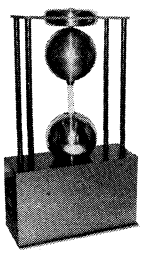

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Extra high voltage low corona, Polarity reversing, transfer or grounding relays of the air insulated type. Ratings 70 to 600 KV peak at 100 Amps continuous. Solenoid, motor or air cylinder operated and spring or gravity return. Available in SPST, SPDT, 2PDT.

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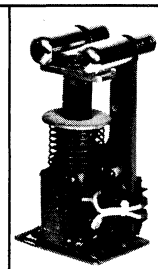
Models are available up to 20,000 amps continuous, and over 500,000 amps pluse, with voltage ratings of 6 volts to 300 KV peak test. Many are air cylinder or motor operated for high contact force.



HV RELAYS

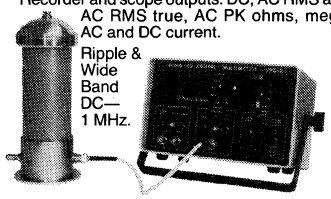
HV relays of the air insulated type both for low and high current. This series has ratings from 1 to 200 amps continuous, 100 to 100,000 amps momentary and capacitor discharge. Peak test voltages from 5 to 300 KV. Single or Multipole. NO, NC, and DT. Auxiliary contacts optional on all types. Extended life and tungsten contacts also available for high current closing. Also usable in oil or insulating gas.

HV ROTARY SWITCHES

Ratings from 5 to 150KV, 1 to 200 amps. Either manual or electrical operators, depending upon requirements. Position detents and interlocks to prevent opening under load.

HV DIGITAL MULTIMETERS

Easy to read, 4½-digit display; 0.05% basic accuracy. 0.0001 volt to 900 KV. Battery/AC with charger. Recorder and scope outputs. DC, AC RMS average, AC RMS true, AC PK ohms, megohms, AC and DC current.



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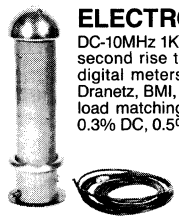
DC-10MHz 1KV-900KV PK to 20 nanosecond rise time, for oscilloscopes, digital meters or recorders such as Dranetz, BMI, Le Croy, etc. Ratios and load matching as required 0.01% to 0.3% DC, 0.5% to 3% wide band.



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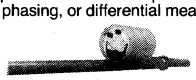
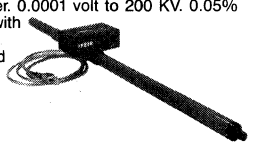


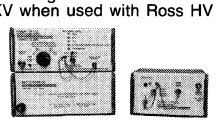
HV DIGITAL PROBES

HV DC, AC & Wideband DC-1 MHz Safety Probes for any scope or digital display or VTVM. Also available complete with large 4½-digit display 0.1% to 5% AC/DC Accuracy, safety handle digital voltmeter. Battery/AC with charger. Removable Digital Display or Multimeter. 0.0001 volt to 200 KV. 0.05% accuracy basic, with DCV, ACV, ohms, megohms, AC and DC current, PK hold.



WIDE BAND FIBER OPTIC TRANSMISSION, ANALOG DC-10 MHz SYSTEMS

AC or rechargeable battery/AC operated. DC-10MHz. System has a maximum output of 10V PK (20V PK to PK) and selectable input of 0.1V to 1,000V PK direct from signal source. Useful from 0.01V to over 900KV when used with Ross HV wideband dividers.

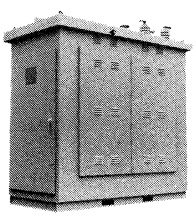


SINGLE POLE HIGH SPEED VACUUM CONTACTORS & ENERGY STORAGE DRIVERS

One Millisecond Contact Opening

For high speed or loss of power automatic circuit breaker trip and for high speed activation of contactor or circuit breaker solenoids. Energy storage up to 400 joules or more at 150 to 700 volts or more, 100 to 4,000 microfarad or more. Instantaneous SCR control available.

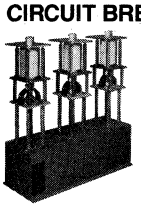
HIGH POWER



HIGH SPEED HIGH VOLTAGE CONTROL AND STEP-START SYSTEMS

½ to 1 cycle sensing and interrupt vacuum circuit breakers. Metal enclosed for indoor or outdoor applications. 5KV-38KV. 50-1200 Amps.

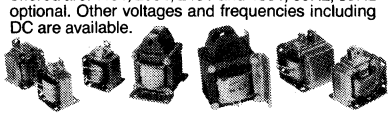
3 PHASE POWER CLASS VACUUM CONTACTORS & 1 CYCLE CIRCUIT BREAKERS



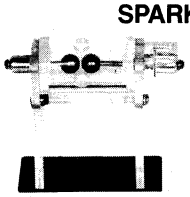
Vacuum switches, single phase, three phase, upright or low profile, for high reliability sealed arc interrupting or crobar shorting. 208V to 200 KV RMS operate. 50 to 4,000 amps continuous, 2,000 to 35,000 amps AC, 10 to 20,000 amps DC interrupt, 5,000 to 100,000 amps momentary and capacitor discharge.

QUIET AC PRECISION SOLENOIDS

To 36 lbs. continuous hold and to 126 lbs. intermittent. Class H coils with 180°C insulation. 1" stroke, or, with special stainless steel guides, extendable to several inches. Corrosion resistant. Coil voltages offered are: 115V, 208V, 240V and 480V, 60Hz, 50Hz optional. Other voltages and frequencies including DC are available.

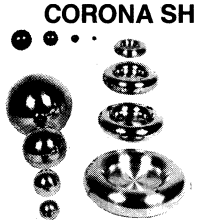


HV ADJUSTABLE SPARK GAPS



Non-melting carbon spheres, 1 cm to 10 cm and heavy wall aluminum spheres, 10 cm and above. Dust tight transparent covers used 1 KV to 88 KV. Open style to 670 KV. Direct reading micrometer type calibrating device.

TOROIDS, SPHERES, CORONA SHIELDS, NUTS



Geometrically designed to avoid excessive voltage gradients at connecting points and other areas needing shielding or balancing of electrostatic fields to increase withstand voltage and minimize corona. Diameters are to international standard metric sizes.

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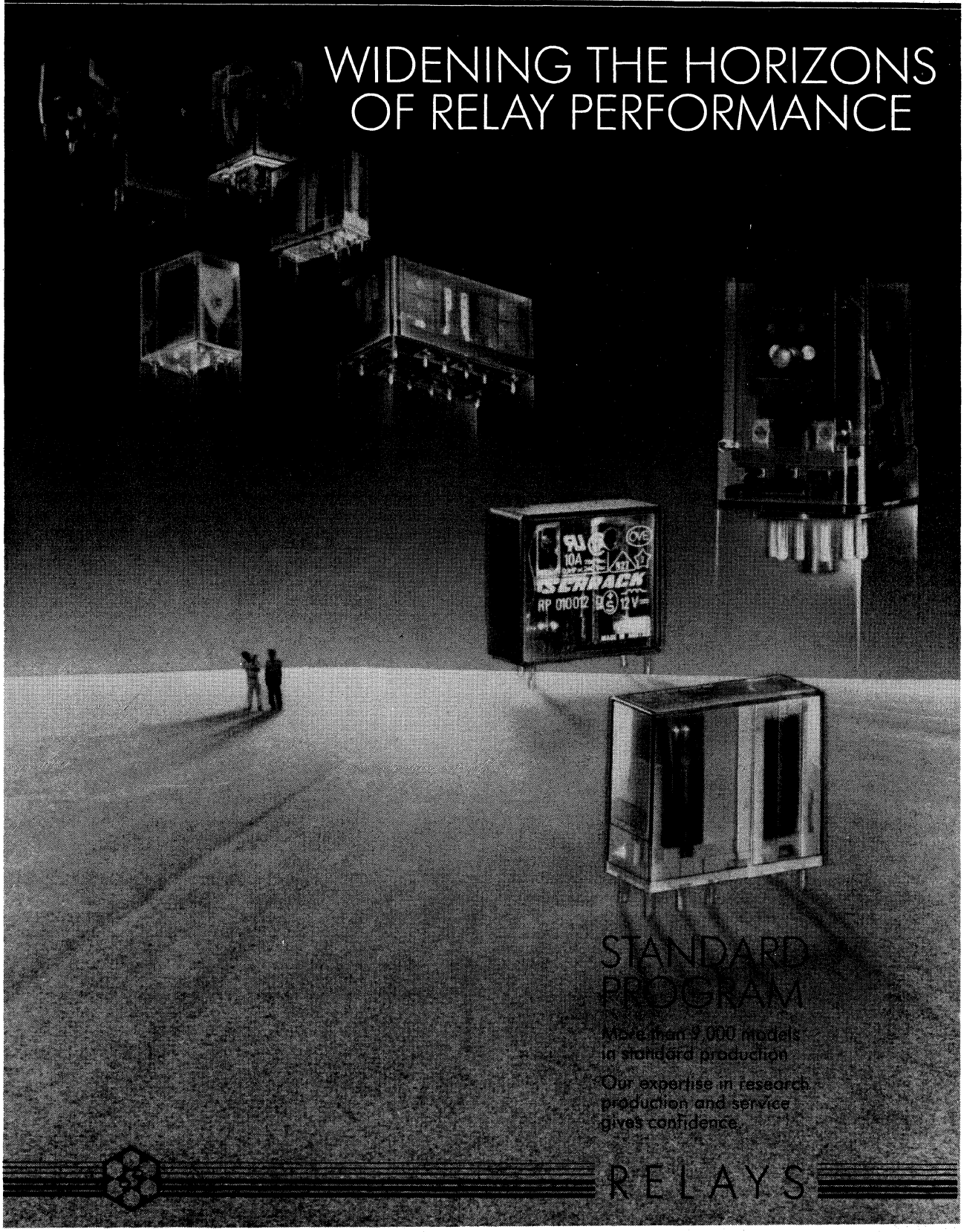
WIDENING THE HORIZONS OF RELAY PERFORMANCE



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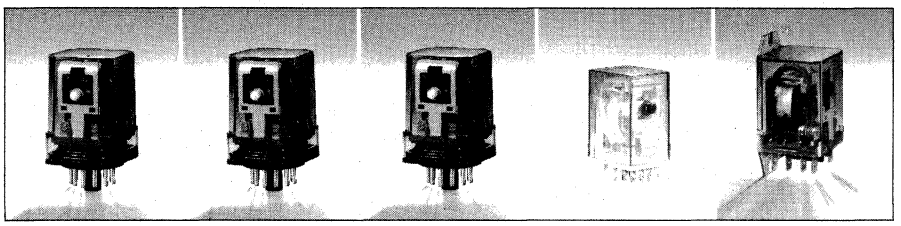

TYPE OF RELAY		CAD (5 A)	CAD (10 A)	CRD (5 A)	CRD (10 A)	CMD / CSD	RA		RM 1, 2, 7, (3)
CONTACTS:									
NUMBER	2	1, 2, 3		2, 3		1, 2, 3	2/4	3	1, 2, 3
CONFIGURATION		Form C (DT)		Form C (DT)		Form C (DT)	Form C (DT)		Form C (DT)
VOLTAGE RATING	V AC	250		250		250	250	250	380
RATED CURRENT (CONT.)	A	5	10	5	10	2	3	5	16 (10)
MAKE CURRENT (MAX.)	A	10	20	10	20	10	6	10	40
RATED BREAKING CAPACITY	VA	1250	2500	1250	2500	500	350	1250	6000 (3800)
MATEREIAL		AgCu	AgCd0+AgCu	AgCu	AgCd0+AgCu	Ag (gold flashed)	Ag (gold fl)	AgCd0	AgCd0
COIL:									
RATED VOLT. (DC RANGE) (VN)	V DC	6...220		12....110		5....100	6...220		6...220
RATED VOLT. (AC RANGE) (VN)	V AC	6...240		24...220		5...200	6...240		6...380
POWER CONS. AT RAT. VOLT. (DC)	APPR. W.	1.2		2.6		0.04...0.3	0.9		1.2....1.6
POWER CONS. AT RAT. VOLT. (AC)	APPR. VA	2		5.3		0.2	1.65		2....2.8
OPERATING RANGE	AT 25°C	DC: 0.75....1.1 VN AC: 0.8 ...1.1 VN		DC: 0.75....1.1 VN AC: 0.8 ...1.1 VN		SEE FULL DETAIL CAT.	DC: 0.75....1.1 VN AC: 0.8 ...1.1 VN		DC: 0,75....1,1 VN AC: 0.8 ...1.1 VN
DROP-OUT VOLTAGE	AT 25°C	DC: ≥ 0.1 VN AC: ≥ 0.4 VN		SEE FULL DETAIL CAT.		≥ 0.1 Vmin.	DC: ≥ 0.05 VN AC: ≥ 0.4 VN		DC: ≥ 0.15 VN AC: ≥ 0.4 VN
GENERAL DATA:									
MECHANICAL LIFE	OP. CYCL.	≥ 20 x 10^6		≥ 20 x 10^6		≥ 20 x 10^6	≥ 100 x 10^6		≥ 20 x 10^6
MAX. OPERATING RATE MECHANICAL FULL LOAD	OP. CYCL./H OP. CYCL./H	6000 1000		6000 1000		6000 1000	6000 1000		6000 1000
OPERATE (PICK-UP) TIME	APPR. MS	10		IMPULS 30 / 5		10....30	10		15
DROP-OUT TIME	APPR. MS	8		IMPULS 10/6		8....25	8		10
BOUNCET TIME	APPR. MS	3		4		4	2		3
AMBIENT TEMPERATURE RANGE	°C	-40...+60	-45...+50	-40...+60	-45...+50	-45...+60	DC -45..+70 AC -45..+60	-45..+55 -45..-45	DC: -45...+70 (+60) AC: -45...+55 (-45)
DIELECTR. STRENGTH (TEST V. AT 50 HZ)	VEFF	2500		2500		2500	2500/2000	2500	2500
INSULATION RESISTANCE	MΩ	≥ 1500		≥ 1500		≥ 1500	≥ 1500		w 1500
VDE 0110 VOLT. RATING GROUP		C 250		C 250		C 250	B 125/B 60	C 250	C 380
SOLDER BATH TEMPERATURE	MAX. °C	-		-		-	-		-
SOLDER DURATION	MAX., SEC.	-		-		-	-		-
STANDARD PACKAGE UNIT	PIECES	5		5		5	5		5
MODIFICATIONS AVAILABLE		OPEN RELAY - CA, TWIN CONTACTS, NEON/LED INDICATOR		-		-	TWIN CONTACTS, MAGNETIC LATCHING, NEON/LED INDICATOR		NEON/LED INDICATOR

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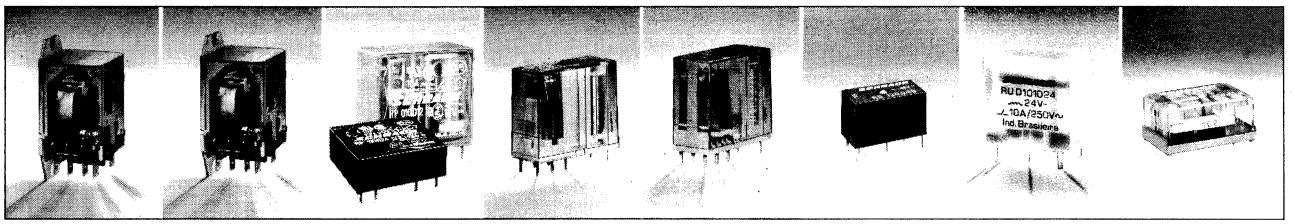

RM 4,5,(6)	RM 8	RP 010/110	RP 310/410/411	RP 420	RS	RU. 101	RU 110
1, 2, 3	2	1	1	2	2	1	1
Form A (NO)	Form C (DT)	Form C (DT), A (NO), B (NC)	Form C (DT), A (NO), B (NC)	Form C (DT), A (NO), B (NC)	Form C (DT)	Form C (DT); A (NO)	Form C (DT)
380	380	250	250	250	125	120 / 250	250
16 (10)	25	10	16 / 12 / 10	10	1.25	15 / 10	6
40	60	16	25 / 20 / 16	10		20 / 15	10
6000 (3800)	6000	2000	4000 / 3000 / 2000	2000	60	1800 / 2200	1320
AgCdO	AgCdO	AgCdO, Ag (gold flashed)	AgCdO, Ag (gold flashed)	AgCdO, Ag (gold flashed)	AgPd (Gold pl.)	AgNi	AgCdO
6 ... 220	6 ... 220	5 ... 110	5 ... 110	5 ... 110	5 ... 48	3 ... 110	5 ... 110
6 ... 380	6 ... 380	-	-	-	-	6 ... 220	-
1.6	1.2	0.5	0.5	0.5	0.55	0.5	0.8
2.8	2.8	-	-	-	-	1.6	-
DC: 0.75 ... 1.1 VN AC: 0.8 ... 1.1 VN	DC: 0.75 ... 1.1 VN AC: 0.8 ... 1.1 VN	0.75 ... 1.8 VN	0.75 ... 1.85 VN	0.75 ... 1.9 VN	0.75 ... 1.55 VN	DC: 0.75 ... 1.3 VN AC: 0.8 ... 1.15 VN	0.75 ... 1.2 VN
DC: ≥ 0.15 VN AC: ≥0.4 VN	DC: ≥ 0.15 VN AC: ≥0.4 VN	≥ 0.15 VN	≥ 0.15 VN	≥ 0.15 VN	≥ 0.05 VN	DC: ≥ 0.1 VN AC: ≥ 0.4 VN	≥ 0.15 VN
$\geq 20 \times 10^{16}$	$\geq 10 \times 10^{6}$	$\geq 20 \times 10^{6}$	$\geq 20 \times 10^{6}$	$\geq 20 \times 10^{6}$	$\geq 20 \times 10^{6}$	$\geq 10 \times 10^{6}$	$\geq 10 \times 10^{6}$
6000 1000	6000 1000	72000 3000	72000 / 72000 1200 / 1800	72000 3000	72000 10800	144000 1000	36000 3600
15	15	7	9	8	6	≤ 15	8
10	15	3	3	3	3	≤ 10	3
4	3	2	2	2	1	≤ 5	1
DC: -45 ... +70 (+60) AC: -45 ... +55 (+45)	DC: -45 ... +65 AC: -45 ... +60	-40 ... +70	-40 ... +70	-40 ... +70	-25 ... +75	-45 ... +70	-40 ... +55
2500	2500	2500	4000	4000	1000	1500	2000
≥ 1500	≥ 1500	≥ 10000	≥1000000	≥ 1000000	≥1000000	≥ 1500	≥ 10000
C 380	C 250	stand. B 250, sealed C 250	C 250	C 250	Ao 125	B 250	B 250
-	-	260	260	260	250	260	260
-	-	5	5	5	3	5	5
5	5	25	25	25	25		25
NEON/LED INDICATOR	FORM A CONTACT NEON/LED INDICATOR	SEALED RELAY, TWIN CONTACTS, MAGNETIC LATCHING	SEALED RELAY, MAGNETIC LATCHING	SEALED RELAY, TWIN CON-TACTS MAGNETIC LATCHING	SENSITIVE RELAY, MAGNETIC LATCHING TWIN CONTACTS	SENSITIVE RELAY, SEALED RELAY FORM A CONTACT	-

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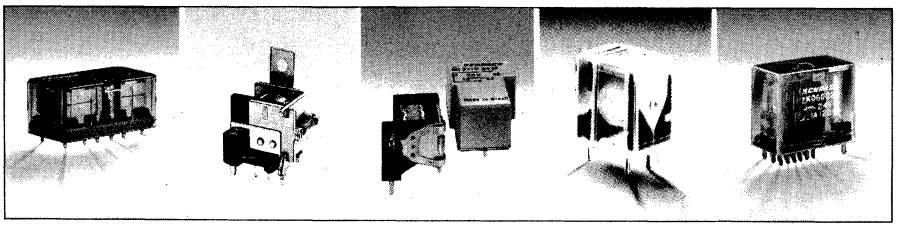

RX 2, 3 (0,1)	ZC	ZD	ZF	ZKU/ZLU		TYPE OF RELAY
						CONTACTS:
4 (2) / 8 (4)	1	1	1	2, 4, 6		NUMBER
2A + 2B (2C) / 4 A + 4 B (4C)	NO / DT (NO/NC) / NO NC	NO / DT / NC / DT	Form C (DT), A (NO), B (NC)	Form C (DT)		CONFIGURATION
250	120	250	250	115 / 220	V AC	VOLTAGE RATING
16 / 10	40 / 20/12 / 12	30/10 / 20 / 15/5 / 5	10	2 / 5	A	RATED CURRENT (CONT.)
70 / 50	50 / 30/15 / 15	40/45 / 25 / 20/10 / 10	15	3 / 7.5	A	MAKE CURRENT (MAX.)
4000 / 2500	2400 / 1200/720 / 720	7500/2500 / 5000 / 3750/1250 / 1250	1200	50 / 500	VA	RATED BREAKING CAPACITY
AgCdO (AgSnO)	AgNi	AgNi, AgCdO, Ag (gold fl.)	AgNi, AgSnO, Ag (gold fl.), AgCdO	Ag (gold fl.), AgCdO		MATERIAL
						COIL:
3 ... 60 (48)	3 ... 110	5 ... 110	3 60	6 ... 110	V DC	RATED VOLT. (DC RANGE) (VN)
-	-	-	-	-	V AC	RATED VOLT. (AC RANGE) (VN)
0.3	1.3	1.1	0.5	0.3 ... 1.2	W	POWER CONS. AT RAT. VOLT. (DC)
-	-	-	-	-	VA	POWER CONS. AT RAT. VOLT. (AC)
0.7 ... 2.65 VN	0.75 ... 1.3 VN	0.75 ... 1.25 VN	0.75 ... 1.3 VN	0.75 ... 1.3 VN	AT 25°C	OPERATING RANGE
0.1 VN	≥ 0.1 VN	≥ 0.1 VN	≥ 0.1 VN	≥ 0.05	AT 25°C	DROP-OUT VOLTAGE
						GENERAL DATA:
≥ 50×10^6	≥ 10×10^6	≥ 10×10^6	≥ 10×10^6	≥ 100×10^6	OP. CYCL.	MECHANICAL LIFE
6000 1000	72000 1000	72000 1200	72000 1000	72000 3600	OP. CYCL./H OP. CYCL./H	MAX. OPERATING RATE MECHANICAL FULL LOAD
20 / 22	≤ 10	9	≤ 15	≤ 15	APPR. MS	OPERATE (PICK-UP) TIME
13	≤ 10	7	≤ 10	≤ 10	APPR. MS	DROP-OUT TIME
1	4	4	≤ 4	≤ 6	APPR. MS	BOUNCE TIME
-50 ... +60	-45 ... +60/90	-55 ... +85/105	-40 ... +80	-40 ... +75	°C	AMBIENT TEMPERATURE RANGE
3000	750	2000	2000	500 / 1000	VEFF	DIELECTR. STRENGTH (TEST V. AT 50 HZ)
≥ 1000	≥ 1000	≥ 10000	≥ 100	≥ 1000	MΩ	INSULATION RESISTANCE
C 250 (B 125)	A 125/B 60	C 250	C 250	B 125 / B 250		VDE 0110 VOLT. RATING GROUP
260	260	260	260	260	MAX. °C	SOLDER BATH TEMPERATURE
5	5	5	5	5	MAX. SEC.	SOLDER DURATION
	25 (100)	25	25 (100)	100	PIECES	STANDARD PACKAGE UNIT
BISTABLE RELAY SEALED RELAY	BUZZER RELAY	SEALED RELAY DUST COVER SPADE TERMINALS	SENSITIVE RELAY SEALED RELAY	SENSITIVE RELAY, AC RELAY (DIODE RECTIFIED)		MODIFICATIONS AVAILABLE

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SCHRACK RELAYS CROSS REFERENCE CHART

SCHRACK	CA	CAD	CMD/CSD	RA	RM	RM 8	RP 010/110	RP 310	RP 410	RP 420	RS	RU 101	RX	ZC	ZD	ZF	ZK/ZL
AA		AAEA/D 1-2-300			AAEKUP 11/14												
AIRPAX												281-313AE					
ALLIED		TMDO		GY-400													T154/ T163
AMER. ZETTLER	AZ 482 AZ 483	AZ 480, 481 TEC1210		AZ1309 TEC1300 1400			AZ693 AZ694	AZ735	AZ735L	AZ 731 AZ 732	AZ 802 AZ 820 AZ 830	AZ 3				AZ 4	AZ 420
AROMAT				HC	HP					JR2	DS		SP				K
BOSCH														0332			
CLARE	GP3R2			GP1R-11, 12	GP3R2												VP
C-D		301, 2, 3, 11, 12, 23		A104/ A114	200							603 623/662					
DELTROL	203	20,000	201	280/290	206												250
EAGLE/BLISS		22/25															
ESSEX/RBM		93 P			93 Q							MS 64					
FUJITSU		FRL 256		FRL 263/ 264	FRL 250					FBR 621	FBR 244					FBR 111	
GLOBE		2WC															
GRANGER	5X814-821	3X7-5X7			5X834-5X842												
GUARDIAN		1200/1410	1215	1300	1510/1515						1495	1345				1575	1555
HART		GHP															67DP
IDEC		RR2P/ RR3P		RY4	RR1B-2B-3B		RG				RD	RE				RCN	
ITT (Takamisawa)		RM80		2Z/4ZS	ITT-2,4					VB	RA, RY, RZ						24, 25, 26
KURMAN		PAP															
LINE	HP-31	MK/MD	MKF/MKC	SRJ/SRE	CRH					OM1	OMF					SR	
MAGNECRAFT	WX88	WX88	W88CPX	W78	W388	389	65			76							W 67
MIDTEX	155	155		156/158	157	187					190						
NEC											MR62					MR31	
OHMITE		GPRTPX															
OMRON	MK	MK		MY4	MJ		G2L113P			G2R-212PV	G2V				G8P	LC1	MHS
PHILIPS/ADVANCE		GHB/GHP		39	12												GP
PHILIPS NA		13			12							28				27	
P & B	KA	KAP/KRP/ KRPA	KC/KCP	KHP/KHU KHC/KHX	KUP/ KUMP	KUHP		RK5W	RK5X	RK11-Z	T82				T90	T71	R10
SIEMENS		V23100-V9		V23100-V7			V23027	V23056	V23056	V23037	D2			V23033			V23154
SIGMA	50F	5ORO	5ORO SENS.	67R	68R	45						49 RE					62R/70R
S-D	A 283	4214/314		B/C 281	A283					277							

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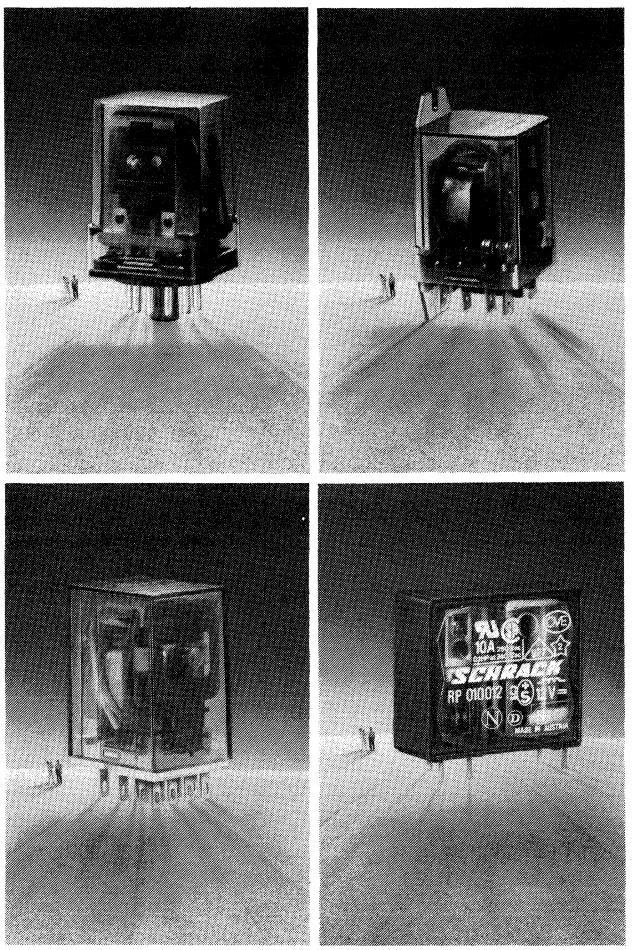

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But equally important, when you select a Schrack Relay, you get advantages not found in conventional models. For example, the visual indicator is purely mechanical and does not incorporate any live components that can burn out or fail. It always shows the "real" state (open or closed) of the relay, which may not be the case with a lamp or LED. A lamp or LED only indicates that there is potential at the coil; in fact, the coil may be open or the contacts welded, and a lamp or LED may still light, causing erroneous indication. The visual on/off indicator locates such faults immediately without having to check individual relays and without having to apply an external voltage to the relay coils. A built-in orange flag moves with the relay armature and is seen through a window in the frosted top face of the dust cover. One glance is sufficient to tell you if the relay is working as well as the position of the contacts.

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Schrack Relays are recognized and/or certified by testing laboratories around the world.

Underwriters Laboratories

Canadian Standards Association

927 VDE Production monitoring

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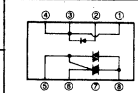
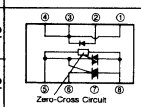
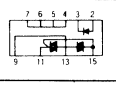
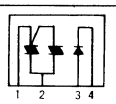
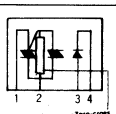
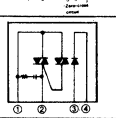
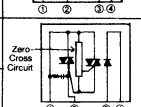
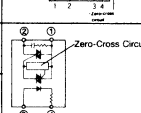
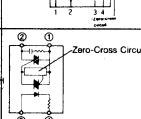
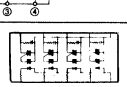
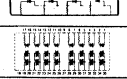
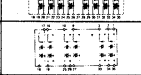
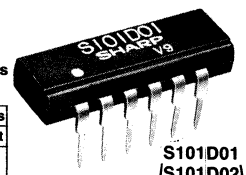
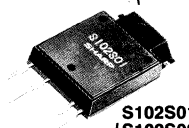
Model No.	Internal connection diagram	Features	Zero cross circuit	Package	Approved by overseas safety standard		Absolute maximum ratings			Electrical characteristics		
							On-state current I_T (Ams)	Repetitive peak off-state voltage V_{DRM} (V)	Isolation voltage (AC) Viso (Vrms)	Minimum trigger current I_{FT} (mA) MAX.	V_D (V)	R_L (Ω)
					UL	CSA						
S16MD01		compact, high current output type		DIP 8-pin			.6	400	5,000	10	6	100
S26MD01		compact, high current output type		DIP 8-pin			.6	600	5,000	10	6	100
S16MD02		compact, high current output type	X	DIP 8-pin			.6	400	5,000	10	6	100
S26MD02		compact, high current output type	X	DIP 8-pin			.6	600	5,000	10	6	100
S101D01		low-priced					0.6	400	2,500	10	6	—
S201D01		low-priced					0.6	400	2,500	10	6	—
S101D02		low-priced		DIP 16-pin			0.6	600	4,000	10	6	—
S201D02		low-priced		DIP 16-pin			0.6	600	4,000	10	6	—
S101S01		compact low-priced, high rush current resistant type			○	○	1,5	400	4,000	15	6	30
S201S01		compact low-priced, high rush current resistant type					1,5	600	4,000	15	6	30
S101S02		compact low-priced, high rush current resistant type (built-in zero-cross circuit)		SIP 4-pin	○	○	1,5	400	4,000	15	6	30
S201S02		compact low-priced, high rush current resistant type (built-in zero-cross circuit)		SIP 4-pin			1,5	600	4,000	15	6	30
S102S01		compact low cost type		SIP 4-pin	○	○	8	400	4000	8	12	30
S202S01		compact low cost type		SIP 4-pin	○	○	8	600	4000	8	12	30
S102S02		compact, low cost type	X	SIP 4-pin	○	○	8	400	4,000	8	6	30
S202S02		compact, low cost type	X	SIP 4-pin	○	○	8	600	4,000	8	6	30
S102S11		compact low cost type with snubber circuit		SIP 4-pin			8	400	4,000	8	12	30
S202S11		compact low cost type with snubber circuit		SIP 4-pin			8	600	4,000	8	12	30
S102S12		compact low cost type with snubber circuit	X	SIP 4-pin			8	400	4,000	8	6	30
S202S12		compact low cost type with snubber circuit	X	SIP 4-pin			8	600	4,000	8	6	30
S112S01		compact, low-cost		SIP 4-pin			12	400	4,000	8	12	30
S212S01		compact, low-cost		SIP 4-pin			12	600	4,000	8	12	30
S112S02		compact, low-cost	X	SIP 4-pin			12	400	4,000	8	6	30
S212S02		compact, low-cost	X	SIP 4-pin			12	600	4,000	8	6	30
S112P11		Compact	X	Resin mold type with radiation fin (I_{ch})			12	400	2,000	—	—	—
S212P11		Compact	X	Resin mold type with radiation fin (I_{ch})			12	600	4,000	—	—	—
S116S01		compact, low cost		SIP 4-pin			16	400	4,000	8	12	30
S216S01		compact, low cost		SIP 4-pin			16	600	4,000	8	12	30
S116S02		compact, low cost	X	DIP 4-pin			16	400	4,000	8	6	30
S216S02		compact, low cost	X	DIP 4-pin			16	600	4,000	8	6	30
S116P11		compact	X	Resin mold type with radiation fin (I_{ch})			16	400	2,000	—	—	—
S216P11		compact	X	Resin mold type with radiation fin (I_{ch})			16	400	4,000	—	—	—
S116P41		4-output (built-in snubber circuit)		Resin mold type with radiation fin (4-ch)			16,5 3,3	400	1,500	10	6	30
S216P41		4-output (built-in snubber circuit)					16,3 3,3	600	4,000	15	6	30
S202D81		2A control (8 channels)		Resin mold type with radiation fin (8-ch)			2	600	2,500	—	—	—
S201DX1		1A control (16 channels)		Resin mold type with radiation fin (16-ch)			1	600	2,500	—	—	—

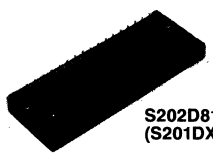


S101D01
(S101D02, S201D01, S201D02)



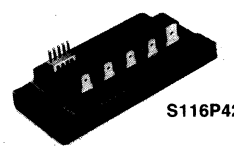
S102S01
(S102S02, S112S01 ~ 2, S116S01 ~ 2)

S102DS2
(S202PS2, S202DS4)



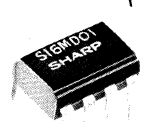
S202D81
(S201DX1)

S116P21
(S216P21)



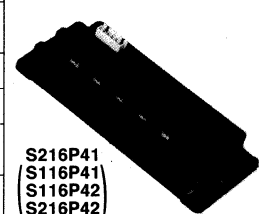
S116P42

S101S01
(S101S02 ~ 4, S201S01 ~ 4)



S16MD01
(S16MD02, S26MD01 ~ 2)

S112P11
(S116P11, S212P11, S216P11)



S216P41
(S116P41, S116P42, S216P42)

*1 Tc ≤ 95°C *2 Lead forming type is also available.

SHARP ELECTRONICS CORP., Micro Electronics Div., Sharp Plaza, Mahwah, NJ 07430-2135•201/529-8757 • Telex: 426903 (SHARPAM MAWA) • Fax: 201/529-8759

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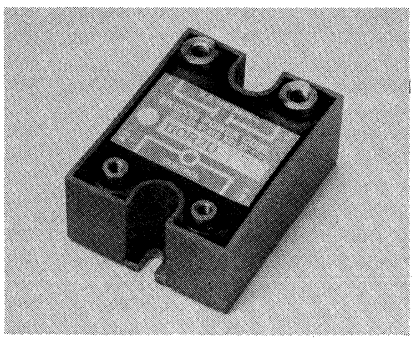
SOLID STATE AC POWER RELAYS

UL Recognized/CSA Certified



FEATURES:

- SPC's Inverse-Parallel SCR Power Hybrid Technology provides highly efficient thermal management for greatly increased cyclic life.
- High performance/low cost circuit design.
- Logic compatible inputs.
- "Zero voltage", phase controllable "random switching", and peak switching versions.
- High voltage (1200 Vpk) versions for 480 V_{RMS} service.
- Industry standard "hockey puck" package.
- 4000 V_{RMS} optical isolation.

	Model Number	Output Current Rating Amps (RMS)	Output Voltage Rating VRMS	PRV	AC Switching Mode (Input)
SCR OUTPUT	480D10SP	10	180-530	1200	Zero Voltage (4-32 VDC Input)
	480D25SP	25			
	480D45SP	50			
	480D80SP	80			
	480D110SP	110			
	480A10SP	10	180-530	1200	Zero Voltage (90-140 VAC Input)
	480A25SP	25			
	480A45SP	50			
	480A80SP	80			
	480A110SP	110			
	240D10SP	10	24-280	600	Zero Voltage (3-32 VDC Input)
	240D25SP	25			
	240D45SP	50			
	240D80SP	80			
	240D110SP	110			
	240D10-10SP	10	24-280	600	Random (Phase Controllable) (3.5-26 VDC Input)
	240D25-10SP	25			
	240D45-10SP	50			
	240D80-10SP	80			
	240D110-10SP	110			
	240A10SP	10	24-280	600	Zero Voltage (90-280 VAC Input)
	240A25SP	25			
	240A45SP	50			
	240A80SP	80			
	240A110SP	110			
	120D10SP	10	24-140	400	Zero Voltage (3-32 VDC Input)
	120D25SP	25			
	120D45SP	50			
	120D80SP	80			
	120D110SP	110			
	120A10SP	10	24-140	400	Zero Voltage (90-280 VAC Input)
	120A25SP	25			
	120A45SP	50			
	120A80SP	80			
	120A110SP	110			
	120D10-10SP	10	24-140	400	Random (Phase Controllable) (3.5-26 VDC Input)
	120D25-10SP	25			
	120D45-10SP	50			
	120D80-10SP	80			
	120D110-10SP	110			
TRIAC OUTPUT	MR240D10	10	24-280	600	Zero Voltage (3-32 VDC Input)
	MR240D25	25			
	MR240A10	10			Zero Voltage (90-280 VAC Input)
	MR240A25	25			
	MR120D10	10	24-140	400	Zero Voltage (3-32 VDC Input)
	MR120D25	25			
	MR120A10	10			Zero Voltage (90-280 VAC Input)
	MR120A25	25			

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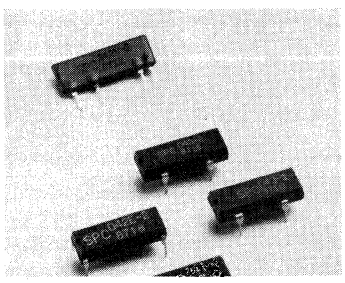
SPECIAL PURPOSE SOLID STATE AC POWER RELAYS

	Model Number	Output Current Rating Amps (RMS)	Output Voltage Rating VRMS	PRV	Type	AC Switching Mode
SPECIAL PURPOSE REPLAYS	25DR1D	25	24-280	600	Dual SSR	Zero Voltage
	40DR1D	40				
	25DR2D	25				Random
	40DR2D	40				
	20QR1D	20	24-280	600	Quad SSR	Zero Voltage
	20QR2D					Random

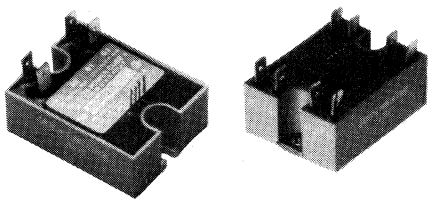
BOARD LEVEL SOLID STATE RELAYS

TO-116 DIP and 4-pin SIP packages employing thick film hybrid circuitry. Includes AC and DC switching versions from signal level to 1 amp output, with switching speeds as low as 1 μsec.

Three industry standard encapsulated PCB mount packages with AC output current ratings of 2.5 to 4 amps. Featuring 4000 Vrms optical isolation, logic compatible 3-32 Vdc input range, and either zero crossing or random phase controllable turn-on.



BOARD LEVEL RELAYS



SPECIAL PURPOSE RELAYS

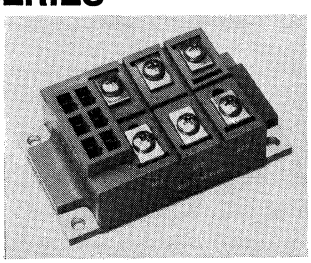
Part Number	Input Specifications Voltage (VDC)	Input Specifications Current (mA at 5V)	Output/Load Ratings (max.) Current	Voltage	AC/DC
D42E-2*	3.5–15	8	1A	280VRMS	AC
D42E-11*	N/A	5**	1A	280VRMS	AC
S42V-2*	3.5–15	8	1A	280VRMS	AC
S42V-11*	N/A	5**	1A	280VRMS	AC
S322 SP	3.5-8.0	22	2.5A	280VRMS	AC
MP240D3SP	3–32	1	3A	280VRMS	AC
MP240D4SP	3–32	1	4A	280VRMS	AC

* Add "H" suffix to P/N for 600V pk output voltage rating
** Guaranteed turn-on at 5mA dc. No internal current limiting or regulation.

100-250 AMP POWER SCR/DIODE MODULES—M80 SERIES

FEATURES:

- Seven Standard Circuit Configurations Available.
- High Terminal to Base Isolation of 2500V RMS.
- SCR Output Ratings of up to 180 Amps.
- Rectifier Output Ratings of up to 250 Amps.
- UL Recognized (File No. E 72446)



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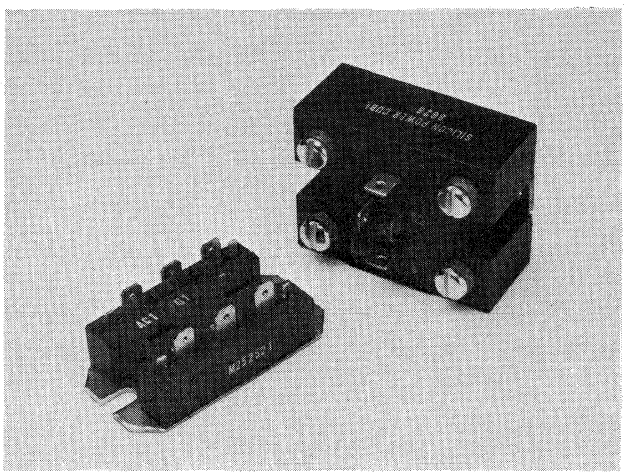
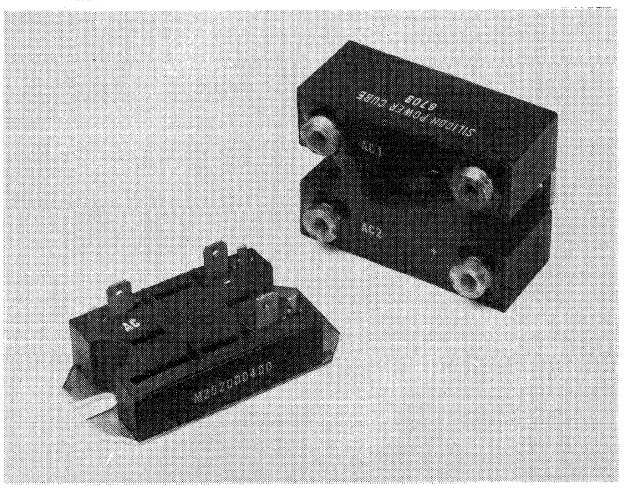
25-100 AMP POWER SCR/DIODE MODULES M25/M50 SERIES



FEATURES

- Eight Standard Circuit Configurations Available.
- Ultra-High Surge Current Capabilities Assures Long Lifetime and Reliable Performance.
- 2500VAC RMS Terminal-to-Base Iisolation.
- Proprietary SPC Unitized Power Circuit Structures Result in Very Efficient Thermal Management for Greatly Extended Cyclic Life.
- UL Component Recognition (File No. E72445).
- Available in standard 120VAC, 240VAC, 320VAC, 440VAC, and 480VAC Ratings (Higher voltages are available. Consult Factory.)

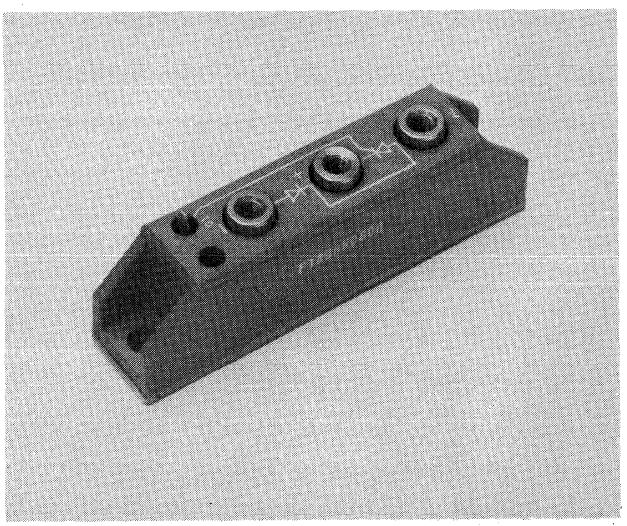
35-100 AMP POWER DIODE MODULES M25/M50 SERIES



FEATURES

- Seven Standard Diode Circuits are Available—Single-Phase Bridge; 3-Phase Bridge; Diode Doubler; Center Tap Common Cathode; Center Tap Common Anode; 3-Phase Common Cathode Half Wave Bridge and 3-Phase Common Anode Half Wave Bridge.
- SPC's Unique Unitized Power Rectifier Structures Provide Highly Efficient Thermal Management for Vastly Expanded Cyclic Lifetime.
- High Terminal-to-Base Isolation of 2500VAC RMS
- UL Component Recognition (File No. E72445).

25-90 AMP POWER SCR/DIODE MODULES F18 SERIES



FEATURES

- Thirteen Standard Module Configurations Available.
- Standard Voltages of 200 Volts to 1400 Volts. Average Device Current Output Ratings of 25 Amps to 90 Amps.
- Ultra-High Surge Current Capabilities.
- SPC's Rugged Unitized Power Circuit Structures Afford Optimally Efficient Thermal Management to Assure Extended Cyclic Life and Reliability.
- UL Component Recognition (File No. E72445).
- 2500VAC RMS Terminal-to-Base Isolation.
- All Units Are 100% Tested at Both 25°C and 125°C Temperature Levels—for Assured Quality.
- Available with Isolation Barriers

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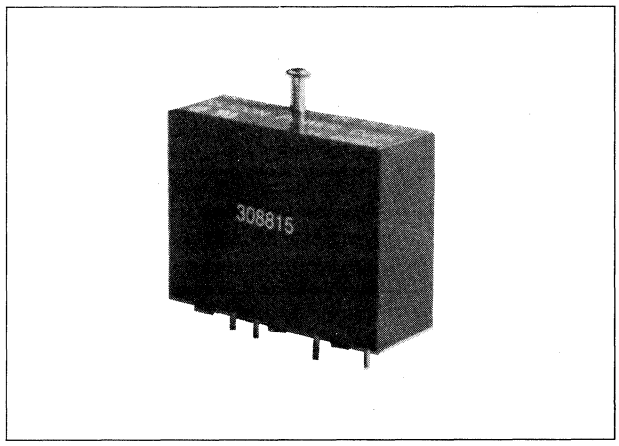
SILICON POWER CUBE

IAC/IDC/OAC/ODC SERIES

Industrial environments can subject sensitive microelectronic circuits to undesirable stresses in the form of voltage transients, electrical noise, shock, vibration, etc. These can result in permanent damage, spurious operations or false indications. SPC'S I/O modules are designed to provide an electrically clean, photo-isolated, noise-free "output" interface from logic level control systems to external loads such as motors, valves, solenoids, etc., or, an "input" interface from the load or sensors to microprocessor or computer-based logic level systems. Used with SPC'S I/O mounting boards, these solid-state modules exhibit long, reliable life in industrial environments.

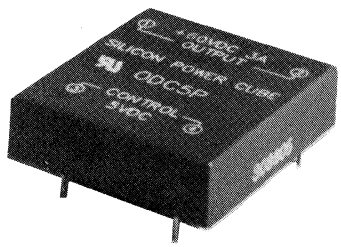


FEATURES

- Color-coded by Function
- 4000 Vrms Optical Isolation
- Industry Standard Package and Pin-out
- High Transient Noise Immunity
- Series Operation Compatibility
- UL Recognized, CSA Certified, SEV Approved Types Available

IACP/IDCP/OACP/ODCP SERIES

These flat pack modules offer reliable input-output interfacing in a low profile package outline that permits PC board spacing on half-inch centers.

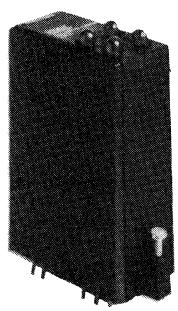


FEATURES

- Low Profile Permits 0.50 inch (12.70mm) PC Board Spacing
- Industry Standard Footprint
- Color-Coded by Function
- 4,000 Vrms Optical Isolation
- High Transient Noise Immunity
- Series Operation Compatibility
- UL Recognized, CSA Certified

IACQ/IDCQ/OACQ/ODCQ SERIES

Each quad module has four I/O channels of the same type. They provide a high packaging density means of reliably interfacing logic level control systems with external loads such as motors, valves, solenoids, etc., or as an interface from the load or sensors to microprocessor or computer-based logic level control systems.

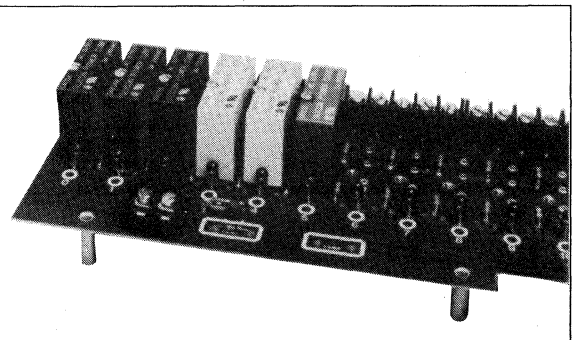


FEATURES

- Industry Standard Plug-in Package
- Input Modules Have Reverse Voltage Feedback Protection
- Output Modules Can Be Controlled By Sinking Logic
- Color-Coded by Function
- 4,000 Vrms Optical Isolation
- High Transient Noise Immunity
- Series Operation Compatibility
- UL Recognized, CSA Certified Types Available

PB SERIES

These mounting boards will accept input/output modules in any combination of input or output types of the same style (single or quad channel). Modules can be easily and quickly inserted, without disturbing field wiring. The single channel models provide an LED status indicator, plug-in 5 amp fuse and 3.3 Kohm pull-up resistor for each module.



FEATURES

- LED Status Indicators
- Plug-in Fuses
- Pull-up Resistors
- Barrier Strip Screw Terminals for Field Wiring
- Card Edge Logic Connections Available
- Screw Terminal Logic Connections Available
- UL Recognized Types
- CSA Certified Types

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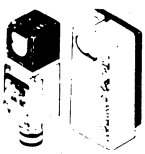
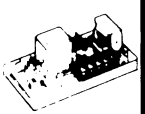
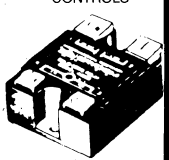
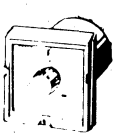

PHOTOELECTRICS

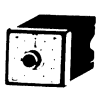
RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS


TEMPERATURE CONTROLS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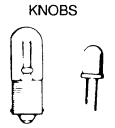
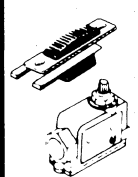
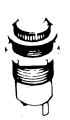
KNOBS


LAMPS & LEDS


SWITCHES

RELAYS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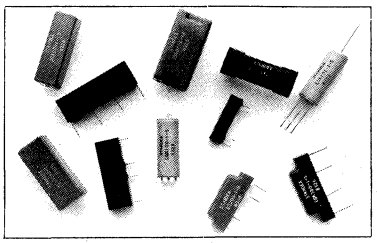

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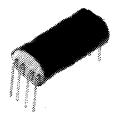
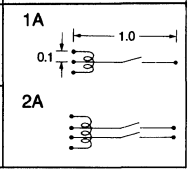
Series LG Form A

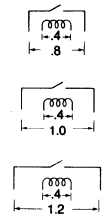


P/N	Coil VDC	Coil Res (ohms) @20°C	Max Pick-up VDC @20°C	Min. Drop Out VDC @20°C	
LG100-1-5	5	500	3.5	.5	1A
LG100-1-6	6	125	4.0	.5	
LG100-1-12	12	500	8.0	1.0	
LG100-1-24	24	2000	16.0	2.0	
LG100-2-5	5	500	3.5	.5	2A
LG100-2-6	6	125	4.0	.5	
LG100-2-12	12	500	8.0	1.0	
LG100-2-24	24	2000	16.0	2.0	

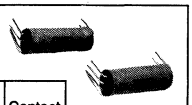


Series EG Form A

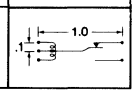
P/N	Coil VDC	Coil Res (ohms)	Pull-in Max.	Drop Out Min.	Contact Form
EG200-1-5	5	500	3.5	0.5	1A
EG200-1-6	6	125	4.0	0.5	
EG200-1-12	12	500	9.0	1.0	
EG200-1-24	24	2000	18.0	2.0	
EG300-1-5	5	500	3.5	0.5	1A
EG300-1-6	6	125	4.0	0.5	
EG300-1-12	12	500	9.0	1.0	
EG300-1-24	24	2000	18.0	2.0	
EG400-1-5	5	500	3.5	0.5	1A
EG400-1-6	6	125	4.0	0.5	
EG400-1-12	12	500	9.0	1.0	
EG400-1-24	24	2000	18.0	2.0	



Series LC Form C

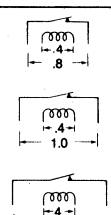


P/N	Coil VDC	Coil Res (ohms)	Max Pull-up	Min. Drop Out	Contact Form
LC100-1-5	5	500	3.5	0.5	1C
LC100-1-6	6	125	4.0	0.5	
LC100-1-12	12	500	9.0	1.0	
LC100-1-24	24	2000	18.0	2.0	



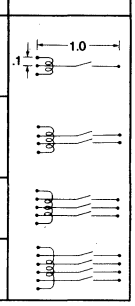
Series EB Form B

P/N	Coil VDC	Coil Res (ohms)	Pull-in Max.	Drop Out Min.	Contact Form
EB200-1-5	5	500	3.5	0.5	1B
EB200-1-6	6	125	4.0	0.5	
EB200-1-12	12	500	9.0	1.0	
EB200-1-24	24	2000	18.0	2.0	
EB300-1-5	5	500	3.5	0.5	1B
EB300-1-6	6	125	4.0	0.5	
EB300-1-12	12	500	9.0	1.0	
EB300-1-24	24	2000	18.0	2.0	
EB400-1-5	5	500	3.5	0.5	1B
EB400-1-6	6	125	4.0	0.5	
EB400-1-12	12	500	9.0	1.0	
EB400-1-24	24	2000	18.0	2.0	



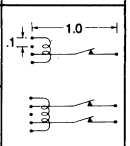
Series JG Form A

P/N	Coil VDC	Coil Res (ohms)	Pull-in Max.	Drop Out Min.	Contact Form
JG100-1-5	5	500	3.5	0.5	1A
JG100-1-6	6	125	4.0	0.5	
JG100-1-12	12	500	9.0	1.0	
JG100-1-24	24	2000	18.0	2.0	
JG100-2-5	5	250	3.5	0.5	2A
JG100-2-6	6	110	4.0	0.5	
JG100-2-12	12	440	9.0	1.0	
JG100-2-24	24	1760	18.0	2.0	
JG100-3-6	6	85	4.0	0.5	3A
JG100-3-12	12	340	9.0	1.0	
JG100-3-24	24	1360	18.0	2.0	
JG100-4-6	6	62	4.0	0.5	4A
JG100-4-12	12	250	9.0	1.0	
JG100-4-24	24	1000	18.0	2.0	



Series JB Form B

P/N	Coil VDC	Coil Res (ohms)	Pull-in Max.	Drop Out Min.	Contact Form
JB100-1-5	5	500	3.5	0.5	1B
JB100-1-6	6	125	4.0	0.5	
JB100-1-12	12	500	9.0	1.0	
JB100-1-24	24	2000	18.0	2.0	
JB100-2-6	6	110	4.0	0.5	2B
JB100-2-12	12	440	9.0	1.0	
JB100-2-24	24	1760	18.0	2.0	



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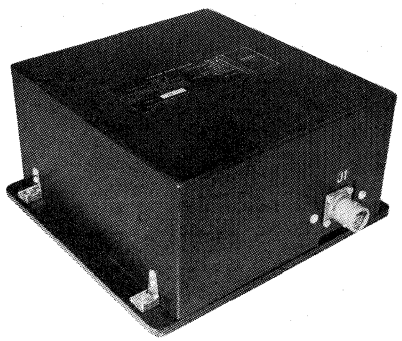
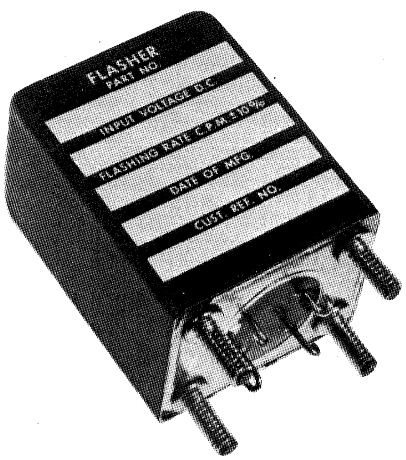


SPECIFICATIONS
INPUT VOLTAGE: 115 VRMS line to neutral ± 5.8 VRMS, 400 Hz ± 20 Hz, 3 phases plus neutral, phase sequence A-B-C (pins 1, 2, 3 & 8)
NORMAL OUTPUT: 28 VDC ± 2.8V, 4.5 to 5.0 AMP max. (pin 5), voltage regulation and ripple: 10% and 1V peak-to-peak max.
ALARM OUTPUT: 28 VDC nominal, 1.8 to 2.0 AMP max. (pin 7)
RESET SWITCH: Customer will supply a momentary normally open switch to permit normal operation when the switch is activated providing none of the fault conditions exist and the input voltage is applied (switch across pins 6 & 4)
MATERIAL AND FINISH: Housing is aluminum with black anodized finish.
OPERATING TEMP. RANGE: 0°C to +85°C
DIELECTRIC STRENGTH: 1250V, 60 Hz between contacts and case and between isolated circuits
VIBRATION: 5 to 55 CPS with DA of .06 in along any axis.
SHOCK: 20G'S for 11 MS
FAULT CONDITIONS: The monitor will supply the alarm output when any of the following conditions exist:
OVER/UNDER VOLTAGE SENSOR; Voltage is above 126.5 VAC ± 1.5V or below 105.5 VAC ± 1.5V across any one or more of the phases with respect to neutral.
PHASE SENSOR: Improper phase sequence (C-B-A) or if any one phase is open with the remaining phases closed.
FREQUENCY SENSOR: Frequency is above 420 Hz +0 Hz/–5 Hz or below 380 Hz +5 Hz/–0 Hz
VOLTAGE DROP: Any one or more of the phases drop to 95 VAC, the voltage regulation and ripple will be 10% and 1 volt peak-to-peak max. Any one or more of the phases drop to 80 VAC, the voltage regulation and ripple will be 30% and 3 volt peak-to-peak max. Any one phase is open while these conditions exist, the voltage regulation and ripple will be 30% and 6 volt peak-to-peak max.

FLASHERS

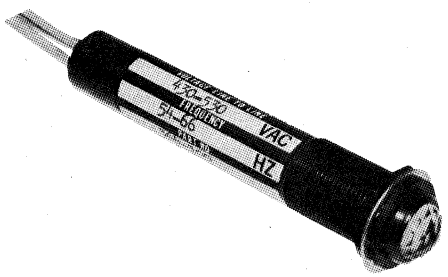


FEATURES:
- High reliability
- Rugged
- Hermetically sealed
- Compact and lightweight
- Solid state and relay outputs
- Long life

SPECIFICATIONS
SOLID STATE FLASHER
INPUT VOLTAGE: 18 to 32 VDC
POWER CONSUMPTION: 3 Watts (Not Including Lamp Power).
FLASHER OUTPUT: 200 ma, 500 ma, 2 AMP, or 5 AMP Lamp or Relay Load.
OUTPUT POLARITY: Positive or Negative Types.
NOT DAMAGED BY REVERSE POLARITY.
FLASHING RATES: AS SPECIFIED.
ON:OFF RATIOS ARE: AS SPECIFIED
OPERATING TEMPERATURE RANGE: –55 C to +71 C.
OPERATING LIFE EXPECTANCY: 10,000 Hours Min.
SHOCK: 100 G's for 11 Milliseconds
VIBRATION: 10 G's at 10 to 500 CPS.
HERMETICALLY SEALED.
MOUNTING: Stud or Flange.
SOLDER HOOK TEMINALS.
WEIGHT: 4 Ounces Nominal.
VOLTAGE DROP: 1.5 Volts Maximum.

RELAY TYPE FLASHER
INPUT VOLTAGE: 18 to 32 VDC.
POWER CONSUMPTION: 4 watts (not including lamp power).
FLASHER OUTPUT: 500 ma, 2 AMP, 5 AMP, lamp or relay load.
CONTACTS ARE S.P.S.T. normally open.
NOT DAMAGED BY REVERSE POLARITY.
FLASHING RATES: AS SPECIFIED.
ON: OFF RATIOS ARE: AS SPECIFIED
OPERATING TEMPERATURE RANGE: –55 C to +71 C.
OPERATING LIFE EXPECTANCY: 500,000 cycles
minimum at rated load.
SHOCK: 15 G's for 11 milliseconds.
VIBRATION: 10 G's at 10 to 500 CPS
UNIT: Hermetically sealed.
MOUNTING: Studs or flange.
SOLDER HOOK TERMINALS.
WEIGHT: 8 ounces nominal.

PHASE SEQUENCE INDICATORS



DESCRIPTION
A unique passive element circuit within the housing allows the indicator to illuminate only when the phase sequence of power being monitored is A-B-C. The phase sequence indicator will not illuminate when any one or more of the power inputs are opened or if the phase sequence is C-B-A.

The indicator will provide trouble-free instantaneous indication with no warm-up time required. The units are potted in an aluminum housing with no moving parts. Designed to meet severe environmental requirements of military applications.

SPECIFICATIONS
POWER CONSUMPTION: 2 watts
OPERATING TEMPERATURE: –55 to +125 C
WEIGHT: 2 ounces
MOUNTING: 5/8 inch dia. hole, panel thickness to 3/4 inch
LEADS: 18 inches long, teflon insulated
HOUSING MATERIAL: aluminum, black anodized
FREQUENCY AND VOLTAGE: per customer specifications
INDICATOR: lights up when all input leads are energized and phase sequence is A-B-C

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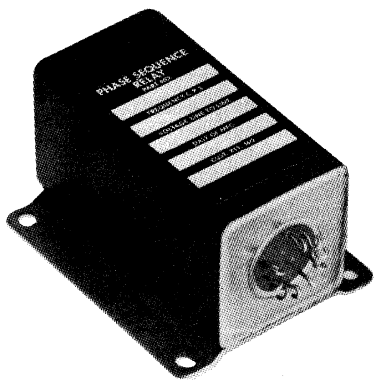
PHASE SEQUENCE RELAYS



FEATURES

- Designed for use in severe environmental conditions
- Automatic monitoring of phase sequence
- Solid state sensing circuit
- Hermetically sealed
- Light weight, small size
- Many voltages and frequency combination available

SPECIFICATIONS

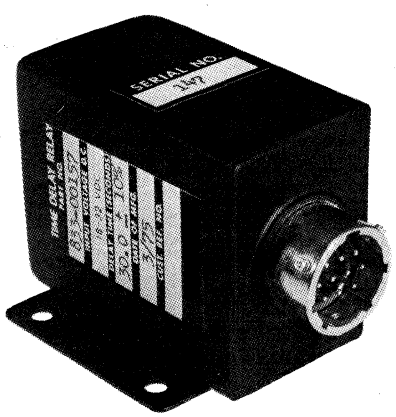
Relay picks up when all input terminals are energized and phase sequence is A-B-C.
Relay drops out if one or more power leads are grounded, opened or if the phase sequence is C-B-A.
POWER CONSUMPTION: 10 watts maximum.
OPERATING TEMPERATURE: –55 C +71 C
CONTACT RATINGS: (Per MIL-C-5757)

28 VDC	Resistive (Form C)	Inductive
2 AMP	2.0 AMPS	1.0 AMPS
3 AMP	3.0 AMPS	1.0 AMPS
10 AMP	10.0 AMPS	5.0 AMPS

115 VAC	Resistive (Form A&B)	Resistive (Form C)
2 AMP	2.0 AMPS	0.2 AMPS
3 AMP	3.0 AMPS	0.2 AMPS
10 AMP	10.0 AMPS	2.0 AMPS

VIBRATION: 10 G's to 500 Hz.
SHOCK: 30 G's for 11 milliseconds stud mount.
100 G's for 11 milliseconds flange mount.
SEAL: Hermetically sealed.
CONTACT RESISTANCE: .08 ohm maximum.
INSULATION RESISTANCE: 100 megohms minimum between terminals and case, between open contacts.
DIELECTRIC STRENGTH: 1000 Vrms 60 Hz, between terminals and **CASE;** 500 Vrms 60 Hz, between open contacts.
LIFE: 100,000 operations minimum.
WEIGHT: 11 ounces maximum.
Relays per MIL-R-5757.
Environmental testing per MIL-E-5272.
Test methods per MIL-STD-202.
Marking per MIL-STD-130.

TIME DELAY RELAYS



FEATURES

- Solid state sensing circuit
- Transient protected
- 2 amp, 3 amp, and 10 amp relay contacts, dpdt.
- Hermetically sealed.
- Light weight (3.5 to 9 oz).
- Choice of 3 operating modes.
- Designed for use in severe environmental conditions.

SPECIFICATIONS

INPUT VOLTAGE: 18 to 32 vdc
POWER REQUIREMENTS AT 28 VDC: 5 watts max, 2 amp relays
6.5 watts max, 10 amp relays
TEMPERATURE RANGE: –65 F to +185 F
VIBRATION: 20 G's, 10 to 2000 Hz
SHOCK: 100 G's for 11 milliseconds
CONTACTS: DPDT
LIFE: 100,000 cycles minimum at rated load
DROP-OUT TIME: 10 milliseconds max.
DROP-OUT VOLTAGE: 1 volt min.
PULL-IN VOLTAGE: 18 volts max.
INSULATION RESISTANCE: 100 megohms min.
DIELECTRIC STRENGTH: 500 volts 60 Hz case to terminals and across open contacts
CONTACT RATING:
2 amp & 3 amp unit: 2 amp & 3 amp resistive at 32 vdc
1 amp inductive at 32 vdc
10 amp unit: 10 amp resistive at 28 vdc or 115 vac
5 amp inductive at 28 vdc or 115 vac
CONTACT RESISTANCE: 0.050 ohms at rated current
RESET-TIME: 0.050 sec. max.
TRANSIENT PROTECTION: Will not be damaged by transients per Mil-Std-704
INTERNAL RELAYS: Per MIL-R-5757

CONTROL COMPONENTS DIVISION 9520 Black Mountain Road, San Diego, CA 92126-4507 USA
Phone 800/826-5053 (Continental U.S. except CA) 619/566-7680 FAX: 619/549-9691 TELEX: 9105951797 STI IRIN

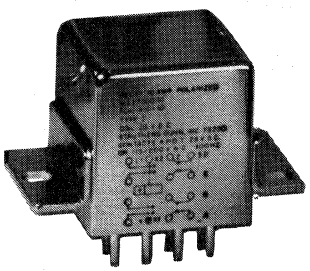
STRUTHERS-DUNN, INC.
a subsidiary of *Nytronics, Inc.*

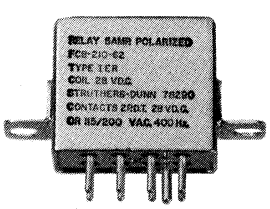
RELAY DIVISION
Lambs Rd., Pitman, N.J. 08071-0901
Tel. 609-589-7500 TWX 510-686-7510
FAX (24 HRS.) 609-589-2619

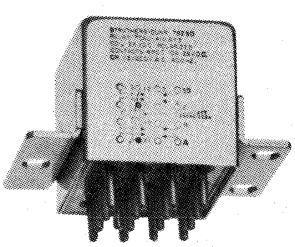
MIL-SPEC ELECTROMECHANICAL RELAYS

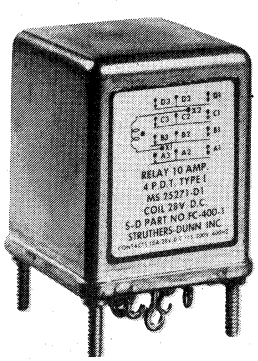
- **All built in accordance with Mil-R-6106**
- **Available with or without flanges, studs and track mounting**
- **Track and socket assemblies available**
- **Coil suppression available**

	to Mil Spec:	Contact Rating (Amps)	Coil Rating/ Frequency	Operate/ Release (ms. max)	Shock (min Gs) *track-mounted	Rated Vibration (min. Gs)
FCA Series 1 PDT FCA 125	6106/19	25	6V/DC 12V/DC 28V/DC 48V/DC 115V/400 115V/50 400	10/10 10/10 10/10 10/10 15/50 20/50	200 200 200 200 200 200	30 30 30 30 30 30
2 PDT FCA 210	MS27401 6106/1 (track mount)	10	6V/DC 12V/DC 28V/DC 48V/DC 115V/400 115V/50 400	10/10 10/10 10/10 10/10 15/50 20/50	200 50* 200 50 200 50 200 50 200 50 200 50	30 30 30 30 30 30 30
3 PDT FCA 325 FCAC 325	MS27743 6106/13 (2 amp aux cont.)	25	6V/DC 12V/DC 28V/DC 48V/DC 115V/400 115V/50 400	10/10 10/10 10/10 10/10 15/50 20/50	200 200 200 200 200 200	30 30 30 30 30 30
4 PDT FCA 410	MS27400 6106/2 (track mount)	10	6V/DC 12V/DC 28V/DC 48V/DC 115V/400 115V/50 400	10/10 10/10 10/10 10/10 15/50 20/50	200 50* 200 50 200 50 200 50 200 50 200 50	30 20 30 30 30 30
6 PDT FCA 610	6106/8	10	6V/DC 12V/DC 28V/DC 48V/DC 115V/400 115V/50 400	10/10 10/10 10/10 10/10 15/50 20/50	50 50 50 50 50 50	20 20 20 20 20 20
FCB Series 2 PDT FCB 210	6106/27 6106/21 (Track mount)	5	6V/DC 12V/DC 28V/DC 48V/DC	4/4	200 50*	30 20*
3 PDT FCB 310	6106/29 6106/24 (Track mount)	10	6V/DC 12V/DC 28V/DC 48V/DC	6/6	200 50*	30 20*
4 PDT FCB 410	6106/28 6106/22 (Track mount)	5	6V/DC 12V/DC 28V/DC 48V/DC	6/6	200 50*	30 20*
FCAL Series 1 PDT FCAL 125	6106/20	25	6V/DC 12V/DC 28V/DC 115/400	15/15 15/15 15/15 20/20	200	30
2 PDT FCAL 210	MS27744 (6106/ 50,36)	10	6V/DC 12V/DC 28V/DC 115/400	15/15 15/15 15/15 20/20	200 50*	30
3 PDT FCAL 325 FCACL 325	MS27742 6106/13	25	6V/DC 12V/DC 28V/DC 115/400	15/15 15/15 15/15 20/20	200	30
4 PDT FCAL 410	MS27745 (6106/ 51)	10	6V/DC 12V/DC 28V/DC 115/400	15/15 15/15 15/15 20/20	200	30
FC Series 2 PDT FC-402	MS25273 MS25323 Mil-R- 5757	10	28/DC 115/400 115/50-60	20/20 25/50 25/50	50	10
4 PDT FC-4 FC-400 FC-404	Mil-R- 5757/7 5757/15 5757/18	2 5 10	26.5/DC 28/DC 115/400 115/50-60 28/DC 115/400 115/50-60	10/15 20/20 25/50 25/50 20/20 25/50 25/50	100 50 50	15 10 10
6 PDT FC-406 FC-6	5757/16 5757/1	5 2	28/DC 115/400 115/50-60 26.5DC	20/20 25/50 25/50 15/15	50 50 50 100	10 10 10 15









ENGINEERING SPECIFICATION DATA SUBJECT TO CHANGE. CONTACT FACTORY FOR INFORMATION. FOR DETAILS ON STRUTHERS-DUNN DISTRIBUTOR-STOCKED RELAYS. REQUEST CATALOG C/1010.

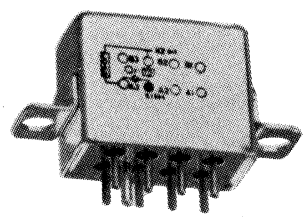
STRUTHERS-DUNN, INC.
a subsidiary of *Nytronics, Inc.*

RELAY DIVISION
Lambs Rd., Pitman, N.J. 08071-0901
Tel. 609-589-7500 TWX 510-686-7510
FAX (24 HRS.) 609-589-2619

MIL-SPEC TIME DELAY RELAYS

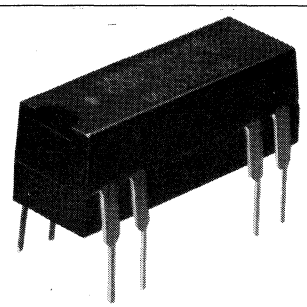
- **Delay on Operate or Delay on Release— Fixed (F) and/or Adjustable (A) and/or Programmable**
- **.05 to 600 sec. timing range (.10 to 300 sec. for TDA Series)**

	To spec. Mil-R-	Contact Rating (Amps)	Coil Rating/ Frequency	Recycle Times (ms.)	Shock (min. Gs)	Vibration (min. Gs)
TDA Series 2 PDT (F)	83726/ 1, 2, 3, 4, 18, 19, 27	10	28V/DC	50	100	20
TDB Series 1 PST (F) (A)	83726/ 24, 25	150 MA (ss output)	20V/DC	10	100	10
TDC Series 2 PDT (A)	83726/ 30, 31	10	28V/DC	10	200	30
TDD Series 2 PDT (F) (A)	83726/ 28, 29	10	28V/DC	10	200	30
TDE Series 4 PDT (F) (A)	83726	10	28V/DC	10	200	30
TDF Series 3 PDT (F) (A)	83726	25	28V/DC	10	200	30
TDG Series 6 PDT (F)	83726	10	28V/DC	10	50	20



MIL-SPEC REED RELAYS

DIP*	83516/ 1, 2	Form / VA 1A / 10 2A / 10 1B / 10 1C / 3	[5/6V/DC 12V/DC 24V/DC]	1/.5 1/.5 .5/.5 2/2.5	50 50 50 50	20 20 20 20
SIP	83516/3	1A 10 1B 10	[5/6V/DC 12V/DC 24V/DC]	1/.5 .5/.5	50 50	20 20
Mercury Wetted	83407/3	Form 1A, 2A, 3A (2A) Form 1C, 2C (1A)	[4.5V/DC 12V/DC]	3/3 3/3	20 20	4 4

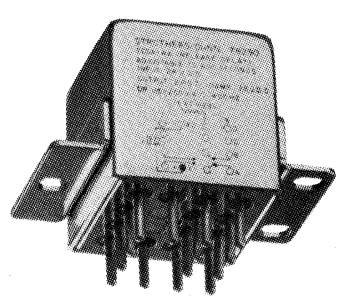


*Latched versions also available [ ]—applies to all contact ratings

MIL-SPEC SENSORS

- VS, CS, FS Series for Voltage/Current/Frequency

Struthers-Dunn custom designs and manufactures a range of Mil-Spec sensors that monitor AC and DC circuits and detect and signal when the parameters of voltage, current or frequency deviate from the required nominal range. These sensors use Struthers-Dunn Mil-approved relays or timers, and are available in models ranging from 1 PDT low level with reed contacts, to 4-pole 10A or 3-pole 25A. Magnetic latching relays are available for all contact arrangements. Enclosures are hermetically sealed, with terminals for socket plug-in, circuit board mounting or solder hooks. For detailed information, contact Struthers-Dunn.



MIL-SPEC QPL LISTING

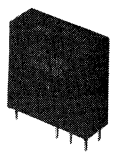
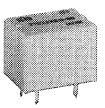
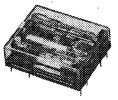
MS25267	MS25325	MS27709	MIL-R-6106/5
MS25268	MS25327	MS27743	MIL-R-6106/25
MS25269	MS25329	MS27744	MIL-R-6106/35
MS25270	MS25917	MS27745	MIL-R-83407
MS25271	MS25918	MIL-R-5757	MIL-R-83516
MS25272	MS25919	MIL-R-6106	MIL-R-83726
MS25273	MS27400	MIL-R-6106/3	
MS25323	MS27401	MIL-R-6106/4	

ENGINEERING SPECIFICATION DATA SUBJECT TO CHANGE. CONTACT FACTORY FOR INFORMATION. FOR DETAILS ON STRUTHERS-DUNN DISTRIBUTOR-STOCKED RELAYS, REQUEST CATALOG C/1010.

STRUTHERS-DUNN, INC.
a subsidiary of Nytronics, Inc.

COMMERCIAL/INDUSTRIAL RELAYS DIVISION
700 Orange St., Darlington, SC 29532-9986
Tel. 803-393-5421 FAX (24 HRS.) 803-393-4123

PRINTED CIRCUIT TERMINAL—LOW LEVEL TO 30 AMP, 1-4 POLE, SEALED AND UNSEALED

SERIES	276	277	232	233	270	272	272L	273	403
									
DIMENSIONS (L x W x H)	0.787″ x 0.500″ x 0.394″	1.142″ x 0.512″ x 1.024″	0.630″ x 0.433″ x 0.453″	0.905″ x 0.827″ x 0.768″	0.866″ x 0.630″ x 0.622″	0.787″ x 0.390″ x 0.354″	0.787″ x 0.390″ x 0.354″	0.866″ x 0.630″ x 0.622″	1.156″ x 0.938″ x 0.344″
FEATURES	• 10 Amp Contact • Miniature Size • Polarized for Coil Sensitivity—40 mA@ 5VDC • 4 mm Coil—Contact Spacing • 5KV Surge Withstand • Immersion Cleanable • PBT Materials	• AC or DC Coil Construction • 8 mm Coil—Contact Spacing • 10KV Surge Capability • Sealed Terminals • PBT Materials • 0.1″ Term. Grid	• Subminiature Size • 1 Form C; 1 Amp Contact • Immersion Cleanable • 0.2W Coil Available • 0.1″ Term. Grid	• Automotive Applications • Incandescent Lamp Switching • 30 Amp Switching 15A Continuous • Low Cost • Dust Cover	• General Purpose Relay • 3, 5 or 10 Amp Switching • Immersion-Cleanable • TV-5 Rating	• 0.1″ Grid DIP Relay • Immersion-Cleanable • 1500V FCC Surge Capability • Meets FCC Part 68 • Crossbar Bifurcated Contacts • Polarized For Coil Sensitivity	• 0.1″ Grid DIP Bistable Mag. Latch—2 Coil • Immersion Cleanable • 1500V FCC Surge Capability • Meets FCC Part 68 • Crossbar Bifurcated Contacts	• Very Low Audible Noise Relay • Immersion Cleanable • 10 Amp Switching at 16VDC and 250VAC	• Low Profile—0.5″ Board Spacing • 2 Form C or 4 Form C • Immersion-Cleanable • Low Capacitance Design • 0.1″ Grid Term.
CONTACT DATA									
Form:	1 Form A;1 Form C	2 Form A;2 Form C	1 Form C	1 Form A;1 Form C	1 Form A 1 Form C	2 Form C	2 Form C	1 Form A;1 Form C	2 Form C;4 Form C
Material:	Silver Alloy	Silver Alloy	Silver Alloy—Gold Plate	Silver Alloy	Silver Alloy / Sil. Cad. Oxide	Gold Clad—Silver Nickel	Gold Clad—Silver Nickel	Silver Alloy	Gold Plated—Silver Palladium
Ratings:	1A 1C							1A 1C	
120/AC	10A 7A	5A	0.5A	10A	3A 5A, 10A	1A	1A	10A 7A	0.27A
240/AC	10A 7A	5A	—	—	1.5A 2.5A, 5A	—	—	10A 7A	—
30/DC	10A 7A	5A	1A	10A 30A@ 12VAC 150W Lamp Load @ 12VDC	3A 5A,10A	2A	2A	10A 7A	1A
COIL DATA									
AC Volts	—	6, 12, 24, 120	—	—	—	—	—	—	—
DC Volts	3, 5, 6 9, 12, 24	3, 5, 6, 12, 24, 48, 110	1.5, 3, 5, 6, 9, 12, 24	12, 24	6, 9, 12, 24, 48	3, 5, 6, 9, 12, 24, 48	3, 5, 6, 9, 12, 24	5, 6, 9, 10, 12, 24	6, 12, 24, 48
Power:									
AC VA	—	0.9	—	—	—	—	—	—	—
DC Watts	0.2	0.53	0.45	1.0	0.36	0.4	0.36	0.2	0.33—2 Form C 0.5—4 Form C
GENERAL DATA									
Ambient Temp.:	−40°C to +70°C	−40°C to +70°C	−25°C to +55°C	−30°C to +80°C	−30°C to +60°C	−40°C to +70°C	−40°C to +70°C	−40°C to +70°C	−10°C to +65°C
Operate Time:	10 ms	15 ms	3 ms	10 ms	6 ms	3 ms	3 ms	10 ms	7 ms
Release Time:	10 ms	10 ms	1 ms	10 ms	2 ms	2 ms	2 ms	10 ms	3 ms
VDE Spacing:	4 mm	8 mm	—	—	—	—	—	—	—
Life:									
Rated Load	100,000	100,000	500,000	100,000	100,000	500,000	100,000	100,000	5 million
No Load	50 million	10 million	5 million	5 million	10 million	100 million	100 million	10 million	100 million
OPTIONS	Dust Cover Version	AC Coil Operation	High Sensitivity Coil Dust Cover Version	Stronger Coil (intermittent duty) for Automotive Applications Flux Tight Term. Seal	TV-5 Rated Versions (Form A only) Appl. and Auto Types Dust Cover Types	High Sensitivity 0.2W Coil Available	High Sensitivity 0.12W Coil Available	Dust Cover Version	—
APPROVALS	UL, CSA	UL, CSA	UL	UL, CSA	UL, CSA	UL, CSA	UL, CSA	UL, CSA (Pending)	—

ENGINEERING SPECIFICATION DATA SUBJECT TO CHANGE. CONTACT FACTORY FOR INFORMATION.
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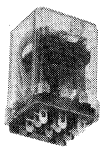
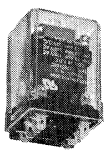
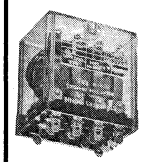
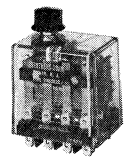
STRUTHERS-DUNN, INC.
a subsidiary of Nytronics, Inc.

COMMERCIAL/INDUSTRIAL RELAYS DIVISION
700 Orange St., Darlington, SC 29532-9986
Tel. 803-393-5421 FAX (24 HRS.) 803-393-4123

3-WAY TERMINAL, 5-15 AMP, 1-3 POLE

3-WAY TERMINAL, 10-AMP, 4 POLE

SERIES	A283	285	286	287	292	284	306	308
								
DIMENSIONS (L x W x H)	1.500" x 1.375" x 2.156"	1.500" x 1.375" x 2.156"	1.500" x 1.375" x 3.281"	1.500" x 1.375" x 3.281"	1.500" x 1.375" x 2.156"	1.500" x 1.938" x 2.156"	1.5" x 1.938" x 2.156"	1.500" x 1.938" x 2.156"
FEATURES	• 3 Way Term. Solder 0.187 Q.C. Plug In • Open Style or Enclosed • Compact • Polycarbonate Cover • 600 VAC Rated	• Perm. Mag. Latch Relay • Single or Dual Coil • 3 Way Term.: Solder 0.187 Q.C. Plug In • High Sensitivity Coils Avail. • AC or DC Input	• Delay-On Timer • 3 Way Term.: Solder 0.187 Q.C. Plug In • Adjustable Timing 0.1 to 300 sec • Inverse Polarity Protection • ±3% Repeatability • 150 ms max. Recycle Time • Transient Protection • No False Contacting • Electronic Module—Epoxy Molded	• Delay-Off Timer • 3 Way Term.: Solder 0.187 Q.C. Plug In • Adjustable Timing 0.1 to 300 sec • Inverse Polarity Protection • Transient Protection • ±3% Repeatability • 150 ms max. Recycle Time • Electronic Module—Epoxy Molded	• Low Power DC Relay • 3 Way Term.: Solder 0.187 Q.C. Plug In • 125 mW/Pole • Operate over Wide Voltage Range • Clear Poly-carbonate Cover	• 3 Way Term.: Solder 0.187 Q.C. Plug In • Sockets: Screw Term. Front-Connected PC Term. Solder Term. • QC Term. • Polycarbonate Cover • Compact Size	• Delay-On Timer • 3-Way Term.: Solder 0.187 Q.C. Plug-In • Adjustable Timing 0.1 to 300 sec • ±3% Repeatability • Inverse Polarity Protected • No False Contacting • Transient Protection • 150 ms max. Recycle Time • Electronic Module—Epoxy Molded	• Perm. Mag. Latch Relay • 3 Way Term.: Solder 0.187 Q.C. Plug In • AC or DC Input • No False Transfer with 5 Times Nom. Voltage Pulse
CONTACT DATA								
Form:	1 Form C to 3 Form C	1 Form C to 3 Form C	1 Form C to 3 Form C	1 Form C to 3 Form C	1 Form C to 3 Form C	4 Form C	4 Form C	4 Form C
Material:	Sil. Cad. Oxide	Sil. Cad. Oxide	Sil. Cad. Oxide	Sil. Cad. Oxide	Silver	Gold Sil. Cad Oxide	Sil. Cad. Oxide	Sil. Cad. Oxide
Ratings:								
120/AC	10A, ⅓ HP	10A, ⅓ HP	10A, ⅓ HP	10A, ⅓ HP	5A	10A,⅓ HP	10A, ⅓ HP	10A, ⅓ HP
240/AC	10A, ½ HP	10A, ½ HP	10A, ½ HP	10A, ½ HP	5A	10A, ½ HP	10A, ½ HP	10A, ½ HP
30/DC	10A, —	10A, —	10A, —	10A, —	5A	10A	10A, —	10A, —
COIL DATA								
AC Volts	6 to 240	6 to 120 (240 with series resistor)	24 to 240	24 to 240	—	6 to 240	24 to 240	6 to 120 (240 with series resistor)
DC Volts	6 to 125 (250VDC with series resistor)	6 to 125 (250VDC with series resistor)	12 to 125	12 to 125	15 to 139 (11.1 to 3.5 ma)	6 to 125 (250VDC with series resistor)	12 to 125	6 to 125 (250 with series resistor
Power:								
AC VA	2 (2 Pole) 2.7 (3 Pole)	0.78	2 (2 Pole) 2.7 (3 Pole)	2 (2 Pole) 2.7 (3 Pole)	—	3.4	3.4	1.33W
DC Watts	1.2 (1.5W @ 125V)	1.6 Standard 0.5 Sensitive	1.2 (1.5W @ 125V)	1.2 (1.5W @ 125V)	0.125/Pole	1.2 (1.9W @ 125V)	1.2 (1.9W @ 125V)	1.2 (1.9W @ 125V)
GENERAL DATA								
Ambient Temp.:	−45°C to +70°C	−45°C to +70°C	−10°C to +70°C	−10°C to +70°C	−45°C to +70°C	−45°C to +50°C AC −45°C to +70°C DC	−10°C to +45°C AC −10°C to +70°C DC	−45°C to +70°C
Operate Time:	15 ms	25 ms AC; 15 ms DC	As selected	15 ms	20 ms	15 ms	As selected	25 ms AC; 15 ms DC
Release Time:	10 ms	25 ms AC; 15 ms DC	10 ms	As selected	15 ms	10 ms	10 ms	25 ms AC; 15 ms DC
Life:								
Rated Load	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
No Load	10 million	10 million	10 million	10 million	10 million	10 million	10 million	10 million
OPTIONS	Indicator Lamp Manual Actuator PC Sockets QC Sockets 15 Amp Contacts 5 Amp Contacts Perm. Mag. Blowout 130°C Coil Gold Diffus. Contacts Tungsten Contacts	Indicator Lamp Manual Actuator PC Sockets QC Sockets 15 Amp Contacts 5 Amp Contacts 130°C Coils Gold Diffus. Contacts	PC Sockets QC Sockets Stud or Bracket Mount 15 Amp Contacts 5 Amp Contacts Gold Diffus. Contacts Fixed Timing Remote Timing	PC Sockets QC Sockets Stud or Bracket Mount 15 Amp Contacts 5 Amp Contacts Gold Diffus. Contacts Fixed Timing Remote Timing	Indicator Lamp (125DC Coil Only) Manual Actuator PC Socket QC Socket Stud or Bracket Mount Gold Diffus. Contacts	Indicator Lamp Manual Actuator Mounting Styles: 6-32 Stud Tapped Hole PC Terminals Gold Diffus. Contacts 5 Amp Contacts	Sockets: Screw Term. Front Connected PC Term. Solder Term. QC Term. Fixed Timing Remote Timing 5 Amp Contacts	Sockets: Screw Term. Front Connected PC Term. Solder Term. QC Term. Dual Coil Construction 5 Amp Contacts
APPROVALS	UL, CSA	UL, CSA	UL, CSA	UL	UL	UL, CSA	UL	—

ENGINEERING SPECIFICATION DATA SUBJECT TO CHANGE. CONTACT FACTORY FOR INFORMATION.
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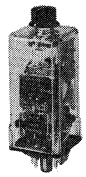
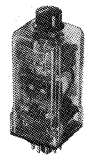
STRUTHERS-DUNN, INC.
a subsidiary of Nytronics, Inc.
COMMERCIAL/INDUSTRIAL RELAYS DIVISION
700 Orange St., Darlington, SC 29532-9986
Tel. 803-393-5421 FAX (24 HRS.) 803-393-4123

2-WAY TERMINAL, 20 AMP, 1-3 POLE — OCTAL STYLE PLUG IN, 5-10 AMP, 1-3 POLES — ICE CUBE STYLE, 1-10 AMP, 2 & 4 POLE

SERIES	298	300	A314	326	327	392	C281	282
								
DIMENSIONS (L x W x H)	1.500″ x 1.375″ x 2.906″	1.500″ x 1.375″ x 2.906″	1.375″ x 1.375″ x 2.813″	1.3.75″ x 1.375″ x 4.375″	1.375″ x 1.375″ x 4.375″	1.375″ x 1.375″ x 2.813″	1.125″ x 0.875″ x 1.531″	1.125″ x 0.875″ x 3.125″
FEATURES	• 2 Way Terminals 0.25 Q.C. Solder • Handles Tough Loads at Low Cost • 277VAC, 20A • 600VAC, 5A • Polycarbonate Cover with Mounting Tabs	• 2 Way Terminals 0.25 Q.C. Solder • Handles Tough Loads at Low Cost • 277VAC, 20A • 600VAC, 5A • Accepts 0.25 Booted Quick Connect • Polycarbonate Cover with Mounting Tabs	• Long Life • Low Cost • Open or Plug-In (8 & 11 pin) • Straight Thru Wiring: Fewer Solder Joints Greater Reliability	• Delay-On Timer • Adjustable Timing 0.1 to 300 sec • Low Cost • Octal Plug-In • Transient Protection • Polarity Protection • Electronic Module-Epoxy Molded • Repeatability ±3% • No False Contacting	• Delay-Off Timer • Adjustable Timing 0.1 to 300 sec • Octal Plug-In • Transient Protection • Polarity Protection • Electronic Module-Epoxy Molded • Repeatability ±3% • No False Contacting	• Low Power DC Relay 125 mW/Pole • Low Cost • Operate Over Wide Voltage Range • Clear Polycarbonate Cover	• General Purpose Low Cost • 1-Amp Bifurcated Contacts • 3A Silver Contacts • 5A and 10A Silver Cad-Oxide Contacts	• Delay-On Timer • Plug-In Mount • PC Mount • Adjustable Timing 0.1 to 300 sec • Transient Protection • Polarity Protection • Electronic Module-Epoxy Molded • Repeatability ±3% • No False Contacting
CONTACT DATA								
Form:	1 Form C to 3 Form C	2 Form C	1 Form C to 3 Form C	1 Form C to 3 Form C	1 Form C to 3 Form C	1 Form C to 3 Form C	2 Form C 4 Form C	2 Form C 4 Form C
Material:	Sil. Cad. Oxide	Sil. Cad. Oxide	Sil. Cad. Oxide	Sil. Cad. Oxide	Sil. Cad. Oxide	Silver	SCO | SIL/SCO	SCO | SIL/SCO
Ratings:								
120/AC	20A, ¾ HP	20A, ¾ HP	10A, ⅛ HP	10A, ⅛ HP	10A, ⅛ HP	5A	10 | 3/5	10 | 3/5
240/AC	20A, 1 HP	20A, 1 HP	5A, ⅓ HP	5A, ⅓ HP	5A, ⅓ HP	—	— | —	— | —
30/DC	20A, —	20A, —	10A, —	10A, —	10A, —	5A	10 | 3/5	10 | 3/5
COIL DATA								
AC Volts	6 to 240	6 to 240	6 to 240	24 to 240	24 to 240	—	6 to 220	12 to 120
DC Volts	6 to 125 (250VDC with series resistor)	6 to 125 (250VDC with series resistor)	6 to 110-125	12 to 125	12 to 125	15 to 139 (11.1 to 3.5 ma)	6 to 110	12 to 110
Power:								
AC VA	3.4	3.4	2.1	2.1	2.1	—	1.2	1.2
DC Watts	1.2 (3 Pole, 2W)	1.2	1.2 (1.5W @ 125V)	1.2 (1.5W @ 125V)	1.2 (1.5W @ 125V)	0.125/Pole	1.0 (1.1W @ 110V)	1.0 (1.1W @ 110V)
GENERAL DATA								
Ambient Temp.:								
AC	−30°C to +50°C	−30°C to +50°C	−45°C to +55°C	−10°C to +55°C	−10°C to +55°C	—	−45°C to +70°C	−10°C to +55°C
DC	−30°C to +60°C	−30°C to +60°C	−45°C to +70°C	−10°C to +70°C	−10°C to +70°C	−45°C to +70°C	−45°C to +70°C	−10°C to +70°C
Operate Time:	20 ms	20 ms	15 ms	As Selected	15 ms	20 ms	15 ms	As Selected
Release Time:	15 ms	15 ms	10 ms	10 ms	As Selected	15 ms	10 ms	10 ms
Life:								
Rated Load	100,000	100,000	100,000	100,000	100,000	100,000	500,000	500,000
No Load	10 million	10 million	10 million	10 million	10 million	10 million	50 million	50 million
OPTIONS	Indicator Lamp Manual Actuator Silver Contacts Perm. Mag. Blowout Mounting Styles: 6-32 Stud (Core) 6-32 Stud (Top) 6-32 Tapped Core 130°C Coil	Indicator Lamp Manual Actuator Silver Contacts Perm. Mag. Blowout Mounting Styles: 6-32 Stud (Core) 6-32 Stud (Top) 6-32 Tapped Core 130°C Coil	Indicator Lamp Manual Actuator Silver Contacts Perm. Mag. Blowout 130°C Coil Open Styles: 6-32 Stud (Core) 6-32 Tapped Core Gold Diffus. Contacts	Perm. Mag. Blowout Silver Contacts Gold Diffus. Contacts Fixed Timing Remote Timing	Perm. Mag. Blowout Silver Contacts Gold Diffus. Contacts Fixed Timing Remote Timing	Indicator Lamp (125DC Coil Only) Manual Actuator Open Styles: 6-32 Stud (Core) 6-32 Tapped Core	Indicator Lamp Manual Actuator Various Mountings Opp. Pol Barrier Diode Across Coil Sealed (Immersion Cleanable) PC Term. Version	Fixed Timing Remote Timing
APPROVALS	UL	UL	UL, CSA	UL, CSA	UL, CSA	UL	UL, CSA	UL

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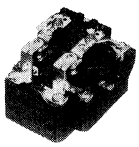
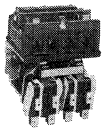
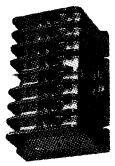
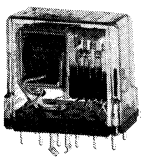
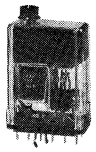
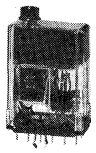
COMMERCIAL/INDUSTRIAL RELAYS DIVISION
700 Orange St., Darlington, SC 29532-9986
Tel. 803-393-5421 FAX (24 HRS.) 803-393-4123

SCREW TERMINAL, 15-30 AMP, 1-3 POLE

SCREW/Q.C. TERMINAL, MOTOR CONTACTORS, 1-7.5 HP, 3-4 POLE

INDUSTRIAL PLUG IN, 5-10 AMP, 2-6 POLE

SERIES	425	A275	375	219	T219	246	247
							
DIMENSIONS (L x W x D)	3.250" x 2.500" x 2.500"	2.875" x 3.625" x 2.750"	4.650" x 3.250" x 2.620"	12 PIN: 2.625" x 1.469" x 3.406" 14 PIN: 3.063" x 1.469" x 3.406"	2.625" x 1.469" x 5.250"	2.625" x 1.469" x 4.093"	2.625" x 1.469" x 4.093"
FEATURES	• High Current • Low Cost • Long Life • Multi-Contact Arrangement • Motor Loads • High Inrush Loads • Var. Speed Drive Load • 600VAC Rated	• 2 Coil Reversing Contactor 1 HP Rated • 0.25" Dual Quick-Connect Terminals • Up to 4 Auxiliary Contacts • Encapsulated Coils—AC or DC • Mechanical Interlock • 600VAC Rated • Operate in Any Position	• 20 Amp Reversing Contactor with Mechanical Interlock • Auxiliary Contacts • 0.25" Dual Quick-Connect Load Terminals • Panel Mounting • Encapsulated Coils	• 10 Amp Multi-Pole—to 4 Form C or 6 Form A • Industrial Plug-In with Locking Clip • Encapsulated Coil • Polycarbonate Cover • Gold Diff. Sil. Cad Oxide Contacts • Single Level Socket Wiring	• Time Delay Relay: Delay-On Interval Flasher • Adjustable Timing: 0.1 sec to 36 hrs. • C/MOS Circuitry • AC/DC Input—Not Polarity Sensitive • Repeatability: AC ±0.5%, DC ±0.2% • No False Contacting Recycle Time: 60 ms • Single Level Socket Wiring	• Delay-On-Operate ISO Timer • Adjustable Timing: 0.1 to 300 sec • Repeatability: ±3% • No False Contacting • Polarity Protection • Recycle Time: 150 ms Max. • Transient Protection • Single Level Socket Wiring	• Delay On-Release ISO Timer • Adjustable Timing: 0.1 to 300 sec • Repeatability ±3% • Recycle Time: 150 ms Max. • Transient Protection • Single Level Socket Wiring
CONTACT DATA							
Form:	Up to 3 Form C	6P DM (3 Per Coil)	8P DM (4 Per Coil)	2 Form C to 4 Form C or up to 6 Form A-Form B Combinations	2 Form C to 2 Form A & 2 Form C	2 Form C to 2 Form A & 2 Form C	2 Form C; 3 Form C
Material:	Sil. Cad. Oxide	Sil. Cad. Oxide	Sil. Cad. Oxide	Sil. Cad. Oxide—Gold Diffused	Sil. Cad. Oxide—Gold Diffused	Sil. Cad. Oxide—Gold Diffused	Sil. Cad. Oxide—Gold Diffused
Ratings:	120VAC 30A* 240VAC 30A* 480VAC 12.5A 600VAC 10A 30VDC 15A — *25A for 3 pole relay	120VAC 15A, 1 HP 240VAC 10A, 2 HP 480VAC 5A, 2 HP 600VAC 5A, 2 HP 30VDC 15A 125VDC 5A 250VDC 1A	120VAC 20A, 2 HP 240VAC 15A, 7.5 HP 480VAC 15A, 7.5 HP 600VAC 15A, 7.5 HP	24/DC or 120/AC Make 30A, Carry 10A, Break 10A 240/AC Make 30A, Carry 10A, Break 5A 125/DC Make 30A, Carry 10A, Break 0.5A	24/DC or 120/AC Make 30A, Carry 10A, Break 10A 240/AC Make 30A, Carry 10A, Break 5A 125/DC Make 30A, Carry 10A, Break 0.5A	24/DC or 120/AC Make 30A, Carry 10A Break 10A 240/AC Make 30A, Carry 10A, Break 5A 125/DC Make 30A, Carry 10A, Break 0.5A	24/DC or 120/AC Make 30A, Carry 10A Break 10A 240/AC Make 30A, Carry 10A, Break 5A 125/DC Make 30A, Carry 10A, Break 0.5A
COIL DATA							
AC—Volts	6 to 480	12 to 240	12 to 600	6 to 240	24 to 120	24 to 240	24 to 240
DC—Volts	6 to 220	12 to 120	—	6 to 125 (250V with series resistor)	24 to 125	24 to 125	24 to 125
Power:	1&2 pole 3 pole						
AC VA	9.8 11	16.7	10 (52 Inrush)	5	1.8W	5	5
DC Watts	2.0 4	4.5	—	1.8 (2.5W @ 125VDC)	1.8	1.8	1.8
GENERAL DATA							
Ambient Temp.:							
AC:	−55°C to +45°C	−45°C to +50°C	−45°C to +50°C	−10°C to +60°C	−20°C to +65°C	−10°C to +45°C AC	−10°C to +45°C
DC:	−55°C to +80°C	−45°C to +70°C	—	—	−10°C to +70°C DC	−10°C to +70°C DC	
Operate Time:	30 ms	50 ms	50 ms	25 ms	As Selected	As Selected	20 ms
Release Time:	15 ms	30 ms	30 ms	20 ms	20 ms	20 ms	As Selected
Life:							
Rated Load	100,000	100,000	100,000	100,000	100,000	100,000	100,000
½ Rated Load	500,000	500,000	500,000	500,000	500,000	500,000	500,000
No Load	10 million	5 million	10 million	10 million	20 million	10 million	10 million
Dielectric Strength	2,500VAC	2,500VAC	2,500VAC	—	—	—	—
OPTIONS	Quick-Connect Term. High Inrush Tungsten Contacts Auxiliary Contacts Perm. Mag. Blowout 130°C Coil	Auxiliary Contacts—Up to Four with 0.25" Quick-Connect Term. Rated 5A	Auxiliary Contacts — Up to 4 Form C Rated 5A at 300VAC Screw Terminals on Main Contacts	Indicator Lamp Manual Actuator Bifurcated Contacts Coil Suppression Perm. Mag. Blowout 130°C Coil Nuclear Qualified	Indicator Lamp Manual Actuator Bifurcated Contacts Perm. Mag. Blowout Fixed Timing	Indicator Lamp Manual Actuator Bifurcated Contacts Magnetic Blowout Fixed Timing Remote Adjust.	Indicator Lamp Manual Actuator Bifurcated Contacts Magntic Blowout Fixed Timing Remote Adjust.
APPROVALS	UL, CSA	UL, CSA	UL	UL, CSA	—	UL, CSA	UL

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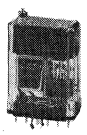
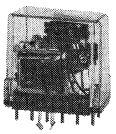
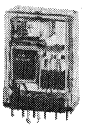
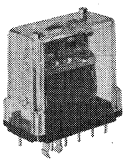
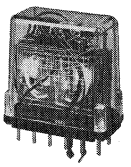
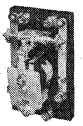
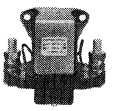
INDUSTRIAL PLUG IN, 5-10 AMP, 2-4 POLE

INDUSTRIAL PLUG IN, 2-5 AMP, 1-2 POLE

SCREW TERMINAL, 2-200 AMP, 1-2 POLE

SERIES	B255	A311	349	112-PGF	RSX1800	C85	102/103
							
DIMENSIONS (L x W x H)	2.625" x 1.469" x 4.563"	2.625" x 1.469" x 3.406"	2.625" x 1.469" x 4.875"	2.625" x 1.469" x 3.625"	2.625" x 1.469" x 3.406"	5.000" x 3.000" x 2.625"	4.250" x 2.656" x 3.000"
FEATURES	• 2 Coil Mechanical Latch • Single Level Socket Wiring • Continuous Duty Coils • Both Coils May Be Energized Simultaneously—No Damage	• Sequence (Stepping) Relay • Single Coil • Contact Transfer on Energizing/De-energizing Stroke of Relay • Single Level Socket Wiring • Continuous Duty Coil	• Over/Undervoltage Sensing Relay • Single Phase or Three Phase • Fixed or Adjustable Differential • Single Level Socket Wiring	• Low Power Design • Withstand 5 to 10 Times Coil Rating • Polycarbonate Cover • Front Removable Cover for Field Adj. • Ground Fault Sensor • Single Level Socket Wiring	• Plug-In Alarm Relay • All Electro-Mechanical Design • Operate from Normally Open or Normally Closed Trouble Contact • Clear Polycarbonate Cover • Sustained or Momentary Alarm • Single Level Socket Wiring	• Heavy Duty Sequence Relay • Positive Action • Front Connected • Any Sequence Up to 12 Steps	• Heavy Duty DC Solenoid Type Contactors • To 200 Amp Switching • Enclosed Contacts
CONTACT DATA							
Form:	2 Form C, 3 Form C or Up to Four Form A/B Combinations	2 Form C	2 Form C or 2 Form A & 2 Form C	Up to 2 Form C	1 Form A and 1 Form C	2 Form A or 1 Form A & 1 Form B	1 Form X
Material:	Sil. Cad. Oxide—Gold Diffused	Sil. Cad. Oxide	Sil. Cad. Oxide—Gold Diffused	Fine Silver	Sil. Cad. Oxide	Fine Silver	Sil. Cad. Oxide
Ratings:							Model 102 / 103
24/DC or 120/AC	30A, 10A, 10A	5A	30A, 10A, 10A	2A	5A	20A	100A / 200A
240/AC	30A, 10A, 10A	—	30A, 10A, 10A	1A	—	20A	100A / 200A
125/DC	30A, 10A, 0.5A	0.1A	30A, 10A, 0.5A	—	—	—	— / —
COIL DATA							
AC—Volts	6 to 240	6 to 240	85 to 135	1 to 225	6, 12, 24, 120	24 to 550	—
DC—Volts	6 to 125 (250V with series resistor)	6 to 125 (250V with series resistor)	0.08 to 21 (125VDC with series resistor)	6, 12, 24, 125	24 to 240	12,24,48	
Power:							
AC VA	5 OP 3 RESET	5	1.8W	Single Pole 0.2 Double Pole 1.0	2.4	18	—
							Model 102 / 103
DC Watts	1.8 OP 1.9 RESET	1.8	—	Single Pole 15mW Double Pole 65mW	2.4	14	10.5 / 13.3
GENERAL DATA							
Ambient Temp.:	−10°C to +60°C	−10°C to +60°C	−10°C to +60°C	−45°C to +65°C	−10°C to +70°C	−45°C to +65°C	−45°C to +65°C
Operate Time:	25 ms	35 ms	20 ms	25 ms max.	50 ms	30 ms	
Release Time:	20 ms	35 ms	25 ms	20 ms	20 ms max.	50 ms	30 ms
Life:							
Rated Load	100,000	100,000	100,000	100,000	500,000	100,000	100,000
½ Rated Load	500,000	500,000	500,000	—	—	—	—
No Load	10 million	5 million	20 million	500,000	20 million	500,000	500,000
OPTIONS	Indicator Lamp Manual Actuator Bifurcated Contacts Magnetic Blowout Coil Suppression Time Delay On Reset Coil	Indicator Lamp Coil Suppression Non-Standard Sequences	Indicator Lamp Bifurated Contacts Magnetic Blowout	Special Pick-up and Drop-out Adjustments Series Coils to 10 Amps	Operate from N.O. Trouble Contact Operate from N.C. Trouble Contact	7, 8, 9, 10, 11 and 12 Tooth Ratchets Available for Special Sequences, Non-Standard Coil Voltages	Other DC Coils AC Operation Form D Contact Form Y Contact
APPROVALS	UL, CSA	UL	—	—	—	—	—

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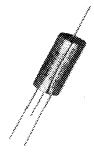
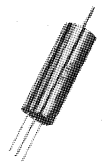
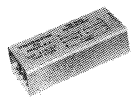
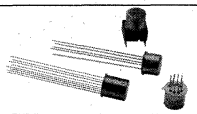
Tel. 803-393-5421 FAX (24 HRS.) 803-393-4123

PRINTED CIRCUIT TERMINAL REED, 0.25-1 AMP, 1-4 POLE

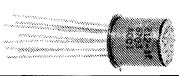
SERIES	MRR-D	MRRQ	MR-Y	MRRK	MRRN	MRR	RR	RRN
								
DIMENSIONS (L x W x H)	0.750" x 0.300" x 0.275"	0.750" x 0.250" x 0.260"	0.950" x 0.400" x 0.312"	1.290" x 0.660" x 0.445"	1.125" x 0.609 x 0.375"	1.062" x 0.425" Dia.	1.875" x 0.655" Dia.	2.500" x 0.740" x 0.641"
FEATURES	• Epoxy Molded • 8 or 14 Pin Designs • 14 Pin DIP Socket Compatible • DTL, TTL and HNIL Compatible • Magnetic Shielding • Low Cost • Form A, Form B or Form C Contacts	• Epoxy Molded—4 Term. Design • 14-Pin Dip Socket Mount (2-Side by Side) • Form A or B Contacts • Magnetic Shielding • DTL, TTL and HNIL Compatible	• Epoxy Molded—End Termination • 0.100 or 0.150 Grid Spacing • Magnetic Shielding • DTL, TTL and HNIL Compatible	• KEL-F Enclosure Ultrasonically Sealed • Magnetic Shielding • 0.1" Grid Spacing • Minimal Switch Stress • Thermal Stability	• Miniature-Open Construction • Magnetic Shielding • 0.1" Grid Terminals • Single Piece, Glass-Filled Nylon Bobbin and Terminal Support • Terminals are Non-Magnetic	• Epoxy Molded—Axial Lead • Magnetic Shielding • Miniature Size	• Epoxy Molded—Axial Lead • Magnetic Shielding • Standard Size	• Standard-Open Construction • Magnetic Shielding • 0.2" Grid Spacing • Single Piece, Glass-Filled Nylon Bobbin and Terminal Support • Terminals are Non-Magnetic
CONTACT DATA								
Form:	1 Form A 2 Form A 1 Form B 1 Form C	1 Form A or 1 Form B	1 Form A to 2 Form C	1 Form A to 3 Form A 2 Form B or 2 Form C	1 Form A to 4 Form A 1 Form C to 3 Form C	1, 2, 4 or 12 Form A	1, 2 or 4 Form A; 1 Form B	1 Form A to 4 Form A 1 Form C to 3 Form C
Material:	Rhodium	Rhodium	Rhodium	Rhodium	Rhodium	Rhodium	Rhodium	Rhodium
Ratings:								
Volts (max)	Form A/B: 100; Form C: 28	100	Form A/B: 200; Form C: 28	Form A/B: 200; Form C: 28	Form A/B: 200; Form C: 28	200	250	Form A/B: 250; Form C: 250
Amps (max)	Form A/B: 0.5; Form C: 0.25	0.5	Form A/B: 0.5; Form C: 0.25	Form A/B: 0.5; Form C: 0.25	Form A/B: 0.5; Form C: 0.25	0.5	1.0	Form A/B: 1.0; Form C: 0.5
Watts (max)	Form A/B: 10; Form C: 3	10	Form A/B: 10; Form C: 3	Form A/B: 10; Form C: 3	Form A/B: 10; Form C: 3	10	15	Form A/B: 15; Form C: 10
COIL DATA								
AC Volts	—	—	—	—	—	—	—	—
DC Volts	5 to 24	5 to 24	5 to 24	6 to 48	6 to 48	6 to 48	6 to 48	6 to 48
Power:								
AC VA	—	—	—	—	—	—	—	—
DC mW	50 to 280	50 to 280	270 (1 Contact) 450 (2 Contacts)	360	189 to 900 depending on No. of Contacts	125 to 1,500 depending on No. of Contacts	400 to 1,500 depending on No. of Contacts	240 to 1,000 depending on No. of Contacts
GENERAL DATA								
Ambient Temp.:	−40°C to +85°C	−40°C to +85°C	−40°C to +85°C	−40°C to +85°C	−40°C to +85°C	−40°C to +85°C	−40°C to +85°C	−40°C to +85°C
Operate Time:	2 ms	1 ms	2 ms	2 ms	5 ms	2 to 10 ms depending on No. of Contacts	2 to 5 ms depending on No. of Contacts	6 ms
Release Time:	2 ms	1 ms	2 ms	1.5 ms	3 ms	1 to 5 ms depending on No. of Contacts	1 to 4 ms depending on No. of Contacts	3 ms
Dielectric (VDC)								
	Form A/B: Form C	Form A/B	Form A/B: Form C	Form A/B: Form C	Form A/B: Form C			
Across Gap	150: 100	150	300: 200	300: 200	400: 250	400	600	500
Contact/Coil	1,500: 1,500	1,500	1,500: 1,500	1,500: 1,500	1,500: 1,500	1,500	1,500	1,500
To Ground	1,500: 1,500	1,500	1,500: 1,500	1,500: 1,500	1,500: 1,000	1,500	1,500	1,500
Insulation Resistance:	1,000 Megohms	1,000 Megohms	1,000 Megohms	1,000 Megohms	1,000 Megohms	1,000 Megohms	1,000 Megohms	1,000 Megohms
Life:			Form A/B: Form C	Form A/B: Form C	Form A/B: Form C			Form A/B: Form C
Rated Load	5 million	5 million	10 mill.: 5 mill.	10 mill.: 5 mill.	10 mill.: 10 mill.	10 million	10 million	10 mill.: 10 mill.
No Load	20 million	20 million	100 mill.: 50 mill.	100 mill.: 50 mill.	200 mill.: 50 mill.	200 million	200 million	200 mill.: 50 mill.
OPTIONS	Suppression Diode Electrostatic Shield 50 MW Coil Sensitivity Magnetic Latch Versions Mercury Switch MIL-Spec. Qualified	Internal Suppression Diode Electrostatic Shield Mercury Switch	Low Power Coils Internal Suppression Diode Electrostatic Shield Mercury Switch	Internal Suppression Diode Electrostatic Shield Mercury Switch	Special Wiring Internal Suppression Diode Electrostatic Shield Mercury Switch Magnetic Latch Version	Pre-Formed Leads Welded Lead Extensions	Pre-Formed Leads Welded Lead Extensions	Special Wiring Internal Suppression Diode Electrostatic Shield Magnetic Latch Version
APPROVALS	UL	—	CSA	—	UL	—	—	—

ENGINEERING SPECIFICATION DATA SUBJECT TO CHANGE. CONTACT FACTORY FOR INFORMATION.
FOR DETAILS ON STRUTHERS-DUNN DISTRIBUTOR-STOCKED RELAYS, REQUEST CATALOG C/1010.



TELEDYNE RELAYS
Military TO-5 Relays

SERIES		CONTACT DATA		COIL DATA			APPLICABLE MIL SPEC. SHEET MIL -R-
		ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC	
411		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	300	39016/7
411D		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	300	39016/23
411DD		1 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 280, 500, 1130, 2000	300	39016/24
411T		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	300	28776/5
412		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	39016/9
412D		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	39016/15
412DD		2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450	39016/20
412T		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	28776/1
431	SENSITIVE	1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	150	39016/10
431D	SENSITIVE	1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	150	39016/25
431DD	SENSITIVE	1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	100, 200, 630, 1025, 2300, 4000, 6500, 11000	150	39016/26
431T	SENSITIVE	1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	150	28776/4
432	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	200	39016/11
432D	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	200	39016/16
432DD	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	64, 125, 400, 850, 1600, 3300, 6500, 11000	200	39016/21
432T	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	200	28776/3
421	MAGNETIC LATCHING	1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290	39016/8
421D	MAGNETIC LATCHING	1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290	39016/27
421DD	MAGNETIC LATCHING	1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	48, 97, 280, 500, 1130, 2000	290	39016/28
420/422	MAGNETIC LATCHING	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290	39016/12
420D/422D	MAGNETIC LATCHING	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290	39016/29
420DD/422DD	MAGNETIC LATCHING	2 FORM C	1	5, 6, 9, 12, 18, 26.5	48, 97, 280, 500, 1130, 2000	290	39016/30



High Current (2 Amperes) Military TO-5 Relays

SERIES	CONTACT DATA		COIL DATA			APPLICABLE MIL SPEC. SHEET MIL -R-
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC	
212	2 FORM C	2	5, 12, 26.5	28, 200, 800	820	–

Commercial/Industrial TO-5 Relays

SERIES		CONTACT DATA		COIL DATA		
		ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC
712		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
712D		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
712TN		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
732	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
732D	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
732TN	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
720/722	MAG LATCH	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290
720D/722D	MAG LATCH	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290

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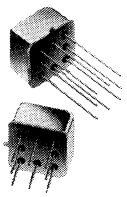
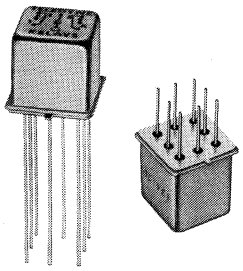


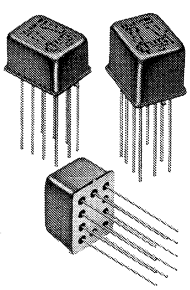


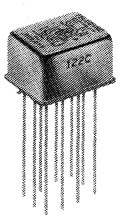
Centigrid® Military Relays

- **General purpose 114 Series**
- **Sensitive 134 Series**

The Centigrid® 114 Series relays are subminiature, hermetically sealed, armature relays featuring low profile, .275" (6.99mm) high by .370" (9.4mm) square, with .100" grid spaced terminals. The sensitive 134 Series is .375" (9.5mm) high and features ultra-low coil power dissipation. Both Centigrids® feature all-welded construction, hermetic sealing, and high force/mass ratios for excellent resistance to environmental extremes. Gold plated precious metal contacts assure reliable switching of loads from dry circuit to 1 ampere. Contact geometry and low intercontact capacitance provide RF switching capability well into the UHF spectrum. The 114 Series and 134 Series are qualified to L, M and P levels of MIL-R-39016.

SERIES	CONTACT DATA		COIL DATA			APPLICABLE MIL SPEC. SHEET MIL -R-
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE	NOMINAL RESISTANCE	NOMINAL OPERATING POWER (mW) AT RATED VDC	
114	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	39016/17
114D	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	39016/18
114DD	2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450	39016/19
134	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200	39016/41
134D	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200	39016/42
134DD	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	64, 125, 400, 800, 1600, 3200, 6500, 11000	200	39016/43





CMOS Compatible Centigrid® Military Relays

- **CMOS compatible general purpose 116C Series**
- **CMOS compatible sensitive 136C Series**
- **CMOS compatible magnetic latching 122C Series**

CMOS compatible Centigrid® relays are subminiature, hermetically sealed, armature relays capable of being directly driven by most IC logic families. Their low profile height and .100" grid spaced terminals, which precludes the need for spreader pads, make them ideal for applications where extreme packaging density and/or close PC board spacing are required. The 116C and 136C Series are qualified to L and M levels of MIL-R-28776 and incorporate internal silicon planar epitaxial type diodes for coil suppression, zener diodes to protect the MOSFET gate inputs, and N-channel enhancement-mode MOSFET chips. The 122C, which incorporates the same interface circuitry as the 116C and 136C, is a magnetic latching relay which is actuated by a short duration voltage pulse. The magnetic "memory" of this device precludes the need for constant bias and or battery backup in the event of system power failure.

SERIES	CONTACT DATA		COIL DATA			APPLICABLE MIL SPEC. SHEET MIL -R-
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC	
116C	2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450	28776/6
136C	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 800, 1600, 3200	200	28776/7
122C	2 FORM C	1	5, 6, 9, 12, 18, 26.5	48, 120, 280, 500, 1130, 2000	335	–

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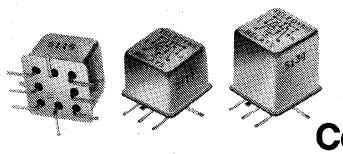
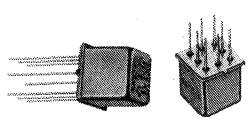


Surface Mount Centigrid® Military Style Relays

- **General purpose S114 Series**
- **Sensitive S134 Series**

Teledyne Relays' S114 and S134 Series are subminiature, hermetically sealed, surface mountable relays, which combine the proven reliability of the Centigrid® Series relays with pre-tinned leads specifically formed in compliance with MIL-STD-454 to make them ideal for all types of surface mount reflow processes. The basic design and internal construction are identical to the 114 & 134 Series Centigrid® relays (as described on Page 2) and meet the requirements of MIL-R-39016.

SERIES	CONTACT DATA		COIL DATA		
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC
S114	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
S114D	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
S114DD	2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450
S134	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200
S134D	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200
S134DD	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	64, 125, 400, 800, 1600, 3200, 6500, 11000	200



Low Cost 172 Series Centigrid® Commercial/Industrial Relays

Low cost commercial versions of the DPDT MIL qualified Centigrid® relays. Hermetic sealing, all welded construction, and gold plated precious metal contacts assure reliable switching of loads from dry circuit to 1 ampere. Contact geometry and low intercontact capacitance provide RF switching capability well into the UHF spectrum.

	GENERIC PART NUMBERS	172-5 172D-5	172-12 172D-12	172-26 172D-26
Coil Voltage (VDC)	Nom.	5.0	12.0	26.5
	Max.	5.8	16.0	32.0
Coil Resistance (ohms ± 20%)		64	400	1600
Pick-up Voltage (VDC, max.) Pulse Operation		3.8	9.0	18.0
Coil Operating Power at Nominal Voltage (Milliwatts)		405	360	440
Diode P.I.V. (VDC, min.) 172D			100	
Negative coil transient (VDC, max.) 172D			2.0	

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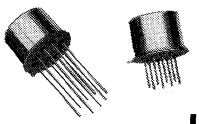

High Environmental Military Style TO-5 Relays

Designed to withstand severe environmental conditions of shock, vibration, or elevated temperature in excess of normal military specification levels. The following versions are available, all of which meet other requirements of MIL-R-39016:

412H Series—High Temperature (200°C)
412K Series—High Shock (4000 g's/0.5ms)
412V Series—High Vibration (380 g's @ 200 Hz)
432H Series—High Temperature (200°C)
432V Series—High Vibration (380 g's @ 200 Hz)
422H Series—High Temperature (200°C)
422K Series—High Shock (2000 g's/0.5ms)

SERIES		CONTACT DATA		COIL DATA		
		ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC
412H		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
412K		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 80, 160, 300, 600, 1350	500
412V		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 70, 155, 235, 610, 1130	525
432H	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
432V	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	80, 120, 240, 480, 950, 1900	370
422H	MAG LATCH	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290
422K	MAG LATCH	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290

RF Relays

- **RF120 Series Military Style Centigrid® Relays**
- **RF170 Series Commercial Centigrid® Relays**

The RF120 and RF170 Series relays are subminiature, hermetically sealed Centigrid® relays featuring extremely low intercontact capacitance that have been optimized to provide exceptional RF performance over the full UHF spectrum. These Series combine microwave switching capability with Teledyne Relays' superior all-welded construction, proven magnetic-latching design, and high force/mass ratios for ruggedness and performance stability in severe environments. Gold plated precious metal contacts ensure reliable DC switching from low-level to ½ amp, as well as low, stable insertion loss.

SERIES	CONTACT DATA			TYPICAL RF DATA AT 1GHZ			COIL DATA		
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	INTERCONTACT CAPACITANCE (pF, TYP.)	ISOL. (dB)	INS. LOSS (dB)	VSWR	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL POWER (mW)
RF120 RF170	2 FORM C	0.5	0.02	45	.15	1.10:1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290

TELEDYNE RELAYS

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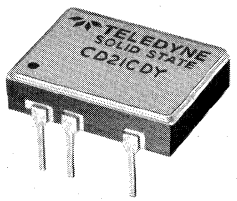
Detailed specifications on any of our products or a complete catalog are available on request.

TELEDYNE SOLID STATE
Military Solid State Relays

CD Series — Low Cost — Short Circuit Protected
Status Indication — Optically Isolated — DC Power FET Output



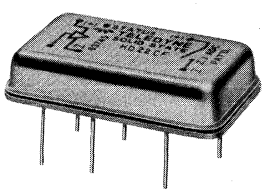
	TELEDYNE PART NUMBER	FEATURES	MAXIMUM LOAD VOLTAGE	MAXIMUM LOAD CURRENT (25°C)
Advance* Information	CD00CD	Basic Solid State Relay (SSR)	60 Vdc	1.75 Adc
	CD01CD	SSR with Status	60 Vdc	1.75 Adc
	CD20CD	SSR with Short Circuit Protection	60 Vdc	1.2 Adc
	CD21CD	SSR with Short Circuit Protection and Status	60 Vdc	1.2 Adc

* Available Early 1990

The CD21CD is the first of a family of low cost military solid state relays with all the features of our standard solid state relays.

- **TTL/CMOS Logic Compatible Control**
- **Integrated Short-Circuit/Current Overload Protection**
- **Status Indication Provides System Built-In-Test Capability**
- **Low Profile Hermetically Sealed Ceramic Package**
- **Meets MIL-STD-704 for 28 Vdc System Surge and Spike Requirements**

HD Series — Short Circuit/Current Overload Protection
True Output Status Feedback — Optically Isolated

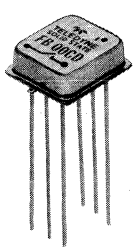


TELEDYNE PART NUMBER	FEATURES	MAXIMUM LOAD VOLTAGE	MAXIMUM LOAD CURRENT (25°C)
HD00CF	Basic Solid State Relay (SSR)	60 Vdc	2.1 Adc
HD02CF	SSR with Output Status	60 Vdc	2.1 Adc
HD20CF	SSR with Short Circuit Protection	60 Vdc	2.1 Adc
HD22CF (88062-001)‡	SSR with Short Circuit Protection and Output Status	60 Vdc	2.1 Adc
HD24CF	SSR with Short Circuit Protection and Short Circuit Trip Status	60 Vdc	2.1 Adc

‡ DESC Selected Item Drawing 88062-001 Pending for HD22CFY

- **TTL/CMOS Logic Compatible Control**
- **Unique Voltage Sense Across Output Gives True Output Status Indication**
- **Integrated Short Circuit/Current Overload Protection**
- **Meets MIL-STD-704 for 28 Vdc System Surge and Spike Requirements**
- **Available with Short Circuit Trip Status (HD24CF)**

FB Series — Bi-directional Power FET Output
Low Leakage — Optically Isolated — Fast Switching Speed



TELEDYNE PART NUMBER	MAXIMUM LOAD VOLTAGE	MAXIMUM LOAD CURRENT (25°C)	LEAKAGE CURRENT @ 25°C	MAXIMUM TURN-ON TIME	MAXIMUM TURN-OFF TIME
FB00FC	±180 Vpk	±800 mA	±200 nA	600 μs	600 μs
FB00KB	±350 Vpk	±250 mA	±200 nA	500 μs	500 μs
FB00CD	± 80 Vpk	± 1.1 A	± 2 μA	800 μs	300 μs

- **Third Output Pin Doubles Load Current Capability**
- **High Voltage Output**
- **Extremely Low Leakage Current**
- **Fast Switching Speeds**
- **Low Profile 6-pin Metal Mini-DIP**

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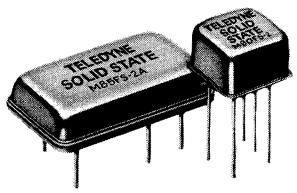
TELEDYNE SOLID STATE
Military Solid State Relays

M90FS/M85FS Series — Short Circuit Protected
Optically Isolated — DC Power FET Output



TELEDYNE PART NUMBER	MAXIMUM LOAD VOLTAGE	MAXIMUM LOAD CURRENT (25°C)	MAXIMUM ON RESISTANCE (100 mA, 25°C)
M90FS-2 (85006-001)‡	60 Vdc	1 Adc	0.3 Ω
M85FS-2	60 Vdc	1.35 Adc	0.3 Ω
M85FS-2A (88061-001)‡	40 Vdc	2.1 Adc	0.15 Ω

‡DESC Selected Item Drawing 85006-001 assigned to M90FS-2Y.
DESC Selected Item Drawing 88061-001 assigned to M85FS-2AY.

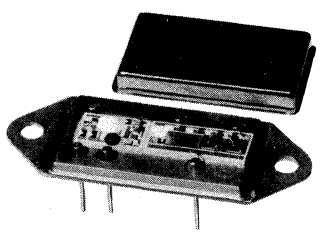
- **Available to DESC Selected Item Drawings**
- **TTL/CMOS Logic Compatible Control**
- **3.8 to 32 Vdc Input Control Range**
- **Meets MIL-STD-704 for 28 Vdc System Surge and Spike Requirements**

These solid state relays provide protection whether switching into a dead short or shorting the output under load.

The M90FS-2 is housed in a low profile Centigrid® package which conserves space in high density packaging applications.

The M85FS series is housed in a metal DIP package which maximizes heat dissipation.

M33 Series — Short Circuit Protected — True Output Status
DC Power FET Output — Up to 10 Amps



TELEDYNE PART NUMBER	FEATURES	MAXIMUM LOAD VOLTAGE	MAXIMUM LOAD CURRENT (25°C)	MOUNTING FLANGES
M33-1	Basic Solid State Relay (SSR)	60 Vdc	5 Adc	Yes
M33C-1N	SSR with Short Circuit Protection	60 Vdc	5 Adc	No
M33C-1	SSR with Short Circuit Protection	60 Vdc	10 Adc*	Yes
M33S-1				
M33C-INS	SSR with Short Circuit Protection and True Output Status	60 Vdc	5 Adc	No
M33C-4NS	SSR with Short Circuit Protection and Short Circuit Trip Status	60 Vdc	5 Adc	No
M33C-1S	SSR with Short Circuit Protection and True Output Status	60 Vdc	10 Adc*	Yes

* with heatsink

- **TTL/CMOS Compatible Control**
- **Optically Isolated**
- **Integrated Short Circuit/Current Overload Protection**
- **True Output Status Indication**
- **Meets MIL-STD-704 for 28 Vdc System Surge and Spike Requirements**
- **Available with Short Circuit Trip Status**
- **Low Profile 22-pin Hermetic Case**

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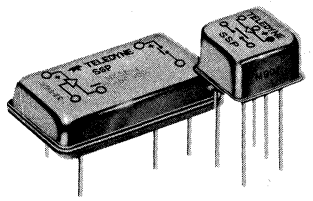
TELEDYNE SOLID STATE
Military Solid State Relays

M85F/M90F Series — AC/DC Power FET Output — Optically Isolated

- **Available to DESC Selected Item Drawings**
- **TTL/CMOS Logic Compatible Control**
- **3.8 to 32 Vdc Input Control Range**

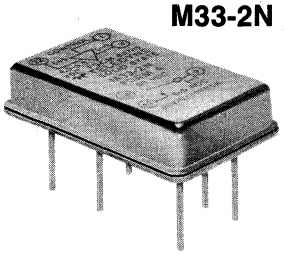


- **Meets MIL-STD-704 28 Vdc Surge and Spike Requirements**

Patent Pending

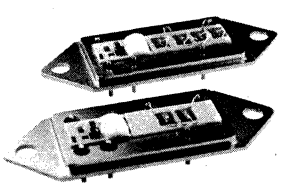
TELEDYNE PART NUMBER	MAXIMUM LOAD VOLTAGE	MAXIMUM LOAD CURRENT (25°C)	ON RESISTANCE TYP. (OHMS)
M90F-1	60 Vdc	0.56 Adc	0.6
M90F-2	60 Vdc	1.0 Adc	0.3
M91F-1	±60 Vpk	0.4 Arms	1.2
M91F-2	±60 Vpk	0.7 Arms	0.6
M85F-1	60 Vdc	0.75 Adc	0.6
M85F-2	60 Vdc	1.35 Adc	0.3
M86F-1	±60 Vpk	0.54 Arms	1.2
M86F-2	±60 Vpk	0.95 Arms	0.6
M93F-1	100 Vdc	0.35 Adc	4
M93F-2	400 Vdc	0.135 Adc	25
M92F-1	±400 Vpk	0.09 Arms	50
M92F-2	±200 Vpk	0.18 Arms	20
M92F-3	±100 Vpk	0.24 Arms	8
M85VF-1	60 Vdc	0.75 Adc	0.6
M85VF-2	60 Vdc	1.35 Adc	0.3
M85F-2A	60 Vdc	2.1 Adc	0.15

M33-2N — High Current Pulse/Squib Fire Capability



- **Up to 100 A Pulse Load Capability**
- **6.5 Adc Continuous at 25°C**
- **Low ON Resistance (75 mΩ)**
- **80 Vdc Blocking Power FET Output**
- **Fast Switching Speed**
- **Transformer Isolated**

M30/M31 Series — Single Pole Double Throw AC/DC Power FET Output — Optically Isolated



- **TTL/CMOS Logic Compatible Control**
- **SPDT Break-Before-Make**
- **Low ON Resistance (0.15Ω)**

TELEDYNE PART NUMBER	MAXIMUM LOAD VOLTAGE	MAXIMUM LOAD CURRENT (25°C)*
M30-1	±80 Vpk	4.1 Arms
M30-2	±160 Vpk	2.6 Arms
M30-4	±320 Vpk	1.3 Arms
M31-1	80 Vdc	4.8 Adc
M31-2	160 Vdc	3.0 Adc
M31-4	320 Vdc	1.5 Adc
M31-1A	80 Vdc	8.2 Adc
M31-2A	160 Vdc	5.2 Adc
M31-4A	320 Vdc	2.6 Adc

* with 2°C/W heatsink

The M30 & M31 are military style SPDT high power bi-directional solid state relays, packaged in a 22-pin low profile hermetic case. The relays are optically isolated to protect delicate input logic circuits from output voltage transients. The control line is directly compatible with CMOS and TTL logic.

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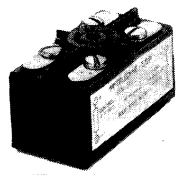
TELEDYNE SOLID STATE
Military Solid State Relays

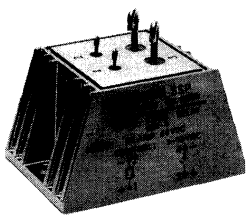
602/M02 10 A/250 Vac — Optically Isolated

• TTL Logic Compatible Input • Zero Voltage Turn-on • DESC Drawing 86031-001 (602-1Y)



TELEDYNE PART NUMBER	CONTROL VOLTAGE RANGE	MAXIMUM LOAD VOLTAGE		MAXIMUM LOAD CURRENT (25°C)
		CONTINUOUS Vac	TRANSIENT PEAK	
602-1/M02-1	3.8-32 Vdc	250	460	10 Arms
602-21	90-250 Vac	250	460	10 Arms

652 Series — AC Output — Qualified to MIL-R-28750 — Up to 35 A
653 Series — DC Output — TTL Compatible Input — Up to 30 A



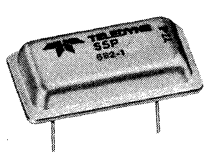
TELEDYNE PART NO.	CONTROL VOLTAGE RANGE	MAXIMUM LOAD VOLTAGE	MAXIMUM LOAD CURRENT (25°C)*
652-1 (M28750/10-001)	4-32 Vdc	250 Vac	25 Arms
652-2 (M28750/10-002)	4-32 Vdc	250 Vac	25 Arms
652-3	4-32 Vdc	250 Vac	35 Arms
653-1	3-16 Vdc	50 Vdc	25 Adc
653-4	16-32 Vdc	80 Vdc	20 Adc
653-5 (88049-001)‡	16-32 Vdc	50 Vdc	30 Adc

652 Series — Patent #4,339,670

*with heatsink ‡DESC Selected Item Drawing 88049-001 assigned to 653-5Y

682/683 AC and DC Solid State DIP Relays
Optically Isolated — Qualified to MIL-R-28750

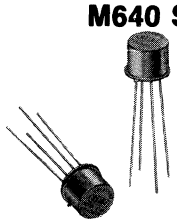
• TTL Logic Compatible Input • Low Profile Metal DIP Package



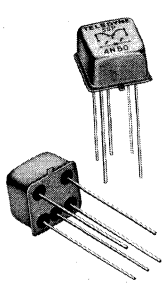
TELEDYNE PART NUMBER	CONTROL VOLTAGE RANGE	MAXIMUM LOAD RATING (25°C)
682-1 (M28750/9)	3.8-32 Vdc	2A* 250 Vac (40-440 Hz)
683-1 (M28750/8)	3-15 Vdc	600mA/50 Vdc

*with heatsink; 1 A without heatsink

M640 Series — Qualified to MIL-R-28750 — Fast Switching Speed



TELEDYNE PART NUMBER	MILITARY PART NUMBER	MAXIMUM LOAD RATING (@ MAX. INPUT VOLTAGE)
M640-1W	M28750/5-001	±40V/50 mApk (Bi-directional)
M643-1W	M28750/6-001	40 Vdc/250 mA
M643-2W	M28750/7-001	250 Vdc/100 mA



4N50 ISOcube® Military Opto-Isolator
Hermetically Sealed — High Isolation

Packaged in a low profiled hermetically sealed case, .275" (6.98mm) high by .370" (9.4mm) square, with pin-out on .100" grid centers for ease of pc board layout. The miniature 4N50 provides the highest input/output isolation available in a military style optical isolator.

PERFORMANCE FEATURES	
Isolation	1500 Vrms
Transfer Ratio	140% min.
Output Voltage	40V min.

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TELEDYNE SOLID STATE

Commercial/Industrial Solid State Relays

Subminiature Solid State Relays in Standard DIP Packages

Features all solid state circuitry with hybrid microcircuit construction, and high input/output isolation (up to 2500 Volts/10^9 Ohms). Fourteen models available providing choice of output: bi-directional, AC (zero or non-zero switch) and DC. The 640 Series, 643 Series and C46/47 Series are direct pin-for-pin replacements for standard TO-116 DIP reed relays.

- **641/645 Series and 645V-2H are UL recognized (File #55197) and CSA certified (File #31043)**
- **645V-2H is VDE approved to VDE 0883/6.80**
- **645 Series meets VDE and FCC Class A conducted emission limits**
- **C46/C47, and 645 Series are patented**

TELEDYNE PART NUMBER	CONTROL RATINGS		ISOLATION	MAXIMUM LOAD RATINGS			
	VOLTAGE (Vdc)	MAXIMUM CURRENT (mAdc @ 5v)	TRANSFORMER/ OPTICAL	TYPE (AC/DC)	CURRENT @ MAXIMUM INPUT VOLTAGE	VOLTAGE CONTINUOUS	VOLTAGE TRANSIENT (PEAK)
640-1	4-10	22	Transformer	Bi-directional	±80 mA	±50 Vpk	±50 Vpk
641-1	4-10	16	Transformer	AC	0.5 A	140 Vrms	200 Vpk
641-2	4-10	16	Transformer	AC	0.5 A	250 Vrms	400 Vpk
643-1	3.8-10	15	Transformer	DC	400 mA	60 Vdc	60 Vdc
643-2	3.8-10	15	Transformer	DC	100 mA	250 Vdc	250 Vdc
643-3	3.8-10	15	Transformer	DC	600 mA	130 Vdc	130 Vdc
645-1	3.8-32	12	Optical	AC	1 A	140 Vrms	200 Vpk
645-2	3.8-32	12	Optical	AC	1 A	250 Vrms	400 Vpk
645-2H	3.8-32	12	Optical	AC	1 A	250 Vrms	550 Vpk
645V-1	3.8-32	15.5	Optical	AC	1 A	140 Vrms	200 Vpk
645V-2	3.8-32	15.5	Optical	AC	1 A	250 Vrms	400 Vpk
645V-2H	3.8-32	15.5	Optical	AC	1 A	250 Vrms	550 Vpk

Serendip Power FET Relays

C46F-1	3.8-32	12	Optical	Bi-directional	250 mA	±100 Vdc	±100 Vdc
C46F-2	3.8-32	12	Optical	Bi-directional	200 mA	±200 Vdc	±200 Vdc
C46F-3	3.8-32	12	Optical	Bi-directional	100 mA	±400 Vdc	±400 Vdc
C47F-1	3.8-32	12	Optical	DC	350 mA	100 Vdc	100
C47F-2	3.8-32	12	Optical	DC	140 mA	400 Vdc	400

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TELEDYNE SOLID STATE

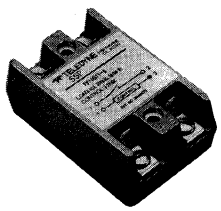
Commercial/Industrial Solid State AC Power Relays

601 Series — Optically Isolated, Zero Voltage Turn-On 5 and 10 Amps

UL Recognized — File #E59547
CSA Certified — File #31043

CONTROL VOLTAGE RANGE	MAXIMUM LOAD VOLTAGE		MAXIMUM LOAD CURRENT RATING & PART NUMBERS	
	CONTINUOUS Vrms	TRANSIENT Vpk	5 A	10 A
3-32 Vdc	250	500	601-1	601-2
	250	600	601-1H	601-2H

611 Series — Optically Isolated, Zero Voltage Turn-On 10 to 40 Amps

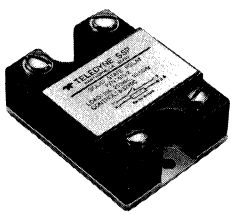


UL Recognized — File #E55197
CSA Certified — File #31043
(611-11 thru 611-16)

CONTROL VOLTAGE RANGE	MAXIMUM LOAD VOLTAGE		OUTPUT CURRENT RATING & PART NUMBERS			
	CONTINUOUS (RMS)	TRANSIENT (PEAK)	10 A	15 A	25 A	40 A
3-28 Vdc	140	200	611-7*	611-3	611-1	611-5
	250	400	611-8*	611-4	611-2	611-6
	250	600	611-8H*	611-4H	611-2H	611-6H
90-250 Vac (47-70 Hz)	140	200	611-17	611-13	611-11	611-15
	250	400	611-18	611-14	611-12	611-16
	250	600	611-18H	611-14H	611-12H	611-16H

*Available in N/C (Form B) configuration, with "B" suffix (e.g., 611B-7).

C15, 615, 615 V Series — Optically Isolated, Zero Voltage Turn-On 10, 25, and 40 Amps



615 Series

CSA Certified
File #31043

UL Recognized
File #E55197

615V Series

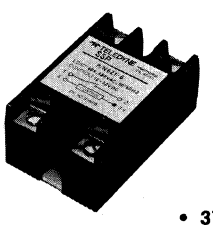
VDE Approved
TO 0806/8.81

- **TTL Logic Compatible Input**
- **High Dielectric Isolation**
- **VDE/UL/CSA Version Available**

Control	OUTPUT (LOAD) CURRENT RATING & PART NUMBER			MAXIMUM LOAD VOLTAGE	
	10 A	25 A	40 A	CONTINUOUS (RMS)	TRANSIENT (PEAK)
3-32 Vdc (615) 3.8-32 Vdc (615V)	615-1	615-3	615-5	140	200
	615-2	615-4	615-6	250	400
	615-2H 615V-2H*	615-4H 615V-4H*	615-6H 615V-6H*	250	600
3.8-32 Vdc	C15DS-V-AR44-25 (25 A)			440	800
	C15DS-V-AR44-40 (40 A)			440	800

*615V models meet VDE creepage and dielectric strength requirements.

621 Series — High Voltage, Optically Isolated, Zero Voltage Turn-On



- **CSA Certified File #31043 (621-1 thru 621-6)**
- **UL Recognized File #E55197 (621-1 thru 621-6)**
- **3750 Vrms Isolation**
- **High Voltage Output 480 Vrms, 800 Vpk**

Designed to meet safety requirements of UL, CSA, VDE and IEC and dielectric requirements of VDE.

CONTROL VOLTAGE RANGE	MAXIMUM LOAD CURRENT RATING & PART NUMBERS		
	15 A	25 A	40 A
3-14 Vdc	621-1*	621-3*	621-5*
12-32 Vdc	621-2*	621-4*	621-6*
90-250 Vac (45-70 Hz)	621-11	621-13	621-15

*Available in N/C (Form B) configuration — Order e.g. 621B-1).

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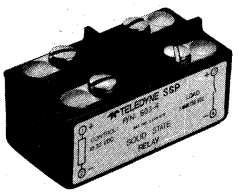
TELEDYNE SOLID STATE

Commercial/Industrial Solid State DC Power Relays

603 Series — Optically/Transformer Isolated



MAXIMUM LOAD CURRENT RATING AND PART NUMBERS		CONTROL VOLTAGE RANGE	ISOLATION	MAXIMUM LOAD VOLTAGE
2 Adc	5 Adc			
603-1	603-2	3-32 Vdc	Optical	50 Vdc
603-21*	603-22*	3-32 Vdc	Optical	50 Vdc
—	603-3	4-10 Vdc	Transformer	250 Vdc
—	603-4	10-32 Vdc	Transformer	250 Vdc
603-11	603-12	90-250 Vac	Optical	50 Vdc

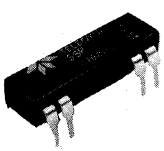
*** Note: 603-21, -22 have controlled rise and fall time.**

613 Series — High Current, DC, Transformer Isolated

TELEDYNE PART NUMBER	CONTROL VOLTAGE RANGE	MAXIMUM LOAD VOLTAGE	MAXIMUM LOAD CURRENT
613-1	4-10 Vdc	50 Vdc	20 Adc
613-2	10-32 Vdc		

Solid State Computer Input/Output Interface Modules

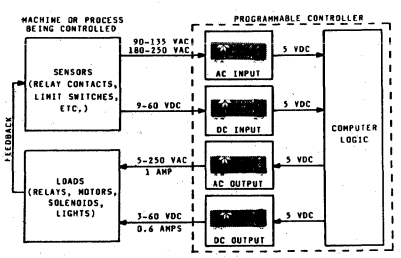
C76 Hybrid DIP I/O™ System
Optically Isolated — TTL/CMOS Logic Compatible Input



- **Enable Function on Inputs**
- **High Noise Immunity**
- **Meets VDE Voltage and Spacing Requirements**
- **TO-116 DIP Package (16 pin)**

PART NUMBER	TYPE	CHARACTERISTICS
C76AO-1	AC Output	3.8-16 Vdc Input 5-250 Vrms, 1 A Output
C76AI-1	AC Input	90-135 Vrms and 180-250 Vrms Inputs
C76DO-1	DC Output	3.8-16 Vdc Input 3-60 Vdc, 0.6 A Output
C76DI-1	DC Input	9-60 Vdc Input

C76 HYBRID I/O INTERFACE SYSTEM



Teledyne Solid State C76 DIP I/O™ Modules are designed for use in computerized control systems for noise-free isolated interfacing of computer logic elements to harsh industrial environments. Modules employ custom microcircuits in a TO-116 DIP. Eliminates mounting tracks for low "per-point" cost. Meets VDE requirements. Features CMOS and TTL compatibility, optical isolation, high noise immunity and an ENABLE function on input modules. For use in robotics, computerized process control, machine tool control, programmable controllers and ATE.

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Detailed specifications on any of our products or a complete catalog are available on request.

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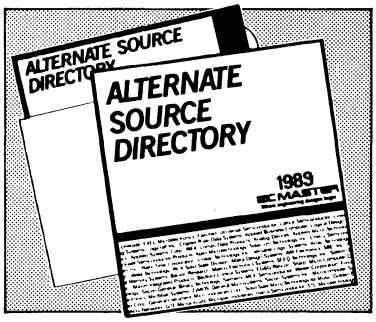

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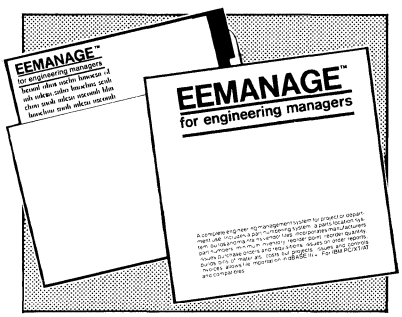

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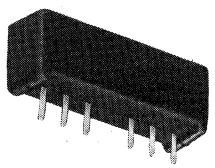
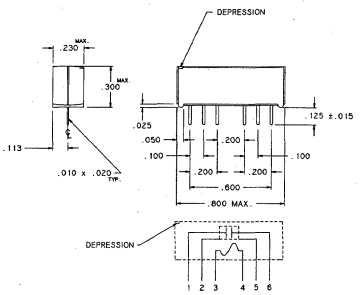
WABASH MAGNETICS – The Reed Relay Specialist

805 SERIES



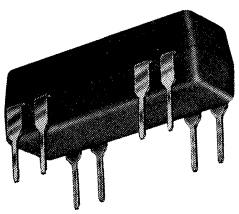


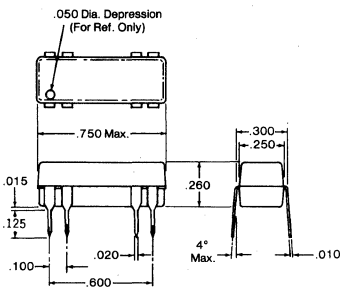
SPECIFICATIONS – Contact Ratings (Maximum Form A) – **Voltage:** 200 VDC. **Current (Switch):** 0.5 Amps. **Current (Carry):** 1 Amp. **Power (DC):** 10 Watts. **Power (AC Suppressed):** 15 Volt-Amperes. **Resistance (Initial):** 200 Milliohms. **Peak Breakdown Voltage:** 250 VDC. **Operate Time:** 0.5 mSec. **Max Release Time:** 0.5 mSec Max. **Operating Parameters – Temperature** −40°C to +85°C. **Shock:** 100G Max. 8 ±1 mSec. 1/2 Wave. **Insulation Resistance:** 10^{10} ohms min. **Capacitance:** 0.2 picofarad. **Nominal Coil Voltage:** 5/6, 12/15. **Must Operate Voltage:** 3.8, 9.6. **Must Release Voltage:** 0.5, 1.0. **Physical Characteristics – Contact Configuration:** 1A. **Environmental Protection:** Enclosed for extended life and cleaning.

Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A SPST NO	5/6	19	500	805-101
	12/15	24	800	805-102

E.S.S. Added for 50 ohm transmission line switching.

815 SERIES

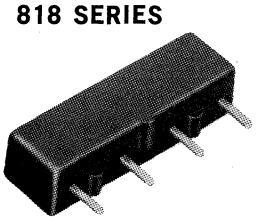


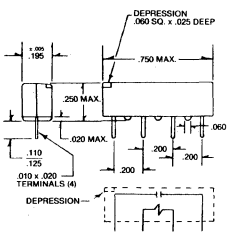


The 815 Series, offers increased versatility while maintaining the DIP package approach to hi-density printed circuit applications. Standard part numbers listed are subject to specifications shown for the 805 Series. The 815 has the capacity to offer dry reed switches to ½ Amp rating plus up to a 200 VDC max. switching voltage. Optional features include diode suppression, magnetic shielding and electrostatic shielding.

Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	14	200	815-101-014
	5/6	19	500	815-102-014
	12/15	19	500	815-103-014
	24	40	2150	815-104-014
2A	5/6	14	200	815-201-014
	12/15	19	500	815-202-014
	24	38	2000	815-203-014
1B	5/6	7	200	815-221-014
	12/15	16	500	815-222-014
	24	32	2000	815-223-014
1C	5/6	8	80	815-241-014
	12/15	19	500	815-242-014
	24	38	2000	815-243-014

818 SERIES

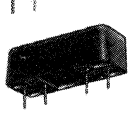


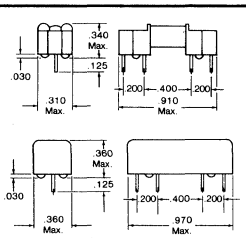


SPECIFICATIONS—Contact Ratings (Maximum Form A)—**Voltage:** 200 VDC. **Current (Switch):** 0.5 Amps. **Current (Carry):** 1 Amp. **Power (DC):** 10 Watts. **Power (AC Suppressed):** 15 Volt-Amperes. **Resistance (Initial):** 200 Milliohms. **Peak Breakdown Voltage:** 250 VDC. **Operate Time:** 0.5 mSec. **Max. Release Time:** 0.5 mSec Max. **Operating Parameters — Temperature** −40°C to +85°C. **Shock:** 100G Max. 8 ±1 mSec. 1/2 Wave. **Insulation Resistance:** 10^{10} ohms min. **Capacitance:** 0.2 picofarad. **Nominal Coil Voltage:** 5/6, 12/15. **Must Operate Voltage:** 3.8, 9.6. **Must Release Voltage:** 0.5, 1.0. **Physical Characteristics—Contact Configuration:** 1A **Environmental Protection:** Enclosed for extended life and cleaning.

Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A SPST NO	5/6	19	500	818-101
	12/15	24	800	818-102

802/803 SERIES

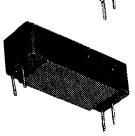


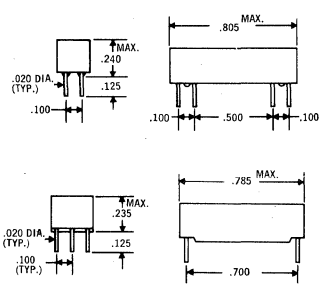


The 802 and 803 are sub-miniature reed relays in a Single-Inline package. They are both available in a 1 Form A configuration and are P.C. mountable. Contact ratings of 200 volts DC with total power handling of 10 watts is standard.

Contact Form	Nominal Voltage	Coil Resistance ±10%▲	Part Number
1A	5/6	500	802-101
	12/15	500	802-102
	24	2000	802-103
	5/6	125	802-104
Enclosed 1A	5/6	500	803-101
	12/15	500	803-102
	24	2000	803-103
	5/6	125	803-104

SUB-MINIATURE RR 804/806 SERIES



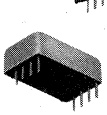


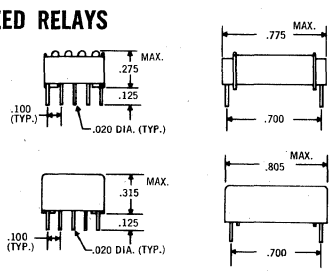
The 804 and 806 sub-miniature reed relays come in a 1 Form A configuration. Both relays are P.C. mountable and are completely enclosed for environmental protection, extended life and easy cleaning. Call Wabash Magnetics for complete details.

SPECIFICATIONS – Contact Ratings: (max.) 200 VDC, 0.5 Amp (switching), 1.0 Amp (carry), 10 Watts DC, 15 V-A (AC suppressed), 250 Volts peak breakdown, 200 milliohms max. initial contact resistance. **Temperature:** +85°C to −40°C. **Shock:** 30 G max., 11 ±1 mSec. **Vibration:** 10 G max. @ 0 to 1700 Hz. **Insulation Resistance:** 10^{10} ohms min. **Capacitance:** 0.5 pf. **Life Expectancy:** 100 x 10^6 operations at dry ckt.; 50 x 10^6 operations at signal levels; 20 x 10^6 operations at rated load.

Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	8	60	804-101
	12/15	18	370	804-102
	24	27	950	804-103
1A	5/6	12	500	806-101
	12/15	24	1200	806-102
	24	38	2000	806-103

SUB-MINIATURE DRY REED RELAYS 807/808 SERIES





Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1B†	5/6	8	200	807/808-211
	12/15	16	800	807/808-212
	24	32	2000	807/808-213
1C† *	5/6	8	125	807/808-316
	12/15	16	500	807/808-317
	24	32	2000	807/808-318

Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	13	350	807/808-101
	12/15	24	1200	807/808-102
	24	39	3200	807/808-103
2A	5/6	10	200	807/808-201
	12/15	20	800	807/808-202
	24	32	2000	807/808-203

* (1A1B guarantee break-before-make)

Contact Forms Available: 1, 2, 3 Pole. Forms A, B, & C.

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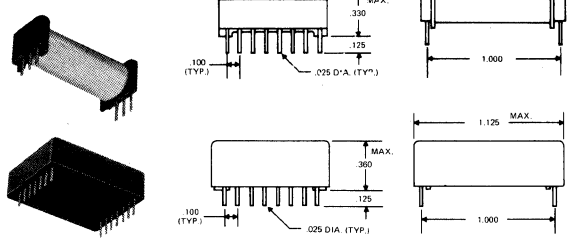
WABASH MAGNETICS – The Reed Relay Specialist

MINIATURE DRY REED RELAYS 827/828 SERIES



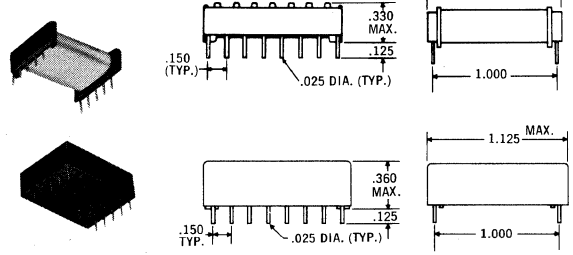
Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number	Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	22	500	827/828-101	1B†	5/6	8	200	827/828-211
	12/15	28	800	827/828-102		12/15	16	800	827/828-212
	24	44	2000	827/828-103		24	32	2000	827/828-213
2A	5/6	14	200	827/828-201	1C†	5/6	8	60	827/828-316
	12/15	29	800	827/828-202		12/15	16	240	827/828-317
	24	46	2000	827/828-203	*	24	32	960	827/828-318

* (1A1B guarantee break-before-make)

Contact Forms Available: 1, 2, 3, 4, & 6 Poles. Forms A, B, & C including magnetic latchers.

SPECIFICATIONS — Contact Ratings: (max.) 200 VDC, 150 VAC, 0.5 Amp (switching), 3 Amp (Carry), 10 Watts DC, 25 V-A (AC suppressed), 300 Volts peak breakdown, 200 milliohms max. initial contact resistance. **Temperature:** −40°C to +85°C. **Shock:** 30 G max., 11 ±1 mSec. **Vibration:** 10 G max. @ 0 to 1700 Hz. **Insulation Resistance:** 10^9 Ohms min. **Capacitance:** 0.5 pf. **Life Expectancy:** 100 x 10^6 ops @ dry ckt.; 50 x 10^6 ops @ signal levels; 20 x 10^6 ops @ rated load.

MINIATURE DRY REED RELAYS 837/838



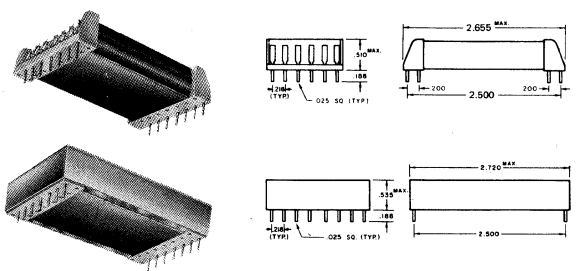
Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number	Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	22	500	837/838-101	1B†	5/6	8	200	837/838-211
	12/15	28	800	837/838-102		12/15	16	800	837/838-212
	24	44	2000	837/838-103		24	32	2000	837/838-213
2A	5/6	14	200	837/838-201	1C†	5/6	8	60	837/838-342
	12/15	29	800	837/838-202		12/15	16	240	837/838-343
	24	46	2000	837/838-203	*	24	32	960	837/838-344

* (1A1B guarantee break-before-make)

Contact Forms Available: 1, 2, 3, 4, & 6 Pole. Forms A, B, & C including magnetic latchers.

SPECIFICATIONS — Contact Ratings: (max.) 200 VDC, 150 VAC, 0.5 Amp (switching), 3 Amp (carry), 10 Watts DC, 25 V-A (AC suppressed), 300 Volts peak breakdown, 200 milliohms max. initial contact resistance. **Temperature:** −40°C to +85°C. **Shock:** 30 G max., 11 ±1 mSec. **Vibration:** 10 G max. @ 0 to 1700 Hz. **Insulation Resistance:** 10^9 Ohms min. **Capacitance:** 0.5 pf. **Life Expectancy:** 100 x 10^6 ops @ dry ckt.; 50 x 10^6 ops @ signal levels; 20 x 10^6 ops @ rated load.

STANDARD REED RELAYS 842/843 SERIES



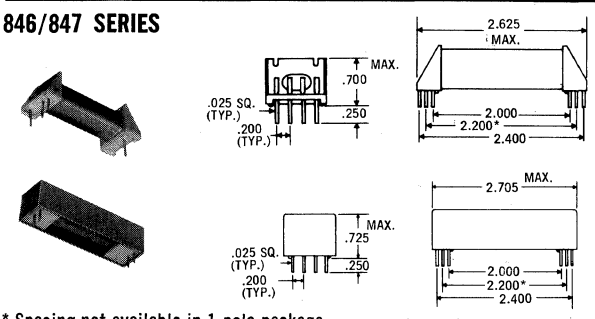
Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number	Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	22	150	842/843-101	1B†	5/6	9	100	842/843-209
	12/15	45	600	842/843-102		12/15	18	400	842/843-211
	24	90	2400	842/843-103		24	36	1600	842/843-213
	48	175	9000	842/843-104		48	72	6400	842/843-215
2A	5/6	20	100	842/843-201	1C†	6	9	100	842/843-311
	12/15	41	400	842/843-202		12	18	400	842/843-315
	24	82	1600	842/843-203	*	24	36	1600	842/843-319
	48	165	6400	842/843-204		48	72	6400	842/843-323

* (1A1B guarantee break-before-make)

Contact Forms Available: 1, 2, 3, 4, 5, 6, 8, & 12 Pole. Forms A, B, & C including magnetic latchers.

SPECIFICATIONS — Contact Ratings: 400 VDC, 250 VAC, 1.5 Amp (switching) 6 Amp (carry), 25 Watts, 40 V-A (AC suppressed) 50 milliohm max. initial contact resistance 500 volts peak breakdown. **Temperature:** −40°C to +85°C. **Shock:** 30 G max., 11 ±1 mSec. **Vibration:** 10 G max.@ 0-1700 Hz. **Insulation Resistance:** 10^9 Ohms min. **Capacitance:** 1.5 pf. **Life Expectancy:** Dry ckt., 100 x 10^6 ops; signal level, 50 x 10^6 ops; rated power, 20 x 10^6 ops.
Available to 12 form A. True form C also available.

846/847 SERIES



Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number	Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	22	150	846/847-101	1B†	5/6	9	100	846/847-209
	12/15	45	600	846/847-102		12/15	18	400	846/847-211
	24	90	2400	846/847-103		24	36	1600	846/847-213
	5/6	20	100	846/847-201					
2A	12/15	41	400	846/847-202					
	24	82	1600	846/847-203					

Contact Forms Available: 1 & 2 Pole. Forms A, B, & C including magnetic latchers.

SPECIFICATIONS — Contact Ratings: 400 VDC, 250 VAC, 1.5 Amp (switching) 6 Amp (carry), 25 Watts, 40 V-A (AC suppressed) 75 milliohm max. initial contact resistance 500 volts peak breakdown. **Temperature:** -∘40°C to +85°C. **Shock:** 30 G max., 11 ±1 mSec. **Vibration:** 10 G max. @ 0-1700 Hz. **Insulation Resistance:** 10^9 Ohms min. **Capacitance:** 1.5 pf. **Life Expectancy:** Dry ckt., 100 x 10^6 ops; signal level, 50 x 10^6 ops; rated power, 20 x 10^6 ops.
True form C also available.

* Spacing not available in 1 pole package.

The relays shown here are just a sampling of the many designs and configurations manufactured by Wabash Magnetics as standard products. We also offer design assistance and custom designed relays through our fully staffed engineering department. Should you require a custom designed relay, here are some parameters to consider:

U.L. and C.S.A. Recognition

Several relay series are recognized under the Component Program of Underwriters' Laboratories. Most of these relays also have C.S.A. recognition. Regardless of which series you are interested in, Wabash can help you obtain the U.L. or C.S.A. recognition your design requires.

Wabash Magnetics
1st & Webster Streets, Wabash, Indiana 46992
(219) 563-2191 TWX: 810-290-2722 FAX: 219-563-1652

Prints and specifications, if available, are the best design tool. The minimum information required for Wabash to design a relay is:

Mechanical Specifications

- Maximum length
- Maximum width
- Maximum height above P.C. board
- Pin configuration
- Open or covered
- Type of environment relay will be exposed to
- End Use

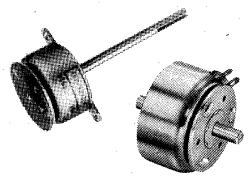
Electrical Specifications

- Switch configuration
- Nominal voltage
- Must operate voltage or current
- Must release voltage or current
- Coil resistance
- Switching current
- Contact resistance
- Carry current
- U.L. recognition required
- Special considerations (ESS, low thermal, high insulation resistance, etc.)

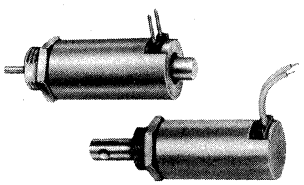
Lucas Ledex

Solenoids

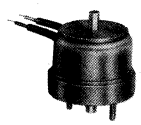
Over 400 choices of standard solenoid designs are available off-the-shelf. But, if none of these meet your unique requirements, we'll provide you with custom engineered prototypes fast. Either way, Lucas Ledex Inc. offers you the widest variety of solenoids for your design. Request solenoid catalog.



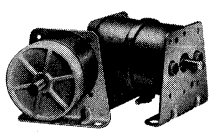
Rotary Solenoids
Step-turn-index-lock-punch-lift. For millisecond-fast, high torque and endurance, specify a Lucas Ledex rotary solenoid. Nine basic sizes, right or lefthand strokes from 10 to 110 degrees. Torque output to 117 pound-inches. Life of over 100 million cycles with endurance engineered models. Four standard sizes of Magton rotary solenoids produce high torque with no axial displacement. Standard angular strokes: 60°, 45°, and 30°, either CW or CCW. Can be modified. Long operating life: 100 million cycles.



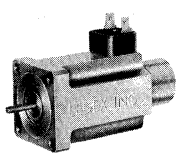
Linear Solenoids
Short-medium-long strokes are all available from one source—Lucas Ledex Inc. Choose our low profile flat face push/pull for high force/short stroke, our low profile conical face push/pull for medium force/stroke, and our tubular solenoids for long strokes. New Series 20 tubular solenoids provide 50 million actuations, quiet operation, push or pull, and economy—available from stock. Rugged construction provides accurate repeatability after long usage. Our tubular solenoids have built-in impact cushions to absorb energy at the end of the stroke and electroless nickel plated plungers for longer life.



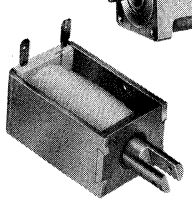
Magnetic Latching Solenoids
Magnetic latching solenoids use permanent magnets coupled with conventional rotary, tubular, low profile, or open frame solenoids, to hold the plunger in an open or closed position without current drain. A momentary pulse releases the latch. Memory is retained during power loss.



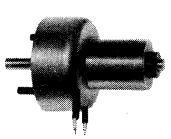
Stepping Solenoids
Step 10-15-20 or 30 degrees with the highest torque in a stepping solenoid—the Series 50-L. Square wave pulse drives either the unidirectional or bidirectional model for 10,000,000 steps with a non-accumulative accuracy of ± 1°. Direct couple for mechanical ease and avoid linkages. Can be manually overridden in case of power failure.



Proportional Solenoids
Open loop/closed loop, variable position sensing is now possible by using our proportional solenoid with our controller for smooth, accurate response. Hydraulic systems can use our wet plunger type which requires no dynamic seals and provides up to 50 pounds force. Do away with pilot stages and expensive servo valves.



Open Frame Solenoids
TDS Series open frame solenoids for large volume OEM applications are available at competitive prices in 34 standard configurations. Lucas Ledex D-Frame solenoids are dependable and reliable. Eight standard models are available from stock with strokes up to 1.25". Quick connect terminals and class "B" coils are standard.



Soft Shift® and Custom Designed Solenoids
Soft Shift solenoids give variable speed control, from snap action to quiet variability. Variable positioning with electronic control.
Typical custom designed solenoids include dot matrix and printhammer models.

Request complete line solenoid catalog.

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Call 513-898-3621
FAX: 513-898-8624

For the name of your nearest Lucas Ledex representative, call toll free 1-800-999-0009. (in Canada 1-800-344-7788)

SOLENOIDS

Manufacturer	Starting EEM Page No.	Model/Series	Linear			Rotary	Proportional (Servo)	Stepping	
			Frame Type						
			C	D	Tubular			Unidirectional	Bidirectional
Bicron	B•1657		√		√	√			
Deltrol Controls	B•1658	C1, C2, C3, C6, C7, C8, C9 MED D11, D22, D28, D2, D3HD, D4, D4HD	√	√	√				
Electro-Mechanisms	B•1662	SP; PO SP-100; PO-100 TSP; TPO30-55	√ √		√				
Electronic Specialty	B•1664				√	√			
Liberty Controls	B•1665	L	√	√	√				
Lucas Ledex Inc.	B•1666			√	√	√	√	√	√
Regdon	B•1670	5U5, 5U7 R7X9, R8X7, R8X12 GRFY+AW 809, 827, 930	√	box	√		√		

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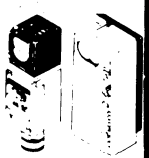
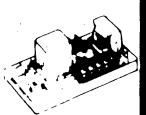
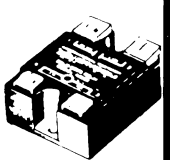

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

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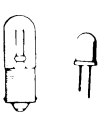
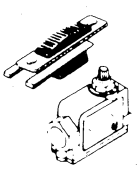

LAMPS & LEDS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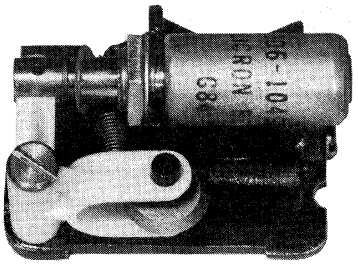

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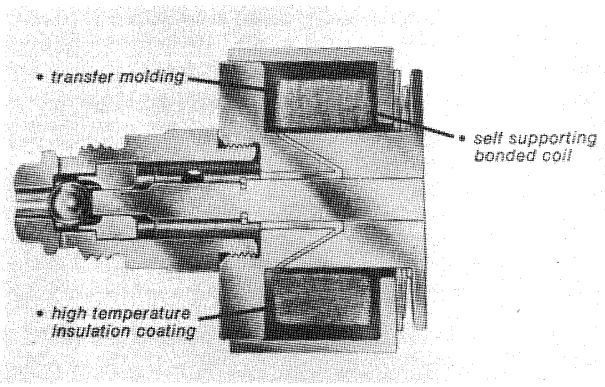

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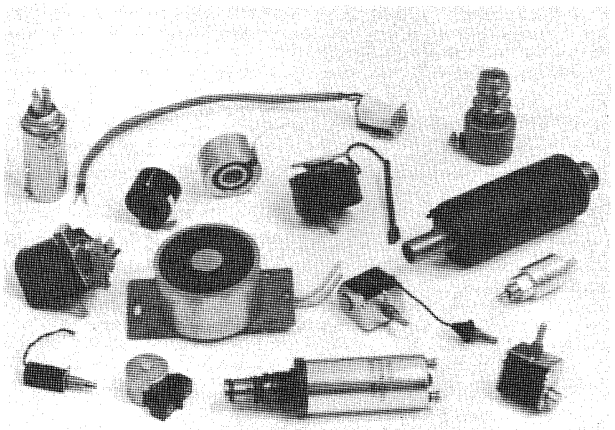

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FREE LITERATURE AVAILABLE

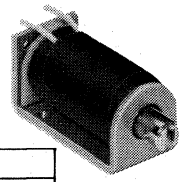
Application and Design Notes
Specification Guidelines

Bicron Electronics Co.
100 Barlow Street
Canaan, CT. 06018

DELTROL SOLENOIDS MADE IN U.S.A. SEE SECTION 4500 FOR RELAYS

C-1 PULL TYPE

L = 13/16
H = 7/16
W = 23/64
WIRE LEADS



NOTE: Standard intermittent duty at nominal voltage is 25%, maximum on time is 30 seconds. Approx. 35 sq. in. heat sink is required.

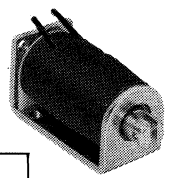
Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53704-82	12VDC	Cont.	50	3W
53704-83	24VDC	Cont.	200	3W
53704-88	12VDC	Int.	12.2	12W
53704-89	24VDC	Int.	50	12W

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	3/8
DC Cont.	1-1/4	3/4	1/2	7/16	1/4
DC Int.	4	2-3/4	2	1-3/4	1

C-2 PULL TYPE

L = 63/64
H = 17/32
W = 31/64
WIRE LEADS



NOTE: Standard intermittent duty at nominal voltage is 25%, maximum on time is 30 seconds. Approx. 50 sq. in. heat sink is required.

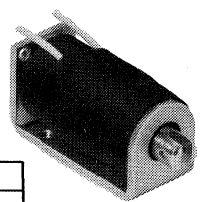
Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53702-82	12VDC	Cont.	32	4.5W
53702-83	24VDC	Cont.	128	4.5W
53702-88	12VDC	Int.	8	18W
53702-89	24VDC	Int.	32	18W

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2
DC Cont.	3-3/4	1-3/4	1-1/4	1	1/4
DC Int.	12	6-1/2	5	4	1-1/4

C-3 PULL TYPE

L = 7/32
H = 11/16
W = 19/32
WIRE LEADS

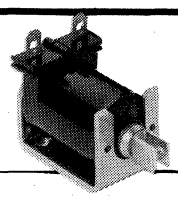


NOTE: Standard intermittent duty at nominal voltage is 25%, maximum on time is 30 seconds. Approx. 65 sq. in. heat sink is required.

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53725-82	12VDC	Cont.	25	6W
53725-83	24VDC	Cont.	100	6W
53725-88	12VDC	Int.	6.2	24W
53725-89	24VDC	Int.	25	24W

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2
DC Cont.	8	3-1/4	2-1/4	1-3/4	1
DC Int.	30	13	9	8	4



C-6 PULL TYPE

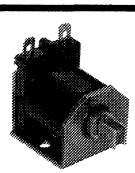
L = 1-1/8
W = 55/64
H = 1-17/64
.187 QUICK CONNECT/SOLDER TERMINALS

NOTE: Standard intermittent duty cycle at nominal voltage is one (1) minute on and three (3) minutes off.

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53685-83	24VDC	Cont.	124	4.7W
53686-83	24VDC	Int.	50.8	12W
53687-94	120VAC	Cont.	776	6.8VA
53688-94	120VAC	Int.	327	19.6VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4
DC Cont.	7	3	2	1-1/2
DC Int.	15	8	5	3-1/2
AC Cont.	10	7	5	4
AC Int.	21	13	11	8



C-7 PULL TYPE

L = 1-9/64
W = 1-1/16
H = 1-13/32
.187 QUICK CONNECT/ SOLDER TERMINALS

STROKE (INCHES) FORCE (OUNCES

	1/16	1/8	3/16	1/4
DC Cont.	19	8	5	3
DC Int.	28	12	8	5
AC Cont.	17	12	10	8
AC Int.	30	22	19	17

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53634-83	24VDC	Cont.	118	5W
53635-83	24VDC	Int.	50.5	11.5W
53637-94	120VAC	Cont.	509	7.8VA
53638-94	120VAC	Int.	220	21VA

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

DELTROL *ALL DIMENSIONS ARE NOMINAL*

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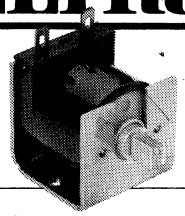
DELTROL SOLENOIDS

MADE IN U.S.A.

SEE SECTION 4500 FOR RELAYS



C-8 PULL TYPE

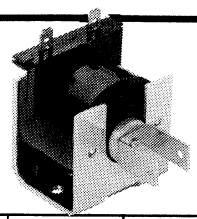
L = 1-3/16
W = 1-9/32
H = 1-11/16
.187 QUICK CONNECT/ SOLDER TERMINALS

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

			Coil	
Stock No.	Volts/ Type	Duty	Resist. (Ohms)	Power
53713-82	24VDC	Cont.	93.3	6.5W
53713-88	24VDC	Int.	37.5	16W
53712-84	120VAC	Cont.	346	9.5VA
53712-90	120VAC	Int.	151	25VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4
DC Cont.	20	11	7	5
DC Int.	42	27	19	14
AC Cont.	16	11	10	9
AC Int.	32	24	21	20



C-9 PULL TYPE

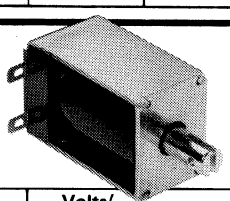
L = 1-1/16
W = 1-3/8
H = 1-13/16
.187 QUICK CONNECT/SOLDER TERMINALS

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off. AC intermittent duty cycle is one (1) minute on and four (4) minutes off. Approx. 10 sq. in. heat sink required.

Stock No.	Volts/ Type	Duty	Resist. (Ohms)	Power
53676-83	24VDC	Cont.	66.5	8.6W
53677-83	24VDC	Int.	37.6	15.5W
53673-94	120VAC	Cont.	240	13.7VA
53674-94	120VAC	Int.	84.1	52VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2
DC Cont.	26	17	12	9	3
DC Int.	42	28	22	16	5
AC Cont.	21	16	15	14	10
AC Int.	54	43	39	37	27



D-11 PULL TYPE

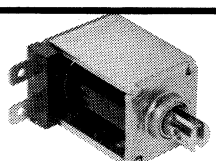
L = 1-27/32
W = 15/16
H = 1-3/16
.187 QUICK CONNECT/SOLDER TERMINALS

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

Stock No.	Volts/ Type	Duty	Resist. (Ohms)	Power
53736-81	12VDC	Cont.	18	8W
53736-82	24VDC	Cont.	72	8W
53736-87	12VDC	Int.	8	18W
53736-88	24VDC	Int.	32	18W
53738-84	120VAC	Cont.	200	12VA
53738-90	120VAC	Int.	85	42VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	38	28	16	11	4	3
DC Int.	55	40	24	22	10	6
AC Cont.	14	12	9	8	7	6
AC Int.	45	25	20	18	15	14



D-22 PULL TYPE

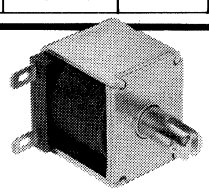
L = 1-1/4
W = 3/4
H = 3/4
.187 QUICK CONNECT/SOLDER TERMINALS

NOTE: Standard intermittent duty cycle at nominal voltage is 25% with three (3) minutes max. on and nine (9) minutes min. off in a repetitive cycle. Approx. 10 sq. in. heat sink required.

Stock No.	Volts/ Type	Duty	Resist. (Ohms)	Power
53723-81	12VDC	Cont.	35	4.2W
53723-82	24VDC	Cont.	141	4.2W
53723-87	12VDC	Int.	14.8	9.6W
53723-88	24VDC	Int.	60	9.6W
53724-84	120VAC	Cont.	1,090	6.5VA
53724-90	120VAC	Int.	724	8.5VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	3/8
DC Cont.	9	4	2-1/2	1-3/4	1
DC Int.	20	10	6	4	2
AC Cont.	6	3-1/2	2-3/4	2-1/2	1-3/4
AC Int.	8-1/2	5-1/2	4	3-1/2	2-1/2



D-28 PULL TYPE

L = 1-1/4
W = 1
H = 1-7/32
.187 QUICK CONNECT/ SOLDER TERMINALS

Stock No.	Volts/ Type	Duty	Resist. (Ohms)	Power
53708-81	12VDC	Cont.	27.1	5.5W
53708-82	24VDC	Cont.	108	5.5W
53708-87	12VDC	Int.	12.7	11.5W
53708-88	24VDC	Int.	51	11.5W
53706-84	120VAC	Cont.	420	8VA
53706-90	120VAC	Int.	220	21VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2
DC Cont.	20	10	6	4	2
DC Int.	35	19	12	8	3
AC Cont.	16	12	10	8	4
AC Int.	29	20	17	14	6

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

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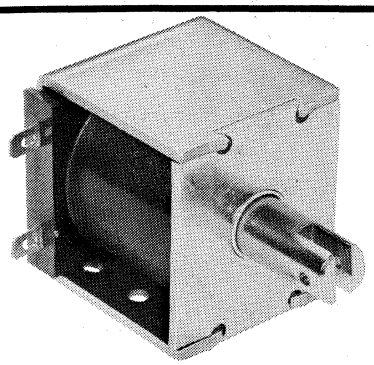
DELTROL SOLENOIDS MADE IN U.S.A. SEE SECTION 4500 FOR RELAYS

D-2 PULL TYPE



L = 1-9/16
W = 1-7/16
H = 1-5/8

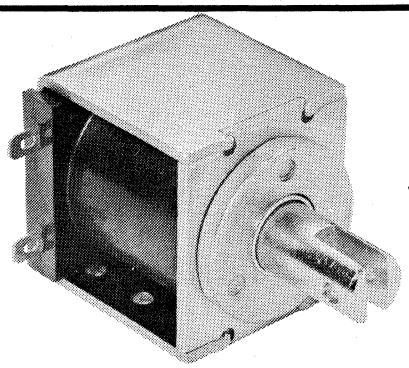
NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53728-81	12VDC	Cont.	13.6	10.5W
53728-82	24VDC	Cont.	54.7	10.5W
53728-87	12VDC	Int.	4.92	29W
53728-88	24VDC	Int.	20.0	29W
53729-84	120VAC	Cont.	139	13VA
53729-90	120VAC	Int.	47.0	44VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	84	50	34	23	8	4
DC Int.	122	97	74	56	21	9
AC Cont.	27	20	17	16	14	5
AC Int.	69	56	50	45	36	15

D-3HD PULL TYPE



L = 1-3/4
W = 1-7/16
H = 1-5/8

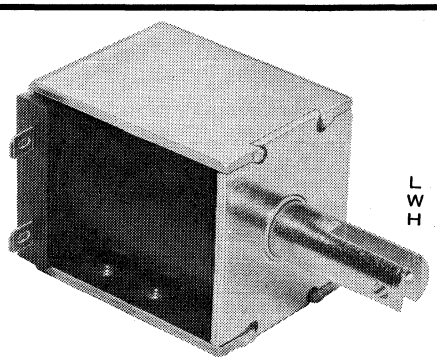
NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53732-81	12VDC	Cont.	12.8	11.2W
53732-82	24VDC	Cont.	51.5	11.2W
53732-87	12VDC	Int.	5.3	27W
53732-88	24VDC	Int.	21.4	27W
53733-84	120VAC	Cont.	109	20VA
53733-90	120VAC	Int.	27	115VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	110	72	45	31	10	4
DC Int.	150	124	96	72	25	10
AC Cont.	35	26	23	22	21	13
AC Int.	112	88	80	78	68	40

D-4 PULL TYPE



L = 2
W = 1-7/16
H = 1-5/8

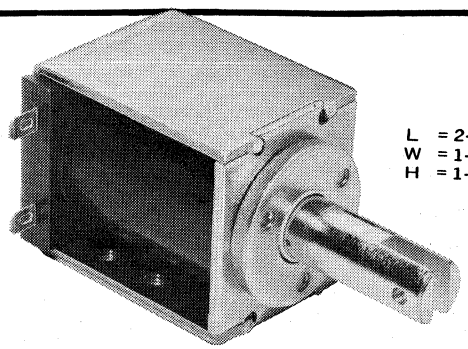
NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53717-81	12VDC	Cont.	12.3	11.5W
53717-82	24VDC	Cont.	50.4	11.5W
53717-87	12VDC	Int.	3.0	47.6W
53717-88	24VDC	Int.	12.3	47.6W
53718-84	120VAC	Cont.	133	11.5VA
53718-90	120VAC	Int.	37	60VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	94	66	46	34	14	7
DC Int.	142	122	106	92	52	30
AC Cont.	12	10	9	9	10	13
AC Int.	44	38	34	32	38	46

D-4HD PULL TYPE



L = 2-3/16
W = 1-7/16
H = 1-5/8

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53719-81	12VDC	Cont.	12.1	11.7W
53719-82	24VDC	Cont.	49.2	11.7W
53719-87	12VDC	Int.	3.8	38W
53719-88	24VDC	Int.	15.2	38W
53720-84	120VAC	Cont.	72.4	32VA
53720-90	120VAC	Int.	19.1	170VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	116	85	60	42	16	8
DC Int.	160	136	114	98	46	26
AC Cont.	24	20	19	18	21	24
AC Int.	84	72	64	60	66	76

ALL DIMENSIONS ARE NOMINAL.

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DELTROL SOLENOIDS MADE IN U.S.A. SEE SECTION 4500 FOR RELAYS

MED-8 x 1

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53762-81	12VDC	Cont.-Pull	36	4W
53762-87	12VDC	Int.-Pull	12	12W
53762-82	24VDC	Cont.-Pull	139	4W
53762-88	24VDC	Int.-Pull	48	12W
53766-82	24VDC	Cont.-Push	139	4W
53766-88	24VDC	Int.-Push	48	12W

PUSH TYPE PULL TYPE

Dia. = 1/2
L = 1

NOTE: Standard intermittent duty cycle is one (1) minute on and three (3) minutes off.
Mtg. Thread Size: 3/8 — 32 x 1/4" L.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4
DC Cont.	4	2	1-1/4	1
DC Int.	7	4	3	2-1/2

MED-8 x 1-1/2

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53764-81	12VDC	Cont.-Pull	29	5W
53764-87	12VDC	Int.-Pull	9.6	15W
53764-82	24VDC	Cont.-Pull	115	5W
53764-88	24VDC	Int.-Pull	38.4	15W
53768-82	24VDC	Cont.-Push	115	5W
53768-88	24VDC	Int.-Push	38.4	15W

PUSH TYPE PULL TYPE

Dia. = 1/2
L = 1-1/2

NOTE: Standard intermittent duty cycle is one (1) minute on and three (3) minutes off.
Mtg. Thread Size: 3/8 — 32 x 1/4" L.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	5/16
DC Cont.	4-1/2	2-1/2	2	1-3/4	1-1/2
DC Int.	9	6	4-1/2	4	3-1/2

MED-12 x 1-1/2

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53751-81	12VDC	Cont.-Pull	25	6W
53751-87	12VDC	Int.-Pull	10	15W
53751-82	24VDC	Cont.-Pull	100	6W
53751-88	24VDC	Int.-Pull	40	15W
53761-81	12VDC	Cont.-Push	25	6W
53761-87	12VDC	Int.-Push	10	15W
53761-82	24VDC	Cont.-Push	100	6W
53761-88	24VDC	Int.-Push	40	15W

PUSH TYPE PULL TYPE

Dia. = 3/4
L = 1-1/2

NOTE: Standard intermittent duty cycle is one (1) minute on and three (3) minutes off.
Mtg. Thread Size: 9/16 — 18 x 3/8" L.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	3/8	1/2
DC Cont.	18	10	6-1/2	5	3	2
DC Int.	32	22	15	12	7-1/2	5-1/2

MED-16 x 1-1/8

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53754-81	12VDC	Cont.-Pull	19	8W
53754-87	12VDC	Int.-Pull	7.5	19W
53754-82	24VDC	Cont.-Pull	75	8W
53754-88	24VDC	Int.-Pull	30	19W
53759-82	24VDC	Cont.-Push	75	8W
53759-88	24VDC	Int.-Push	30	19W

PUSH TYPE PULL TYPE

Dia. = 1
L = 1-1/8

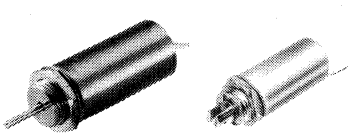
NOTE: Standard intermittent duty cycle is one (1) minute on and three (3) minutes off.
Mtg. Thread Size: 3/4 — 16 x 3/8" L.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	3/8
DC Cont.	38	17	10	7	4
DC Int.	77	46	25	16	6

MED-16 x 2

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53753-81	12VDC	Cont.-Pull	15	10W
53753-87	12VDC	Int.-Pull	6	24W
53753-82	24VDC	Cont.-Pull	60	10W
53753-88	24VDC	Int.-Pull	24	24W
53757-81	12VDC	Cont.-Push	15	10W
53757-87	12VDC	Int.-Push	6	24W
53757-82	24VDC	Cont.-Push	60	10W
53757-88	24VDC	Int.-Push	24	24W



PUSH TYPE PULL TYPE

Dia. = 1
L = 2

NOTE: Standard intermittent duty cycle is one (1) minute on and three (3) minutes off.
Mtg. Thread Size: 3/4 — 16 x 3/8" L.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	3/8	1/2	5/8
DC Cont.	57	35	24	17	11	8	6
DC Int.	80	58	46	37	27	20	15

ALL DIMENSIONS ARE NOMINAL.

DELTROL controls / DIVISION OF DELTROL CORP
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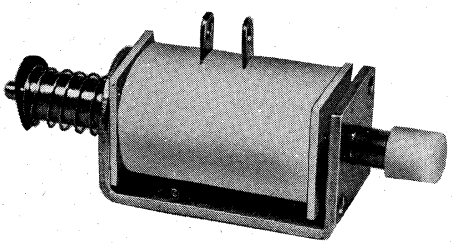
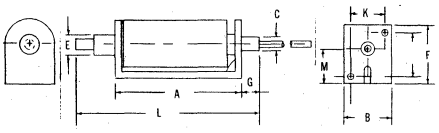
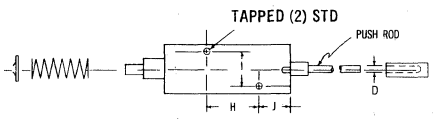
electro-mechanisms INCORPORATED
P.O BOX A
AZUSA, CALIF. 91702
AREA CODE (818) 359-2535
FAX (818) 303-2189

MINI-SOLENOID ACTUATORS



SP SERIES PUSH TYPE





Frame: ..... C1006 Iron — Cad-II Plated
Core: ..... C1002 Electroless Nickel Plated
Plunger: ..... C1002 Electroless Nickel Plated
Wire: ..... 130°C Magnet Wire
Termination: ..... Heavy Leads — PVC, Type BU, 5″ Terminals — Solder Lugs
Tape: ..... Mylar
Bobbin: ..... 30% Glass Filled Nylon
Tip: ..... Delrin
Pushrod: ..... Phosphor Bronze
Tol: ..... .xxx ±.005

3, 6, 12, 24, 48 VDC

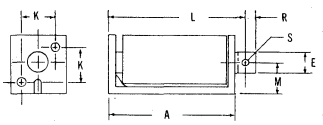
SPECIFICATIONS

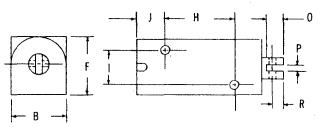
Note: Dimension L is shown with solenoid in energized position. Return Spring and Delrin Tip are Standard on all SP Series.

Part No.	A	B	C	D	E	F	G	H	I	J	K	L	M	S	Max. Stroke*	Weight Oz.	Tapped Holes	Wattage Nom.
SP-18	.403	.180	.062	.025	.068	.235	.085	3/16	3/32	1/8	*	.67	.145		3/16	.05	0-80	1.5
SP-25	.548	.236	.093	.036	.100	.298	.093	1/4	.136	1/8	*	.84	.180		1/4	.1	1-72	2
SP-37	.820	.360	.125	.051	.150	.430	.125	5/16	1/4	3/16	1/4	1.22	.250		3/8	.3	1-72	3
SP-50	.980	.488	.125	.051	.187	.530	.150	1/2	3/8	7/32	5/16	1.44	.285		1/2	.7	1-72	4.5
SP-62	1.215	.600	.187	.091	.250	.691	.178	5/8	7/16	1/4	7/16	1.732	.391		5/8	1.2	4-40	6
SP-75	1.621	.730	.240	.091	.306	.838	.172	5/8	7/16	1/4	1/2	2.15	.473		3/4	2.7	4-40	9

Standard Coils 105°C, Hi Temp Available. * Max Stroke, Standard Pushrod length.

PO SERIES PULL TYPE





Frame: ..... C1006 Iron — Cad-II Plated
Core: ..... C1002 Electroless Nickel Plated
Plunger: ..... C1002 Electroless Nickel Plated
Wire: ..... 130°C Magnet Wire
Termination: ..... Heavy Leads — PVC, Type BU, 5″ Terminals — Solder Lugs
Tape: ..... Mylar
Bobbin: ..... 30% Glass Filled Nylon
Tip: ..... Delrin
Pushrod: ..... Phosphor Bronze
Tol: ..... .xxx ±.005

SPECIFICATIONS

Note: Dimension L is shown with solenoid in energized position.

Part No.	A	B	E	F	H	I	J	K	L	M	O	P	R	S	Max. Stroke	Weight Oz.	Tapped Holes	Wattage Nom.
PO-25	.548	.236	.100	.298	1/4	.136	1/8	*	.672	.180	.100	.025	.062	.031	1/4	.1	1-72	2
PO-37	.820	.360	.150	.430	5/16	1/4	3/16	1/4	.892	.250	.150	.051	.075	.031	3/8	.3	1-72	3
PO-50	.980	.488	.187	.530	1/2	3/8	7/32	5/16	1.074	.285	.200	.063	.106	.063	1/2	.7	1-72	4.5
PO-62	1.215	.600	.250	.691	5/8	7/16	1/4	7/16	1.340	.391	.200	.063	.094	.063	5/8	1.2	4-40	6
PO-75	1.621	.730	.306	.838	5/8	7/16	1/4	1/2	1.797	.473	.200	.063	.094	.063	3/4	2.7	4-40	9

Standard Coils 105°C, Hi Temp Available.

SPECIALS

ELECTRO-MECHANISMS, INC., is completely equipped, both engineering and production wise, to supply you with variations of our solenoids that you might need for your application. We are also capable of designing special types that you might need within the size range of our products. We would appreciate the opportunity to help you solve design and application problems you may have in the area of miniature solenoid actuators.

The force charts below represent three different duty cycles.

Nominal voltage represents continuous duty.

2X Nominal voltage represents a 25%, intermittent duty cycle 4X Nominal voltage represents a 6% intermittent duty cycle.

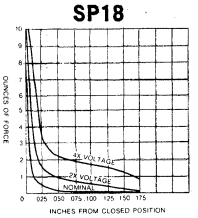
The duty cycle consists of two factors:

1. Percentage of time solenoid is energized in one complete operating cycle.

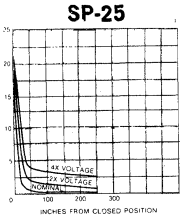
$$\text{(Ref: DUTY CYCLE} = \frac{\text{Time On}}{\text{Time On} + \text{Time Off}} \times 100\text{)}$$

2. Length of time of the longest single energization in one complete operating cycle.

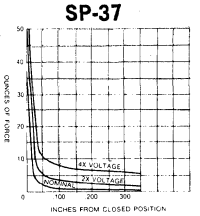
SP18



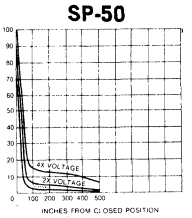
SP-25



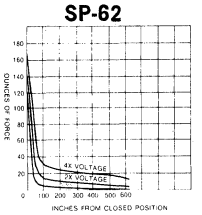
SP-37



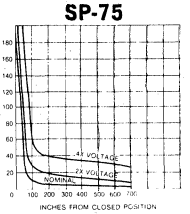
SP-50



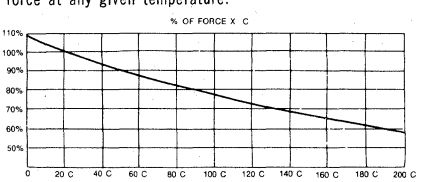
SP-62



SP-75



All forces shown are at 25° ambient. For use at higher ambient temperatures use the chart below to determine force at any given temperature.



FEATURES

ELECTRO-MECHANISMS micro-miniature solenoids offer you static and impact forces equal to standard solenoids 2 to 3 times the size of these units.

Because of their small size, they have extremely fast reaction time. As fast as 2 msec at 4x nominal voltage.

The unique design of PUSH or PULL action, offers many applications beyond the conventional pull type solenoid.

A complete line of 15 solenoids from 3/16″ O.D. to 1.250″ O.D. allows you to choose the correct solenoid with the force you require, from stock items.

The units are highly reliable with life of many millions of operations.

The solenoids are also available with coils in Class F and Class H for high temperature requirements.

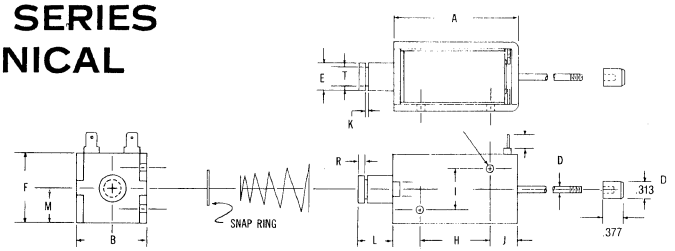
Simplicity of design helps keep the costs down and allows us to pass these savings on to you, our customer.

TYPICAL APPLICATIONS

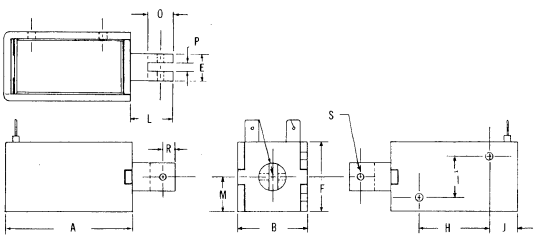
- Hammers for high speed printers
- Camera shutter actuators
- Locking mechanisms for switches, adding machines and typewriters
- Interpossers for card punching and tape perforation
- Cam actuation
- Pen lifters for plotters
- Event markers for chart recorders
- Key actuators for numerical readouts on typewriters and adding machines
- For life testing different devices
- For indicator flags
- Sensing devices
- Remote switching and actuation

electro-mechanisms INCORPORATED
P.O BOX A FAX (818) 303-2189
AZUSA, CALIF. 91702
AREA CODE (818) 359-2535

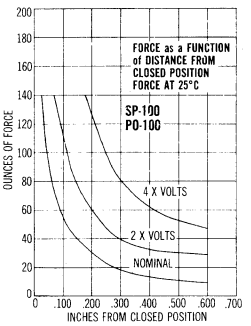
SP-100 SERIES 60° CONICAL



PO-100 SERIES 60° CONICAL



11.5 WATTS VDC
3, 6, 12, 24, 48, 110
60° CONICAL

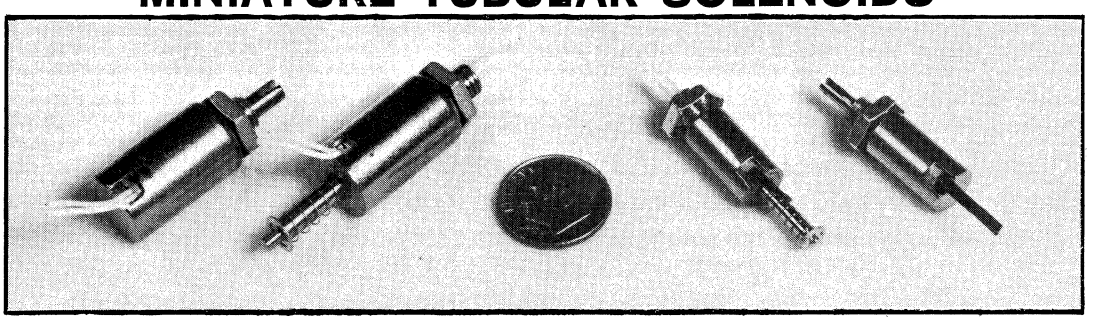


SPECIFICATIONS

Part No.	A	B	D	E	F	H	I	J	K	L	M	O	P	R	S	T	Height of Terms	Max. Stroke	Tapped Holes	Weight Oz.
SP-100	2.270	1.254	.092	.500	1.254	1.115	.750	.430	.040	.752	.627	*	*	.100	*	.343	.365	1	6-32	10
PO-100	2.270	1.254	*	.500	1.254	1.115	.750	.430	*	.700	.627	.375	.143	.168	.100	*	.365	1	6-32	10

Standard Coils 130°C, Hi Temp Coils Available. * Not Applicable.

MINIATURE TUBULAR SOLENOIDS



3 SIZES AVAILABLE PUSH or PULL

5/16" DIA. X .625
2 WATTS
MODELS TPO-TSP-30

1/2" DIA. X .875
3 WATTS
MODELS TPO-TSP-45

9/16" DIA. X 1.00
4.5 WATTS
MODELS TPO-TSP-55

FORCE VS STROKE

Stroke (Inches) Force (Ounces)

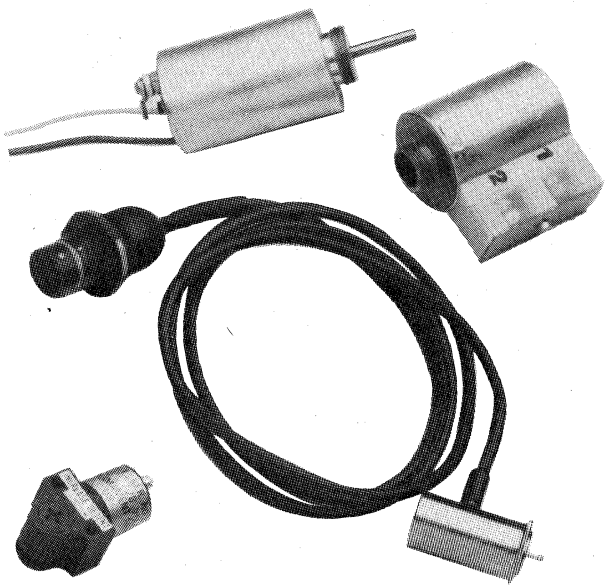
MODEL TPO-30	1/32"	1/16"	1/8"	3/16"	1/4"	3/8"
DC CONTINUOUS	1.6	1.2	.90	.4		
DC 2X	3.2	2.1	1.7	1.2		
DC 4X	5.1	3.7	3.3	2.6		
MODEL TPO-45						
DC CONTINUOUS	4.9	2.8	1.8	1.6	1.1	
DC 2X	7.1	4.9	3.0	2.8	2.3	
DC 4X	15.0	10	7.0	6.8	6.1	
MODEL TPO-55						
DC CONTINUOUS	18	7.0	5.5	3.4	3.0	1.4
DC 2X	38	10.0	7.2	6.0	5.2	3.1
DC 4X	50	20.0	14.3	12.8	11.8	10.1

SOLENOIDS...

ENGINEERING•QUALITY•DELIVERY
MILITARY GRADE

Hard to find all these in one company?

NOW YOU CAN!



Our engineers design only solenoids and relays. Their years of experience save you money and shorten your manufacturing lead time.

Complete designs from start to finish or slight modifications to existing products. We know our capabilities and if we can't design and build a cost-effective unit, we'll let you know immediately!

Quality: At Electronic Specialty quality is consistent.
Our in-house environmental and dynamic testing lab gives us control of product quality and keeps our lead times to a minimum.

Delivery: Our sale engineers can help you with your particular application. Slight variations, or a totally new design, they give you answers on price and design quickly. Because we've supplied these kinds of components for years we are equipped to build and deliver your order when you need it.

Design capability, fast delivery of quality products with the assurance they are what you need. That's what Electronic Specialty Corporation offers you. Whether your orders are large or small we never forget the customer is what keeps us in business.

Call us, let us give you a competitive quote quickly and accurately.

PHYSICAL CHARACTERISTICS
Push or pull type

CASE SIZE
1/2″ diameter case O.D. to 3″ diameter case O.D.

STROKE RANGE
.01″ to .5″

WEIGHT
4 oz. to 48 oz.

ELECTRICAL CHARACTERISTICS
AC & DC Operation

Coil Voltages	AC	5 VRMs to 240 VRMs from 50 hz to 800 hz
	DC	5 VDC to 600 VDC

Coil resistance-Commensurate with required power and voltage requirements.
Dielectric to 1500 VDC or VRMs
Insulation resistance 100 meg at 5000 VDC

OPERATING CHARACTERISTICS
Force curves matched to customer requirements or use existing designs.
Plunger strokes from .001 to .5 inches.

ENVIRONMENTAL CHARACTERISTICS

Temperature ranges –65F to 300F	Vibration
Pressure range	Shock
Fluid compatibility	Salt Spray

CONNECTIONS

Stud screw terminal	Twist lock
Quick connect	Wire leads
Mil Spec multiple connectors	

Electronic Specialty Corporation

P.O. BOX 3501
VANCOUVER, WASHINGTON 98668-3501
206/574/5000 FAX 206-573-4635
TWX 970-44-005

LIBERTY CONTROLS INC.

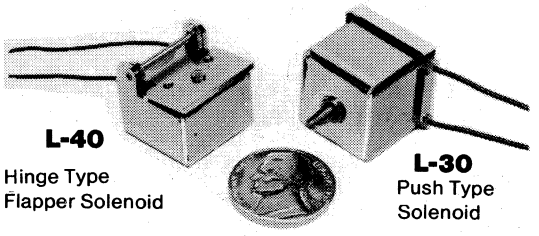
SOLENOIDS

BOX FRAME SOLENOIDS	DUTY CYCLE	DC MIN.*	DC MAX.*	AC MIN.*	AC MAX.*
L-5 H=.61 L=.63 W=.5	Cont.	2.5@1/16"	.3@5/16"	—	—
	Int.	7.5@1/16"	.6@5/16"	—	—
	Pulse	21@1/16"	.8@5/16"	—	—
L-22 H=.75 L=1.16 W=.75	Cont.	13@1/16	.5@1/2"	5.5@1/16"	.5@1/2"
	Int.	22@1/16"	1@1/2"	10@1/16"	1.5@1/2"
	Pulse	38@1/16"	3@1/2"	19@1/16"	3@1/2"
L-20 H=.94 L=1.14 W=.81	Cont.	21@1/16"	1@1/2"	10@1/16"	2@1/2"
	Int.	34@1/16"	2@1/2"	20@1/16"	4@1/2"
	Pulse	62@1/16"	8@1/2"	48@1/16"	11@1/2"
L-28 H=1.19 L=1.13 W=.94	Cont.	31@1/16"	1@1/2"	15@1/16"	2@1/2"
	Int.	47@1/16"	3@1/2"	29@1/16"	4@1/2"
	Pulse	83@1/16"	13@1/2"	62@1/16"	11@1/2"
L-81 H=1.24 L=1.25 W=1.00	Cont.	38@1/16"	4@3/8"	19@1/16"	5@3/8"
	Int.	53@1/16"	7@3/8"	34@1/16"	8@3/8"
	Pulse	107@1/16"	34@3/8"	90@1/16"	25@3/8"
L-11 H=1.19 L=1.84 W=.94	Cont.	48@1/16"	3@3/4"	18@1/16"	6@3/4"
	Int.	67@1/16"	7@3/4"	33@1/16"	13@3/4"
	Pulse	90@1/16"	26@3/4"	54@1/16"	23@3/4"
L-82 H=1.24 L=2.01 W=1.00	Cont.	55@1/16"	2@3/4"	17@1/16"	11@3/4"
	Int.	92@1/16"	7@3/4"	46@1/16"	28@3/4"
	Pulse	136@1/16"	16@3/4"	96@1/16"	51@3/4"
L-4 H=1.63 L=2.19 W=1.44	Cont.	98@1/16"	5@1"	15@1/16"	9@1"
	Int.	145@1/16"	18@1"	55@1/16"	34@1"
	Pulse	180@1/16"	36@1"	93@1/16"	56@1"
L-88 H=1.85 L=1.65 W=1.58	Cont.	120@1/16"	4@5/8"	24@1/16"	8@1/2"
	Int.	184@1/16"	11@5/8"	49@1/16"	4@3/4"
	Pulse	276@1/16"	40@5/8"	138@1/16"	13@3/4"
L-89 H=1.85 L=2.14 W=1.58	Cont.	144@1/16"	7@3/4"	17@1/16"	7@3/4"
	Int.	200@1/16"	16@3/4"	42@1/16"	18@3/4"
	Pulse	265@1/16"	58@3/4"	98@1/16"	43@3/4"
L-90 H=1.85 L=2.63 W=1.58	Cont.	148@1/16"	5@1-1/4"	12@1/16"	7@1-1/4"
	Int.	208@1/16"	16@1-1/4"	27@1/16"	17@1-1/4"
	Pulse	266@1/16"	40@1-1/4"	80@1/16"	43@1-1/4"

* Forces and Strokes (Ounces and Inches) @ 25°C

U-FRAME SOLENOIDS	DUTY CYCLE	DC MIN.*	DC MAX.*	AC MIN.*	AC MAX.*
L-61 H=.83 L=1.13 W=.75	Cont.	18@1/16"	1@1/2"	10@1/16"	2@1/2"
	Int.	22@1/16"	1@1/2"	22@1/16"	5@1/2"
	Pulse	38@1/16"	3@1/2"	44@1/16"	11@1/2"
L-9 H=1.00 L=1.14 W=1.06	Cont.	27@1/16"	1.5@1/2"	15@1/16"	2.5@1/2"
	Int.	38@1/16"	3@1/2"	35@1/16"	7@1/2"
	Pulse	84@1/16"	11@1/2"	72@1/16"	15@1/2"
L-24 H=1.00 L=1.23 W=.84	Cont.	28@1/16"	2@5/8"	14@1/16"	2@5/8"
	Int.	46@1/16"	3@5/8"	26@1/16"	5@5/8"
	Pulse	68@1/16"	8@5/8"	52@1/16"	18@1/2"
L-62 H=1.42 L=1.07 W=1.38	Cont.	48@1/16"	3@1/2"	24@1/16"	10@1/2"
	Int.	80@1/16"	5@1/2"	64@1/16"	26@1/2"
	Pulse	172@1/16"	27@1/2"	117@1/16"	48@1/2"
L-26 H= .94 L=1.75 W=.84	Cont.	33@1/16"	1@3/4"	16@1/16"	3@3/4"
	Int.	52@1/16"	3@3/4"	25@1/16"	6@3/4"
	Pulse	74@1/16"	11@3/4"	72@1/16"	20@3/4"
L-63 H=1.42 L=1.29 W=1.38	Cont.	56@1/16"	2@3/4"	20@1/16"	6@3/4"
	Int.	84@1/16"	4@3/4"	56@1/16"	18@3/4"
	Pulse	168@1/16"	16@3/4"	103@1/16"	34@3/4"

STANDARD VOLTAGES:
6, 12, 24, 48, 120, 240 AC/DC.
Other Voltages Available.



L-40
Hinge Type
Flapper Solenoid

L-30
Push Type
Solenoid

ENCLOSED TO SHIELD MAGNETIC LEAK!
Available only from Liberty Controls

Call Now to find out more about our New line of Tubular Solenoids.

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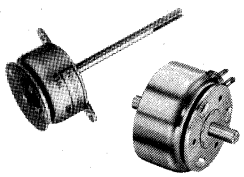
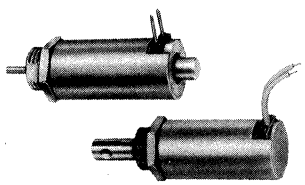
Lucas Ledex

Solenoids

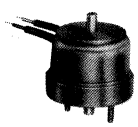
Over 400 choices of standard solenoid designs are available off-the-shelf. But, if none of these meet your unique requirements, we'll provide you with custom engineered prototypes fast. Either way, Lucas Ledex Inc. offers you the widest variety of solenoids for your design. Request solenoid catalog.



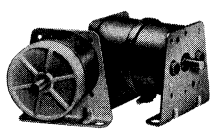
Rotary Solenoids
Step-turn-index-lock-punch-lift. For millisecond-fast, high torque and endurance, specify a Lucas Ledex rotary solenoid. Nine basic sizes, right or lefthand strokes from 10 to 110 degrees. Torque output to 117 pound-inches. Life of over 100 million cycles with endurance engineered models. Four standard sizes of Magton rotary solenoids produce high torque with no axial displacement. Standard angular strokes: 60°, 45°, and 30°, either CW or CCW. Can be modified. Long operating life: 100 million cycles.



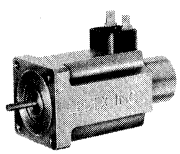
Linear Solenoids
Short-medium-long strokes are all available from one source—Lucas Ledex Inc. Choose our low profile flat face push/pull for high force/short stroke, our low profile conical face push/pull for medium force/stroke, and our tubular solenoids for long strokes. New Series 20 tubular solenoids provide 50 million actuations, quiet operation, push or pull, and economy—available from stock. Rugged construction provides accurate repeatability after long usage. Our tubular solenoids have built-in impact cushions to absorb energy at the end of the stroke and electroless nickel plated plungers for longer life.



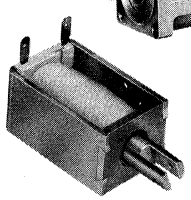
Magnetic Latching Solenoids
Magnetic latching solenoids use permanent magnets coupled with conventional rotary, tubular, low profile, or open frame solenoids, to hold the plunger in an open or closed position without current drain. A momentary pulse releases the latch. Memory is retained during power loss.



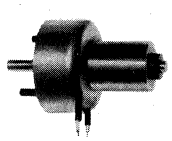
Stepping Solenoids
Step 10-15-20 or 30 degrees with the highest torque in a stepping solenoid—the Series 50-L. Square wave pulse drives either the unidirectional or bidirectional model for 10,000,000 steps with a non-accumulative accuracy of ± 1°. Direct couple for mechanical ease and avoid linkages. Can be manually overridden in case of power failure.



Proportional Solenoids
Open loop/closed loop, variable position sensing is now possible by using our proportional solenoid with our controller for smooth, accurate response. Hydraulic systems can use our wet plunger type which requires no dynamic seals and provides up to 50 pounds force. Do away with pilot stages and expensive servo valves.



Open Frame Solenoids
TDS Series open frame solenoids for large volume OEM applications are available at competitive prices in 34 standard configurations. Lucas Ledex D-Frame solenoids are dependable and reliable. Eight standard models are available from stock with strokes up to 1.25". Quick connect terminals and class "B" coils are standard.



Soft Shift® and Custom Designed Solenoids
Soft Shift solenoids give variable speed control, from snap action to quiet variability. Variable positioning with electronic control.
Typical custom designed solenoids include dot matrix and printhammer models.

Request complete line solenoid catalog.

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Vandalia, Ohio 45377-0427, U.S.A.
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FAX: 513-898-8624

For the name of your nearest Lucas Ledex representative, call toll free 1-800-999-0009. (in Canada 1-800-344-7788)

Lucas Ledex Solenoids & Switches

Solenoids and switches—We have both the products and the people to help you with the quickest and best solutions to your design problems. Our wide selection of stock models lets you get a fast start on your prototype, and our expert engineering staff will work closely with you on custom designs. You'll find helpful solenoid and switch technology.

Rotary solenoids—choose from 250 stock models or custom designs for prototype work. Also Magton® rotary solenoids for high reliability applications. Stock units shipped within 24 hours.

Series 20 tubular push or pull solenoids have life expectancies in excess of 50 million actuations in push models, 100 million in pull models.

Low profile push/pull, flat face, or conical solenoids are built for high force to size, and fast response.

Soft Shift® solenoids—capable of proportional control as well as on-off.

Stepping solenoids—highest torque solenoid available. Extended life up to 10 million cycles minimum on unidirectional models or each direction on bidirectional models.

Open frame solenoids—34 models of TDS Series and 8 models of our D-frame Series solenoids offer economical long term service.

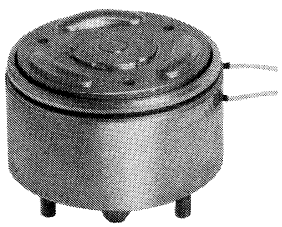
Magnetic latching solenoids—all solenoid configurations maintain energized position without current draw.

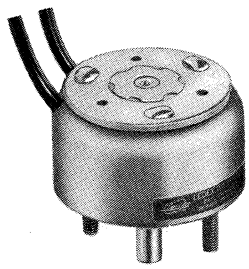
Pushbutton switches—All models stocked. Individual pushbuttons, flat panel pushbuttons, low profile rotary, binary selector, keyboard, and keylock switches. Ganged and panel mounted switches with the look and feel of quality.

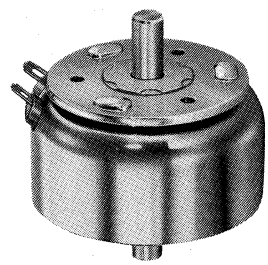
Rotary manual switches provide economy by simplifying circuitry, eliminating auxiliary circuit components and minimizing wiring. Reliable for military and commercial uses.

Stepping switches operate in −55°C to +80°C and switch 1A @ 120 VAC or 2A @ 28 VDC. More switching—less space.

Packaged switches handle high density transfer switching without relays in extreme environments. Meet relevant MIL specs.







Rotary Solenoids			25°		35°		45°		67½°		95°	
Model	O.D.(in.)	Ht.(in.)	Cont. (stroke)	1/20 (duty)	Cont. (stroke)	1/20 (duty)	Cont. (stroke)	1/20 (duty)	Cont. (stroke)	1/20 (duty)	Cont. (stroke)	1/20 (duty)
0E	3/4	9/16	—	.41			—	.20				
1E	1	5/8	—	1.10			—	.62				
2E	1 1/8	21/32	.20	1.70	.15	1.30	.10	.89				
3B	1 5/8	7/8	.35	3.2	.25	2.3	.15	1.7	.09	.8		
3E	1 5/16	51/64	.35	3.2	.25	2.3	.15	1.18	.09	.89		
4E	1 9/16	61/64	.9	5.2	.6	3.5	.4	3.1	.2	1.9	.15	1.2
5B	1 7/8	1 13/64	1.8	10.0	0.9	8.3	.7	6.0	.5	4.0	.19	1.9
5S	1 7/8	1 3/64	1.9	13.2	.9	9.2	.7	6.9	.5	4.9	.20	2.6
6S	2 1/4	1 27/64	4.6	30.6	3.4	20.5	1.7	12.1	1.6	9.7	0.9	5.7
7B	2 3/4	2 5/64	9	35.5	5	32.0						
7S	2 3/4	1 55/64	11	46.6	6	42.0	5	32.8	2.5	19.3	1.5	11.6
8S	3 3/8	2 5/16	16	117	12	77	10	65	4.2	35	3.5	20

For detailed performance curves, write for literature. Torque shown in lb. in. Many stock models to choose from.

Lucas Ledex

Lucas Ledex Inc.
P.O. Box 427
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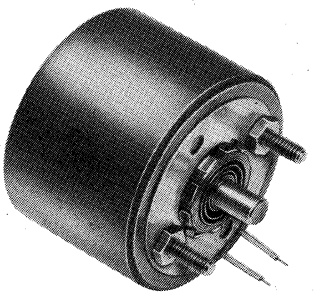
Magton solenoids give you hundreds of millions of cycles of life, severe environmental operating capabilities, low noise, and true rotary motion with no axial displacement. They may be what you need to handle shock or vibration in aerospace, or any demanding application where extremely long life is required.

Design uses a balanced armature mounted on ball bearings. Four sizes up to 2.42" dia. provide 30°, 45°, or 60°, (90° optional) at CW or CCW travel stop to stop; wide range of output torques (to 50 in.-oz.) and 5 to 400 VDC available. Request literature.

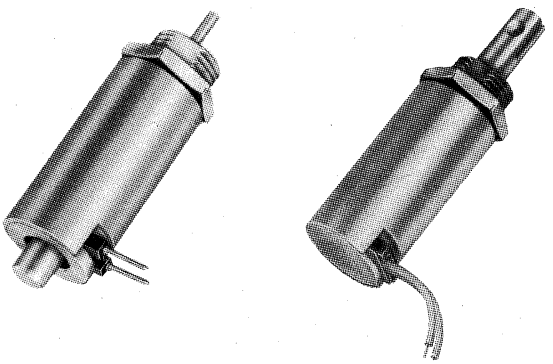


Series 20 Tubular Solenoids

Available push or pull
Typical output, 1/10 duty

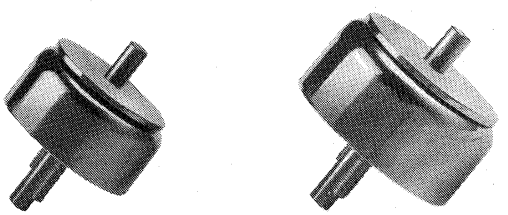
Model	½"	¾"	1"
Size	½" dia. x 1"	¾" dia. x 1½"	1" dia. x 2"
Force .25 Stroke	1 oz. to 8½ oz.	¼ to 2½ lb.	¾ to 5½ lb.
Shaft diameter, push	.062"	.094"	.125"
Mounting	Thr'd Bushing	Thr'd Bushing	Thr'd Bushing
Weight	.84 oz.	2.6 oz.	6 oz.

For detailed performance curves, write for our solenoid catalog now.
Stock models available both push and pull, ½", ¾", and 1".



The Series 20 offers the economical solution to your long life actuating needs. A low friction bobbin assembly provides for a life expectancy of millions of actuations. The problem of powdered metal flaking is eliminated through the metal-to-plastic bearing surface construction. The terminal version mates with standard connectors. A special mounting nut is supplied, packed loose.

The Series 20 is ideal for applications where field servicing is prohibitive. Its quietness and high reliability provides definite advantages in applications involving peripheral equipment, business machine mechanisms, door inter-locks, interposers, and gate releases. Request literature.



Low Profile Solenoids

Typical output, 1/10 duty

Model	0EC	0BC	1EC	1EF	2EC	2EF	3EC	3EF	4EC	4EF	5SF	5EC	6EC
Size	.75"ϕx.5" Conical Face	.77"ϕx.680" Conical Face	1.0"ϕx.53" Conical Face	Flat Face	1.125"ϕx.58" Conical Face	Flat Face	1.312"ϕx.69" Conical Face	Flat Face	1.562"ϕx.835" Conical Face	Flat Face	1.875"ϕx.88" Flat Face	1.875"ϕx1.035" Conical Face	2.25"ϕx1.33" Conical Face
Stroke (in.)	.040	.040	.040	.010	.040	.010	.040	.010	.050	.020	.020	.100	.100
Force (lbs.)	2.9	2.9	5.8	17.5	7.7	25	12.5	40	20	50	92	31	58
Stroke (in.)	.120	.120	.120	.020	.120	.020	.120	.020	.200	.040	.040	.300	.300
Force (lbs.)	0.8	0.8	1.8	11.5	3.0	18	5.5	32	8	34	70	14	30
Weight (ozs.)	.875	1.0	1.5		2.25		3.75		6		9	10.5	21.5

For detailed performance curves, write for literature. Many stock models to choose from. New bobbin wound coil models provide extra economy.

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Phone: 513-898-3621
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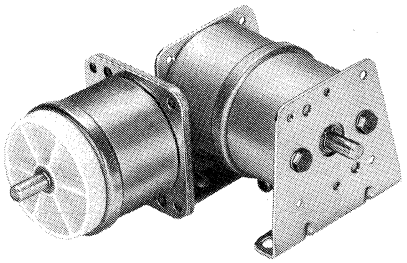
FAX: 513-898-8624

Stepping Solenoids

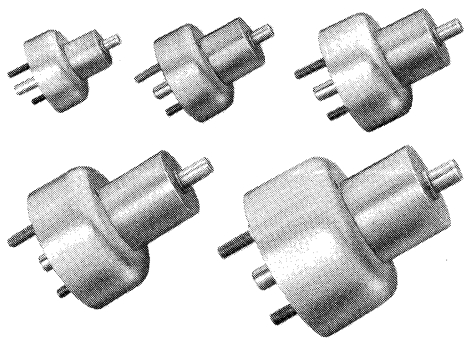
Summary Specifications	Unidirectional	Bidirectional
Voltage	6 to 220 VDC	6 to 220 VDC
High temperature	+85°C	+85°C
Low temperature	−40°C	−40°C
Length	1.9"	2.8"
Height	2¼" (sq. plate)	2¼"
Weight	14 oz.	24 oz.

For more detailed specifications on 64 stock models, request literature.



Soft Shift® Solenoids

Soft Shift—in addition to snap-acting, these linear solenoids provide characteristics allowing variable positioning over a portion of the stroke for use in cost-reduced control systems. Request catalog.

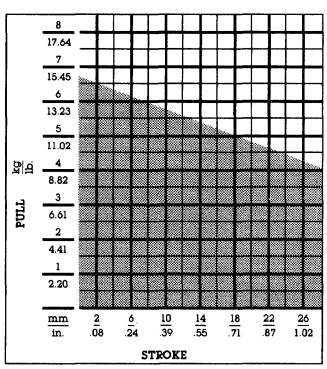


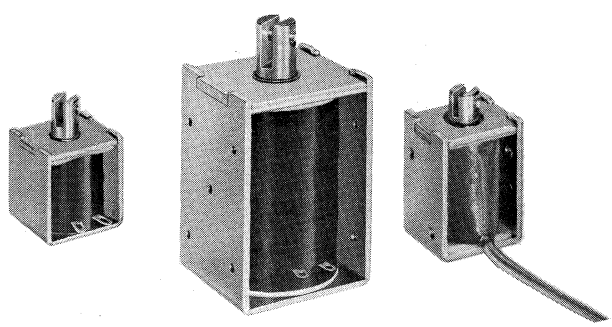
Model	2EP	3EP	4EP	5EP	6EP
Size	1.125"φx.986"	1.312"φx1.232"	1.562"φx1.471"	1.875"φx1.935"	2.250"φx2.214"
Stroke (in.)	.160	.250	.300	.400	.420
Force (lbs.)	.8	1.2	2.0	3.6	7.0
Weight (ozs.)	2.5	4.0	7.0	12.0	23.0

Open Frame Solenoids

TDS Series open frame solenoids feature 34 std. models, hundreds of variations for high-volume OEM applications. Pull-stroke curves fall in shaded range at right. Eight models of our D-frame solenoids also available.

Request Solenoid Catalog now.

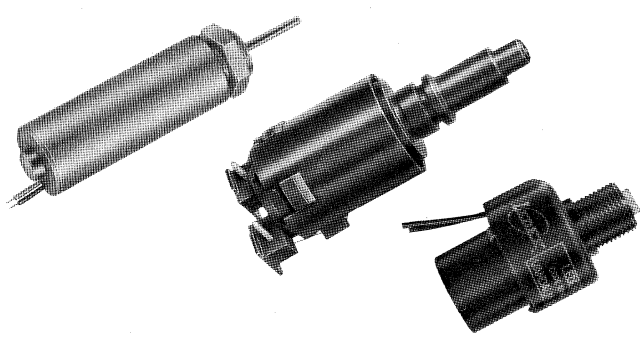




Other Solenoids

Magnetic latching—tubular, low profile, and open frame solenoids hold the plunger in the actuated position using no power. Excellent for fail-safe latching mechanisms. Request catalog.

Printer solenoids—dot matrix and printhammer solenoids are examples of custom designs that deliver exceptional reliability over a long life. Call us to discuss your needs.



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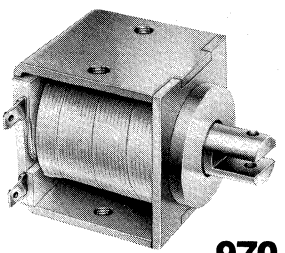

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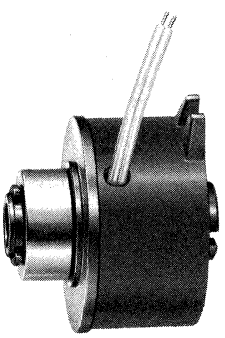

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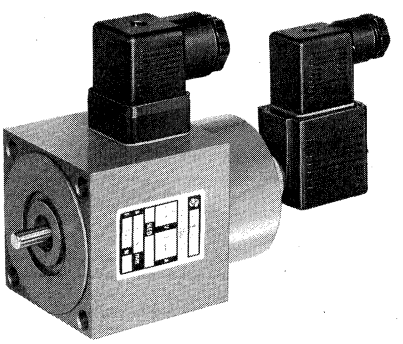

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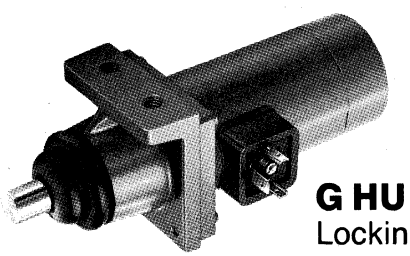

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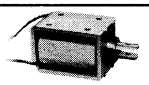
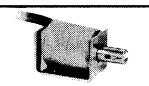
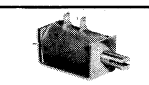
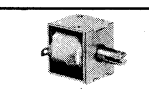
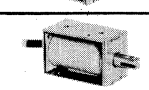
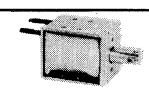
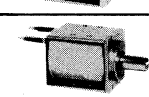
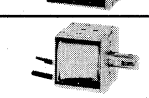
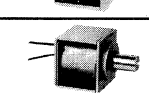
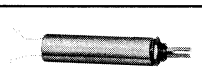
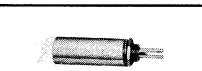
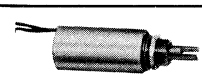
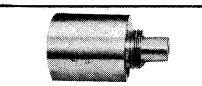
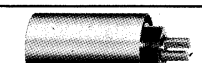
Box-Frame Solenoids (Pull Version)

Push Version Also Available.

	Type	Volts	Duty	Oms	Forces and Strokes ounces @ inches (min.)	(max.)	Body inches H x L x W
	312-6005	24VDC	Cont.	144	22@1/32"	2@1/4"	3/4 x 1 5/32 x 3/4
	312-6006	24VDC	Int.	60	28@1/32"	4@1/4"	3/4 x 1 5/32 x 3/4
	312-6011	120VAC	Cont.	390	12@1/32"	2.5@1/4"	3/4 x 1 5/32 x 3/4
	312-6012	120VAC	Int.	100	20@1/32"	4@1/4"	3/4 x 1 5/32 x 3/4
	5U5-6053	24VDC	Cont.	114	14@1/16"	2.5@3/8"	15/16 x 1 1/4 x 27/32
	5U5-6054	24VDC	Int.	52	27@1/16"	5@3/8"	15/16 x 1 1/4 x 27/32
	5U5-6059	120VAC	Cont.	500	10@1/16"	4.5@3/8"	15/16 x 1 1/4 x 27/32
	5U5-6060	120VAC	Int.	310	17@1/16"	8.5@3/8"	15/16 x 1 1/4 x 27/32
	5U7-6065	24VDC	Cont.	85	15@1/8"	3@1/2"	15/16 x 1 3/4 x 27/32
	5U7-6066	24VDC	Int.	33	32@1/8"	7@1/2"	15/16 x 1 3/4 x 27/32
	5U7-6071	120VAC	Cont.	250	11@1/8"	7.5@1/2"	15/16 x 1 3/4 x 27/32
	5U7-6072	120VAC	Int.	140	18@1/8"	12@1/2"	15/16 x 1 3/4 x 27/32
	809-6101	24VDC	Cont.	104	12@1/8"	2@1/2"	1 3/16 x 1 1/8 x 15/16
	809-6102	24VDC	Int.	50	22@1/8"	3@1/2"	1 3/16 x 1 1/8 x 15/16
	809-6107	120VAC	Cont.	400	12@1/8"	5@1/2"	1 3/16 x 1 1/8 x 15/16
	809-6108	120VAC	Int.	220	24@1/8"	7@1/2"	1 3/16 x 1 1/8 x 15/16
	827-6113	24VDC	Cont.	72	24@1/8"	4@5/8"	1 3/16 x 1 7/8 x 15/16
	827-6114	24VDC	Int.	32	40@1/8"	8@5/8"	1 3/16 x 1 7/8 x 15/16
	827-6119	120VAC	Cont.	200	12@1/8"	6@5/8"	1 3/16 x 1 7/8 x 15/16
	827-6120	120VAC	Int.	85	20@1/8"	13@5/8"	1 3/16 x 1 7/8 x 15/16
	930-6125	24VDC	Cont.	54	63@1/8"	7@3/4"	1 5/8 x 2 x 1 7/16
	930-6126	24VDC	Int.	15	113@1/8"	25@3/4"	1 5/8 x 2 x 1 7/16
	930-6131	120VAC	Cont.	133	8@1/8"	7@3/4"	1 5/8 x 2 x 1 7/16
	930-6132	120VAC	Int.	37	36@1/8"	26@3/4"	1 5/8 x 2 x 1 7/16
	940-6137	24VDC	Cont.	50	78@1/8"	8@3/4"	1 5/8 x 2 3/16 x 1 7/16
	940-6138	24VDC	Int.	15	140@1/8"	18@3/4"	1 5/8 x 2 3/16 x 1 7/16
	940-6143	120VAC	Cont.	53	24@1/8"	15@3/4"	1 5/8 x 2 3/16 x 1 7/16
	940-6144	120VAC	Int.	15	100@1/8"	65@3/4"	1 5/8 x 2 3/16 x 1 7/16
	960-6149	24VDC	Cont.	58	50@1/8"	8@1/2"	1 5/8 x 1 9/16 x 1 7/16
	960-6150	24VDC	Int.	21	100@1/8"	18@1/2"	1 5/8 x 1 9/16 x 1 7/16
	960-6155	120VAC	Cont.	166	14@1/8"	10@1/2"	1 5/8 x 1 9/16 x 1 7/16
	960-6156	120VAC	Int.	60	45@1/8"	30@1/2"	1 5/8 x 1 9/16 x 1 7/16
	970-6161	24VDC	Cont.	58	65@1/8"	9@1/2"	1 5/8 x 1 25/32 x 1 7/16
	970-6162	24VDC	Int.	20	120@1/8"	24@1/2"	1 5/8 x 1 25/32 x 1 7/16
	970-6167	120VAC	Cont.	100	22@1/8"	16@1/2"	1 5/8 x 1 25/32 x 1 7/16
	970-6168	120VAC	Int.	125	85@1/8"	58@1/2"	1 5/8 x 1 25/32 x 1 7/16

Tubular Solenoids (Pull Version)

Push Version Also Available.

	Type	Volts	Duty	Oms	Forces and Strokes ounces @ inches (min.)	(max.)	Body inches Length x Dia.
	R7X9-6171	12VDC	Cont.	80	5@1/32"	1.2@5/32"	1 1/8 x 7/16
	R7X9-6172	12VDC	Int.	14	9@1/32"	2.5@5/32"	1 1/8 x 7/16
	R7X9-6173	24VDC	Cont.	260	5@1/32"	1.2@5/32"	1 1/8 x 7/16
	R7X9-6174	24VDC	Int.	57	9@1/32"	2.5@5/32"	1 1/8 x 7/16
	R8X7-6362	12VDC	Cont.	55	2.5@1/16"	1@3/16"	7/8 x 1/2
	R8X7-6363	12VDC	Int.	20	6@1/16"	1.5@3/16"	7/8 x 1/2
	R8X7-6364	24VDC	Cont.	240	2.5@1/16"	1@3/16"	7/8 x 1/2
	R8X7-6365	24VDC	Int.	80	6@1/16"	1.5@3/16"	7/8 x 1/2
	R8X12-6372	12VDC	Cont.	40	7@1/32"	1.5@1/4"	1 1/2 x 1/2
	R8X12-6373	12VDC	Int.	10	14@1/32"	4@1/4"	1 1/2 x 1/2
	R8X12-6374	24VDC	Cont.	160	7@1/32"	1.5@1/4"	1 1/2 x 1/2
	R8X12-6375	24VDC	Int.	38	14@1/32"	4@1/4"	1 1/2 x 1/2
	R8X16-6384	24VDC	Cont.	145	2.8@1/8"	1.5@3/4"	2 x 1/2
	R8X16-6385	24VDC	Int.	24	7@1/8"	4@3/4"	2 x 1/2
	R12X12-6211	12VDC	Cont.	41	6.5@1/8"	1.2@5/8"	1 1/2 x 3/4
	R12X12-6212	12VDC	Int.	6	20@1/8"	6@5/8"	1 1/2 x 3/4
	R12X12-6213	24VDC	Cont.	165	6.5@1/8"	1.2@5/8"	1 1/2 x 3/4
	R12X12-6214	24VDC	Int.	25	20@1/8"	6@5/8"	1 1/2 x 3/4
	R16X9-6221	12VDC	Cont.	36	22@1/16"	2.5@1/2"	1 1/8 x 1
	R16X9-6222	12VDC	Int.	8	33@1/16"	4@1/2"	1 1/8 x 1
	R16X9-6223	24VDC	Cont.	145	22@1/16"	2.5@1/2"	1 1/8 x 1
	R16X9-6224	24VDC	Int.	30	33@1/16"	4@1/2"	1 1/8 x 1
	R16X16-6231	12VDC	Cont.	26	21@1/8"	6.5@5/8"	2 x 1
	R16X16-6232	12VDC	Int.	3.8	56@1/8"	20@5/8"	2 x 1
	R16X16-6233	24VDC	Cont.	105	21@1/8"	6.5@5/8"	2 x 1
	R16X16-6234	24VDC	Int.	.15	56@1/8"	20@5/8"	2 x 1
	R24X13-6243	24VDC	Cont.	85	50@1/8"	5@5/8"	1 5/8 x 1 1/2
	R24X13-6244	24VDC	Int.	14	150@1/8"	20@5/8"	1 5/8 x 1 1/2
	R24X19-6253	24VDC	Cont.	59	80@1/8"	8@1"	2 3/8 x 1 1/2
	R24X19-6254	24VDC	Int.	10	140@1/8"	32@1"	2 3/8 x 1 1/2

Sales Representatives in major cities.

Complete catalog available upon request.

Omron switches are slightly unconventional

Omron responds to your application needs by adding innovation to even the most basic switch. Automated assembly and 100% quality assurance are just the beginning of our attention to detail; we take pride in designing the "fine points" that distinguish an Omron switch from the others.

Internal Seals Reduce Soldering and Cleaning Time

Our internally-sealed DIP switches, basic switches and mechanical keyswitches are immersible for cleaning without a time-consuming taping operation. Sealed construction also prevents flux entry during automatic flow soldering. Designed for efficiency, our top-actuated DIP switches are also auto-insertable for quick assembly.

Advanced Computer Design Maximizes Performance

Omron's extensive line of pushbutton and lighted pushbutton switches are designed with the operator in mind. Using advanced computer techniques, we've designed a unique "triangle structure" actuator which provides constant force and ideal operating feel for maximum performance. Omron lighted pushbutton switches also feature uniform color illumination to add a quality appearance to your control panels.

Custom Options Accommodate Unique Applications

Omron's snap-action, miniature and subminiature basic switches are available in a wide variety of actuator types and contact configurations to meet your specifications. Switching capacities range from 0.1 to 21 amps, and sealed versions are available for direct soldering to PC boards. In addition, our new A3B lighted pushbutton switches provide water and oil resistance ideal for your machine tool and other harsh industrial applications.

Unconventional Switches for Exceptional Performance

Remember Omron when your switch application requires more than just standard performance. We'll work with you to develop solutions to your specific application problems, if we haven't developed one already. When it comes to photomicrosensors (optical), thumbwheel, basic snap action, keyswitches, DIP, or pushbutton switches, we don't mind being a little unconventional.

1-800-62-OMRON

OMRON®

Responsive Innovation

OMRON ELECTRONICS, INC.
One East Commerce Drive
Schaumburg, Illinois 60173

SWITCHES

Manufacturer	Starting EEM Page No.	DIP	Lever	Pushbutton				Reed	Rocker/ Paddle	Rotary		Slide	Snap Action	Thumb-wheel	Toggle	Mercury	Features
				Position			Push-on/ Push-off			Single Section	Multi-section						
				Momentary Action	Positive Action	Interlock											
Altech Corp.	B•1677		√	√	√	√	√		√	√	√						Explosion proof, Limit switches, Key lock, Power, Selector switches, Sealed, Change over switches, Cam switches
AME Corp.	B•1678			√	√	√	√			√	√				√		Sealed
American Control Tech. Inc.	B•1679	√		√										√			Illuminated, Sealed Intelligent pushbutton, Coded, Intelligent thumb-wheel
American Research & Engineering	B•1680	√										√					Surface mount low profile DIP
American Switch Corp.	B•1681	√	√	√	√	√	√		√				√		√		Illuminated, Sealed, Subminiature toggle switches
Arcoelectric Corp.	B•1682		√	√	√		√		√			√			√		Illuminated
Arrow Hart Components	B•1684		√		√				√	√	√	√			√		Key lock, Power, Sealed
ASM Corp.	B•1685									√	√						Explosion proof, Power, Concentric shaft switches, Shaft and panel sealed
Augat Inc.	B•1686	√		√	√	√			√	√	√	√			√		Illuminated, Key lock, Sealed
Burgess Switch Co.	B•1688		√	√	√	√	√		√				√		√		Decade, Explosion proof, Illuminated, High voltage, RF, Sealed, Touch, Coded, Joystick controllers
C & K Comps., Clayton Div.	B•1693		√	√	√		√		√	√		√					Illuminated, Key lock, Power
C & K Comps., Newton Div.	B•1692	√	√	√	√		√		√	√	√	√	√	√	√		Power, Sealed, Coded, Membrane keypads
C & K/ Unimax Inc.	B•1694		√	√	√		√			√	√		√				Illuminated, Power, Metal-cased snap-acting, Indicator lights
Carlingswitch Inc.	B•1695			√			√		√						√		Illuminated, High voltage, Key lock
Cherry Electrical Prods.	B•1698		√	√		√							√	√			Low torque, Illuminated, Precision switches, Sealed, Coded, Optoelectronic
Cole Instr.	B•1702									√	√						Sealed, Miniature
Compac	B•1703																Power, RF, Sealed, Multiposition RF switch
CRL Comps.	B•1704	√	√	√					√	√	√		√		√		Key lock, Power, Sealed

SWITCHES (cont'd)

Manufacturer	Starting EEM Page No.	DIP	Lever	Pushbutton				Reed	Rocker/ Paddle	Rotary		Slide	Snap Action	Thumbwheel	Toggle	Mercury	Features
				Position			Push-on/ Push-off			Single Section	Multi-section						
				Momentary Action	Positive Action	Interlock											
Crosspoint/ Info-Lite	B•1709																Coded, Switches–Matrix, Programmable
Crouzet Controls	B•1711						√		√					√			Decade, Coded, LED readout
CTS Switch Division	B•1712	√															
CW Industries	B•1718								√	√		√	√				Illuminated, Power
Digitran & Computron	B•1720						√							√			Decade, Explosion proof, Sealed, Coded, MIL, LED lighted
Dow-Key Microwave	B•1721																High voltage, Power, RF, Microwave
Dreefs Switch Inc.	B•1722			√	√	√	√		√	√	√						Illuminated, High voltage, Electronic control
DSA Inc.	B•1723			√	√		√		√			√			√		Illuminated, Key lock, Sealed, Coded
Durakool	B•1724															√	Sealed
EAO Switch	B•1732	√		√	√	√	√										Illuminated, Key lock, Power, Sealed, Panel mounted, LED Illuminated
EECO Inc.	B•1726	√		√					√	√	√	√		√			Decade, Sealed, Coded
Electro-Mech Comps. Inc.	B•1728			√	√	√	√										Illuminated, Key lock, Sealed
Electronic Components. Groupe	B•1733			√			√		√								Miniature
Electroswitch/ Dist.	B•1736									√	√		√				Key lock, Power, Sealed, MIL
Electroswitch Southern Op.	B•1737									√	√						Explosion proof, Key lock, Sealed, Coded
Elma Electronic Corp.	B•1738	√					√			√	√			√			Illuminated, High voltage, Key lock, Sealed, Touch, Coded
Entech Corp.	B•1739		√	√	√	√	√		√	√	√				√		Illuminated, Key lock, Power, Sealed, Leaf switch assemblies, Leaf contact
Fifth Dimension Inc.	B•1740															√	Proximity, Impulse, Tilt
Grayhill Inc.	B•1743	√		√	√				√	√	√	√	√				Power, Sealed, Coded, MIL
Grimes Co.	B•1750	√		√	√								√				Keyboard, MIL

SWITCHES (cont'd)

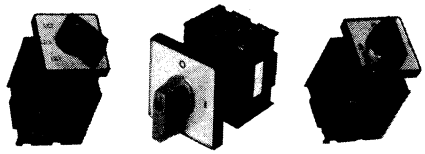
Manufacturer	Starting EEM Page No.	DIP	Lever	Pushbutton				Reed	Rocker/ Paddle	Rotary		Slide	Snap Action	Thumbwheel	Toggle	Mercury	Features
				Position			Push-on/ Push-off			Single Section	Multi-section						
				Momentary Action	Positive Action	Interlock											
Hamlin Inc.	B•1751							√									
Hasco Components Inc.	B•1752			√	√	√	√										Reed switches, Proximity switches
Hermetic Switch Inc.	B•1753							√									High voltage, Power, Sealed, Hi reliability
IDEC Corp.	B•1754			√													Illuminated, Key lock, Sealed
Illinois Lock Co.	B•1756																Key lock
ITT Schadow	B•1758	√		√	√	√	√		√	√	√	√					Illuminated, Power, Sealed, Coded
ITW Switches	B•1762		√	√	√		√		√	√		√	√				Explosion proof, Illuminated, Sealed
IVO Industries	B•1775													√			Decade, Illuminated, Coded
JAE Electronics Inc.	B•1776	√		√						√				√			Illuminated, Miniature, Low profile, Tactile
Janco Corp.	B•1778			√	√		√			√	√						Sealed, For printed circuits, MIL
Lamb Inds.	B•1780	√		√			√		√	√		√			√		Illuminated, Power, Sealed, Miniature DIP rotary, AC receptacle (IEC connector), Indicators, Lamps
L-Com Inc.	B•1782																IEEE-488
Lucas Ledex Inc.	B•1784						√				√						Decade, Explosion proof, Illuminated, Key lock, Touch, Coded
LZR Electronics Inc.	B•1786	√					√					√					Sealed, Surface mount
Manfacturers Components Inc.	B•1788			√					√								Front panel mounts, Illuminated, Power, Sealed
Marlee Switch Co.	B•1789							√								√	RF, Matrices-switching, Switches-coax, twinax, triax, matrix, systems
Marquardt	B•1791								√			√					
McGill Mfg. Co.	B•1798		√	√			√		√				√		√		Illuminated, Key lock, Power, Sealed
Mechanical Enterprises Inc.	B•1801																Illuminated
Mepcopal	B•1803	√								√	√						Coded, Surface mount
Micro Switch	B•1804	√	√	√	√	√	√		√				√		√		Illuminated, Key lock, Power, Sealed, Coded, UL, CSA, MIL
Molex Inc.	B•1814																Hybrid-constructed control panels

SWITCHES (cont'd)

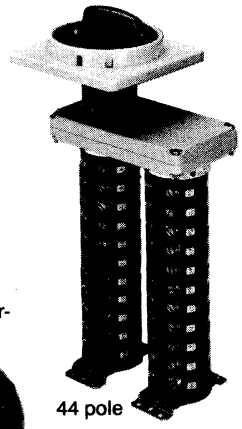
Manufacturer	Starting EEM Page No.	DIP	Lever	Pushbutton				Reed	Rocker/ Paddle	Rotary		Slide	Snap Action	Thumb-wheel	Toggle	Mercury	Features
				Position			Push-on/ Push-off			Single Section	Multi-section						
				Momentary Action	Positive Action	Interlock											
NKK Switches	B-1816			√			√		√	√	√	√			√		Illuminated, Key lock, Power, Sealed, Coded
Oak Switch Systems	B-1822		√	√			√		√	√	√						Explosion proof, Illuminated, Key lock, Power, RF, Sealed, Touch
Omega Engineering	B-1823										√						
Omron Electronics	B-1824	√	√	√	√	√	√		√	√			√	√			Illuminated, High voltage, Key lock, Power, Sealed, Coded
Oslo Controls	B-1827			√	√		√		√								Illuminated, Key lock, Power
Otto Controls	B-1828			√	√	√	√						√		√		Sealed
Preh Electronic Ind. Inc.	B-1830			√	√		√			√	√	√		√			Illuminated, Power
Pres-Air-Trol	B-1831			√			√										Pressure, Vaccuum, Foot, Shockproof, Waterproof, Decade, Explosion proof, Power, Key lock
Rundel Products	B-1832			√	√		√										Illuminated
Schurter Inc.	B-1835			√	√		√		√	√	√		√				Illuminated, Power, Sealed, Sharp dome
Shallco Inc.	B-1836										√						
Shogyo	B-1841		√	√	√		√	√	√	√	√	√	√		√		Key lock, Power, RF, Sealed, Leaf
Standard Grigsby Inc.	B-1842		√	√			√	√		√	√						Explosion proof, Key lock, Sealed, Touch, Coded
Standex Electronics	B-1844							√									High voltage, Power, Sealed
Switchcraft Inc.	B-1847		√	√	√	√	√		√			√			√		Stack switches
T-Bar Inc.	B-1850														√		Sealed
Tech Labs	B-1851									√	√		√	√	√		High voltage, RF, Sealed, Coded, Stepping switch, Power
Veetronix Inc.	B-1852			√	√		√	√									Keyboard, Low voltage, Illuminated , Sealed

Altech Corp.
349 ROUTE 206 SOUTH, SOMERVILLE, N.J. 08876
TELEPHONE: (201) 359-4454 FAX 201-359-8178

Discover the Altech Advantages...

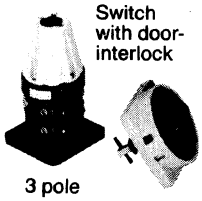


NEW! CM SERIES MODULAR SWITCHES



Dual Column. Tandem Switch with padlockable handle

Switch with door-interlock



3 pole

44 pole

Disconnect Switches

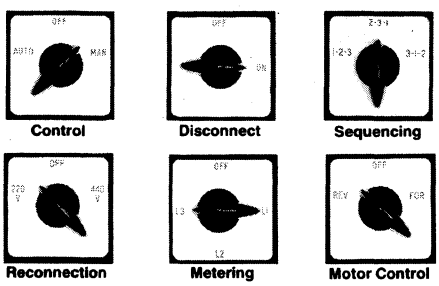
...STATE-OF-THE-ART CAM SWITCHES

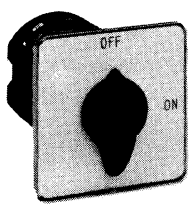
- Altech/Breter cam switches to meet the approvals required for worldwide markets
- Modular switching chambers provide unlimited contacts and contact configurations
- Custom switching requirements are achieved with standard parts
- High quality silver alloy contacts enable "breaking" up to 10 times the rated current
- Steel thru-shaft provides accurate movement of all cams regardless of switch length
- Stainless steel thru-bolts ensure a sturdy multi-chamber assembly

Ratings: Milliamps to 630 Amps, Millivolts to 660 Volts

Options: Door interlocks, key-lock devices, switch enclosures

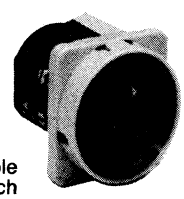
CAM SWITCH APPLICATIONS...



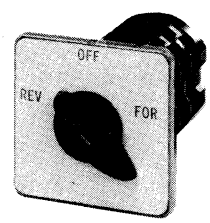


Front panel mounted switch

Drum switch with enclosure



Pad lockable safety switch

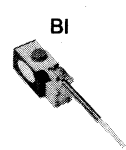


Motor reversing switch

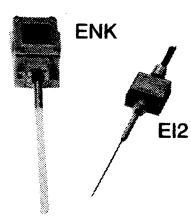
...LIMIT SWITCHES FOR ALL APPLICATIONS

- Altech limit switches meet electrical standards according to IEC, VDE, DIN and other important worldwide standards including UL and CSA
- Limit switches with rollers, wobble sticks, plungers, rods, catwhiskers adapt to any movement detecting requirements
- Available in nonconductive, sealed thermoplastic housing or rugged cast aluminum for harsh environments

ES or GC



BI



ENK

EI2

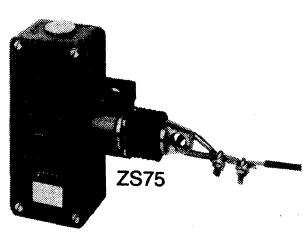
GC Series roller limit switch

ENK Series with catwhisker

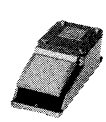
BI Series rod limit switch with reset button

ZS/SI Series cable pull switches can be actuated from any point along cable.

SI2 Series conveyor belt switch (not shown)



ZS75

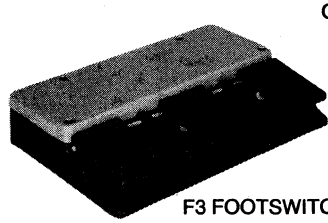


GF FOOTSWITCH

...RUGGED AND DURABLE FOOTSWITCHES

- Single, dual and triple pedal
- Snap-action, momentary, multiposition contacts for standard and special circuits
- Sealed housings, foot shields, interlocks, reset buttons for maximum operator safety
- Cast aluminum housings for heavy duty applications

Options: Housing modifications, preferred colors, cord sets, logos

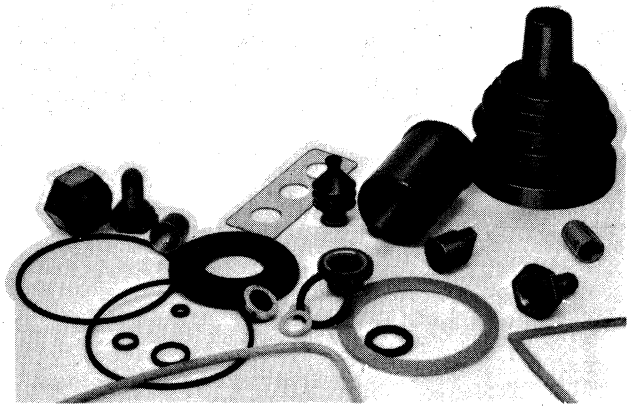


F3 FOOTSWITCH

Call ALTECH for solutions to all your switching requirements

SEE OUR ENCLOSURES IN SECTION 1400 C•1035/SEE OUR TERMINAL BLOCKS IN SECTION 2100 C•1151-55/SEE OUR RELAYS IN SECTION 4500 B•1421

AME SWITCH SEALS



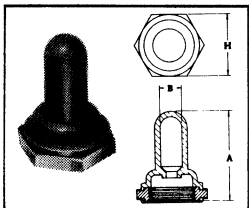
Backed by over 25 years of engineering solutions — for an ever-changing and demanding market.

The wide demand for custom-molded panel and switch seals, threaded inserts bonded to rubber, O-rings, boots and seals, etc., translated is really a demand for talent and know-how to handle the engineering and molding of particularly thorny or unusual custom requirements that frequently plague industry. AME meets the demand. . . with experience, service and unique production techniques.

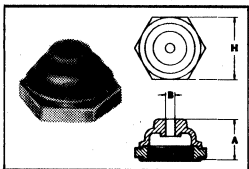
CUSTOM ENGINEERED PRECISION MOLDED ELASTOMERS

- Color filters for incandescent lamps
- Rubber to metal bonding
- Clear silicone products
- Self-sealing hex nuts
- Self-sealing washers
- Extrusions
- O-rings
- Boots
- Gaskets
- Seals
- Conductive rubber
- Die cutting

TOGGLE SWITCH SEALS

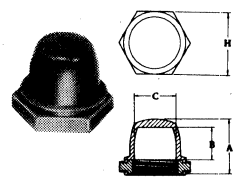


Part Number	Equiv. Military Part Number	Thread Size	Unit	A	B	H	Material Specifications
1100	M5423/01-01	15/32-32 UNS-2B	in.	.86	.22	.625 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 50 Gray
			mm	(21.84)	(5.59)	(15.88)	
1102	None	15/32-32 UNS-2B	in.	.86	.22	.625 Hex	
			mm	(21.84)	(5.59)	(15.88)	
1103	None	15/32-32 UNS-2B	in.	.90	.22	.625 Hex	Nut-Brass, Rubber-Neoprene, 50 Durometer Black
			mm	(22.86)	(5.59)	(15.88)	
1105	M5423/05-01	1/4-40 UNS-2B	in.	.50	.064	.375 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 30 Gray
			mm	(12.70)	(1.63)	(9.53)	



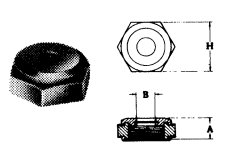
Part Number	Equiv. Military Part Number	Thread Size	Unit	A	B	H	Material Specifications
1101	M5423/02-01	15/32-32 UNS-2B	in.	.40	.09	.625 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 50 Gray
			mm	(10.16)	(2.29)	(15.88)	
1104	None	5/8-24 UNEF-2B	in.	.75	.09	.812 Hex	
			mm	(19.05)	(2.29)	(20.62)	
1106	M5423/11-01	1/4-40 UNS-2B	in.	.25	.05	.375 Hex	
			mm	(6.35)	(1.27)	(9.53)	

PUSH BUTTON SWITCH SEALS



Part Number	Equiv. Military Part Number	Thread Size	Unit	A	B	C	H	Material Specifications
2100	M5423/07-01	15/32-32 UNS-2B	in.	.55	.32	.42	.625 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 60 Gray
			mm	(13.97)	(8.13)	(10.67)	(15.88)	
2101	None	1/2-32 UNS-2B	in.	.46	.29	.41	.750 Dia.	
			mm	(11.68)	(7.37)	(10.41)	(19.05)	
2102	M5423/07-02	15/32-32 UNS-2B	in.	.72	.48	.42	.625 Hex	
			mm	(18.29)	(12.19)	(10.67)	(15.88)	
2103	M5423/10-01	1/4-32 UNEF-2B	in.	.31	.20	.19	.375 Hex	
			mm	(7.87)	(5.08)	(4.83)	(9.53)	
2104	M5423/10-02	1/4-40 UNS-2B	in.	.31	.20	.19	.375 Hex	
			mm	(7.87)	(5.08)	(4.83)	(9.53)	

ROTARY SWITCH & POTENTIOMETER SEALS



Part Number	Equiv. Military Part Number	Thread Size	Unit	A	Size of Shaft B	H	Material Specifications
3100	M5423/09-02	3/8-32 UNEF-2B	in.	.22	.250	.500 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 60 Gray
			mm	(5.59)	(6.35)	(12.70)	
3101	M5423/09-01	3/8-32 UNEF-2B	in.	.22	.125	.500 Hex	
			mm	(5.59)	(3.18)	(12.70)	
3102	M5423/09-04	15/32-32 UNS-2B	in.	.22	.250	.625 Hex	
			mm	(5.59)	(6.35)	(15.88)	

MANY OTHER SIZES AND TYPES AVAILABLE

Pressure capabilities: Internal Pressure
1 Atmosphere, 15 psi (103.4 kPa)
External Pressure
2 Atmospheres, 30 psi (206.8 kPa)
For Part #1106 — Internal pressure
.7 Atmosphere, 10 psi (69 kPa)
External pressure
1.4 Atmospheres, 20 psi (138 kPa)

Endurance: Exceeds 100,000 actuations (depending on environment).

Useful life: 20 years to unlimited (depending on environment).

Switch Seals are designed and manufactured to meet or exceed applicable military specifications.

FAX (201) 263-8199

Switch Seals

An elastomeric boot which seals, thus protecting a switch and internal components against hazardous foreign elements. AME's one piece switch seal is constructed of a flexible rubber boot element bonded during molding to a threaded metal insert that fully encapsulates the switch and bushing to the panel.

This assembly replaces the panel mounting nut and seals the mounting hole making it watertight. It protects against moisture, oil, dirt, dust, most solvents, many acids (see elastomer selection guide).

Switch seals provide vibration resistant mounting and act as double insulation with no interference to switch movement.

CAST URETHANE & SILICONE

AME supplies cast urethane and silicone products precision engineered to meet your most demanding requirements.

If you need high tensile/tear strength, excellent resistance to abrasion and high impact capability, our cast urethane is ideally suited for the job. Superb temperature resistance to the damaging sub-zero cold or searing heat extremes is found in the cast silicone custom engineered by AME Corporation.

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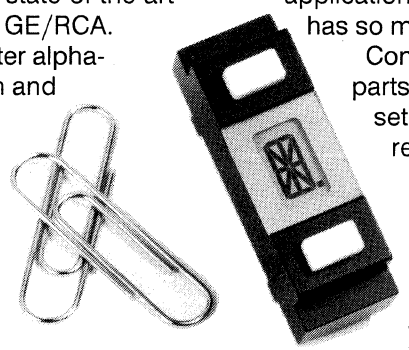
SWITCH SEALS

The world's first intelligent man/machine interface in a DIP . . .

Provides all of the display and switch functions you'll ever need in a single compact device. Stackable and cost-effective.

The secret? A single LSI chip with state-of-the-art CMOS logic. Developed jointly with GE/RCA. Logic that combines a single-character alpha-numeric display, thumbwheel switch and pushbutton switch functions in one easy-to-use component. A true peripheral device with a RAM-like CPU interface.



An intelligent thumbwheel switch that will put you miles ahead of the competition. With capabilities they can only dream about. Unless, of course, you tell them.

In a simple application you might directly replace those out-dated mechanical thumbwheel switches. A typical cookbook design. And without a host CPU.

In a more sophisticated application you might use a host processor to provide programmable control over man/machine interactions. Such as formula selection and entry, display of messages, user friendly menus, or a mix of some or all of these capabilities. The possibilities are limited only by your imagination.

No matter how simple or how complex your application is, no other interactive component has so much to offer and is so easy to use.

Concerned about availability? Standard parts are typically off-the-shelf. We've even set up a second source so that you'll receive an uninterrupted supply.

Got a deadline to meet? Our technical support team will help get you on the air in record time. Or maybe one of our off-the-shelf intelligent thumbwheel assemblies will fit the bill.

Whether you need to make a decision fast, or you're just thinking about down the road. Our microcontroller-based evaluation kit will provide you with instant evaluation, complete documentation and everything else you need to get started. Order one right now and experience intelligent interaction.

To place an order or for more information call: (708) 426-6780.
Please use (312) 426-6780 before Nov. 11, 1989.

EVALUATION/DESIGNER'S KIT

This handy low-cost kit will save you weeks of time. The kit includes everything you need for evaluating, prototyping and designing with this new technology. A MUST for your engineering lab.

Includes a microcontroller programmed to demonstrate the many functions and capabilities of these devices.

The kit includes:

- 15 assorted intelligent thumbwheels
- A microcontroller-based evaluation board with all components (includes a preprogrammed Signetics S87C751 microcontroller)
- Technical data sheets and specifications
- Application notes

Order # EVAL-SST-KIT $245

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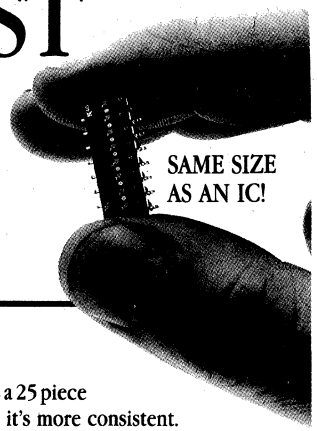
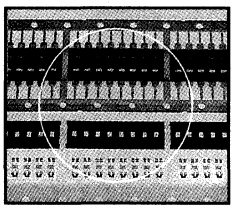
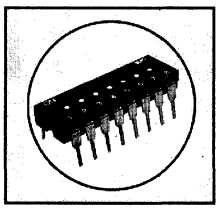
THE WORLD'S SMALLEST SURFACE MOUNT DIP SWITCH!



American Research & Engineering's strip molding process makes for a more reliable switch





It's More Reliable

Three simple components: two composite metal/plastic strips and one plastic molded cover replaces a 25 piece assembly to make a switch that's more reliable because it's more consistent.

SAME SIZE AS AN IC!

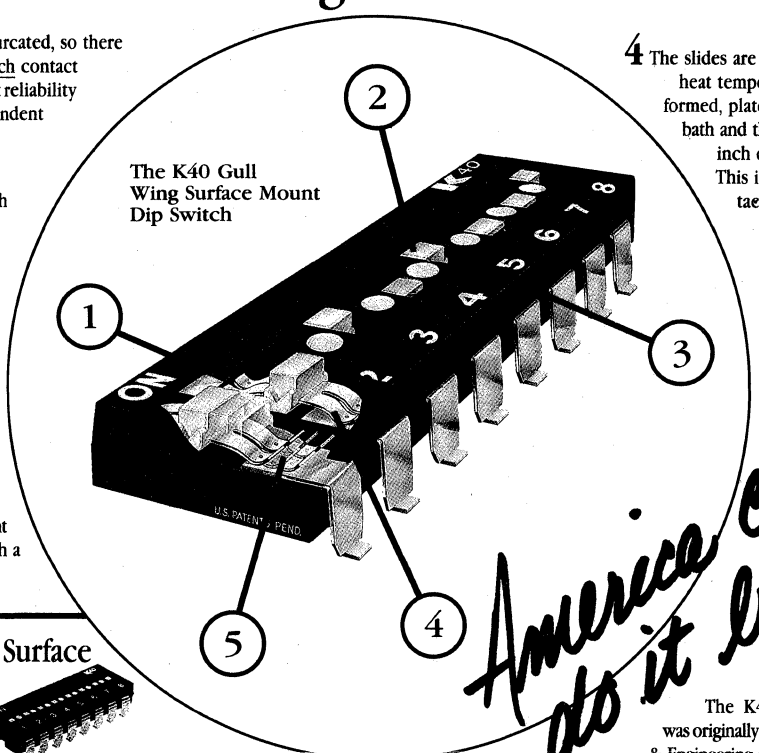
If you don't have automatic insertion equipment, we're banking that some day you will. In the meantime, your board will look neater, better and more professional. And if you have insertion equipment, you'll save the cost of hand insertion!

Three New Patent Designs That Use 40% Less Parts

1 The slides are split, or bifurcated, so there are two separate slides for each contact point. This doubles the contact reliability because you have two independent gold plated contacts at each switch point.

2 The switches are flush with the cover to eliminate accidental, on-off movement once the DIP is programmed. Simple.

3 The package is sealed. The lead frame is molded directly into the housing to provide a one piece, no-leak construction. The cover is ultrasonically molded to the frame after the switch is assembled. There is no better construction. The Surface Mount housing is made of Ryton with a Kapton tape seal.



4 The slides are made from beryllium copper, heat tempered to a full hardness, spring formed, plated in a 100 micro inch nickel bath and then spot gold plated 30 micro inch deep at all the contact points. This is the best proven switch contaet surface that money can buy.

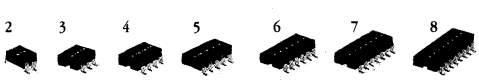
5 Every one of the switch contact surfaces on the main lead frame are plated with 30 micro inch of gold over 100 micro inch of nickel.

America can do it better!

The K40 "J" Bend Surface Mount Dip Switch

Also available for the design engineer trying to save every microinch of board real estate is the K40 "J" bend Surface Mount DIP Switch in positions two through eight.

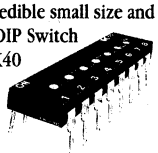
All K40 Dip Switches Are Available In Positions Two Thru Eight!



AMERICAN RESEARCH & ENGINEERING
1500 EXECUTIVE DRIVE ELGIN IL 60123

The K40 Standard Pin Dip Switch

The K40 standard pin DIP Switch was originally designed by American Research & Engineering in 1982 as the world's smallest DIP Switch. It was with its incredible small size and durability that the K40 standard pin DIP Switch led to the development of the new K40 Surface Mount DIP Switch lineup. Lead time for the K40 standard pin DIP Switch is seven to fourteen days and fourteen to twenty-one days for the K40 Gullwing or "J" bend DIP Switch. All K40 switches are manufactured at our plant in Elgin, Illinois.



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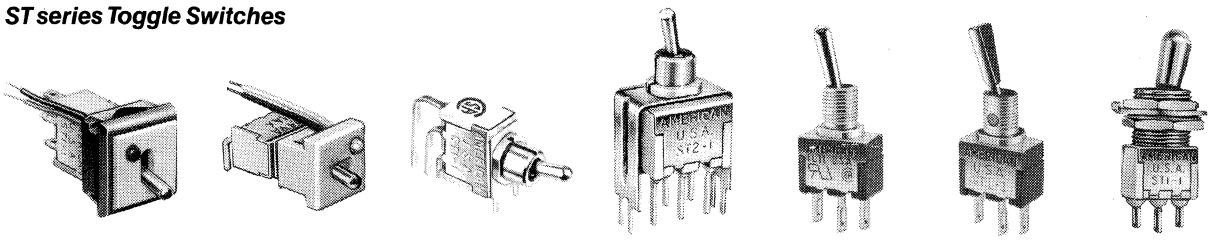
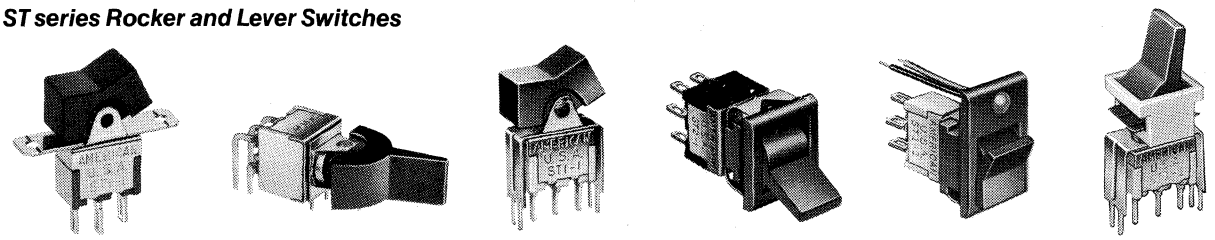
Your best source for quality engineered and innovative products.

- **Subminiature toggle, rocker, lever and pushbutton switches, lighted and unlighted.**
- **Ratings from dry circuit to 6 amps @ 125 VAC, 3 amp @ 250 VAC or 7 amps @ 30 VDC.**
- **Designed and manufactured in Wakefield, MA.**

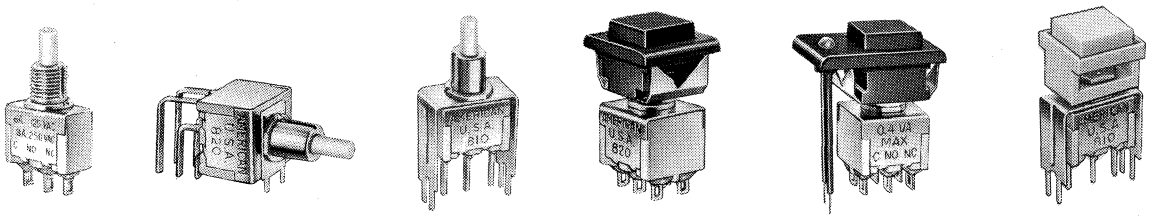
ST series Toggle Switches



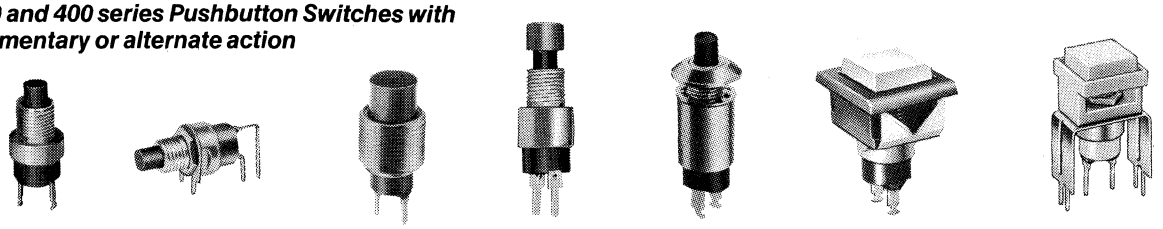
ST series Rocker and Lever Switches



800 series snap-action momentary Pushbutton Switches and PB series momentary Pushbutton Switches

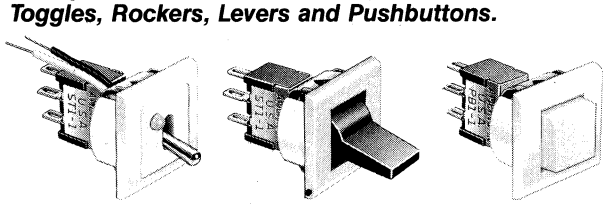


300 and 400 series Pushbutton Switches with momentary or alternate action

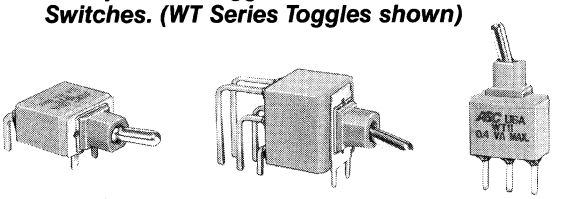


New Products

J96 option round-hole mounting bezels; Toggles, Rockers, Levers and Pushbuttons.



Totally sealed Toggle, Rocker and Pushbutton Switches. (WT Series Toggles shown)



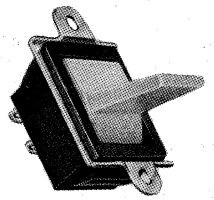
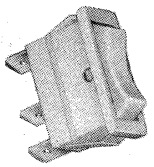
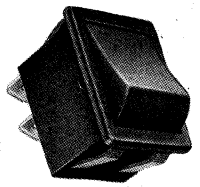
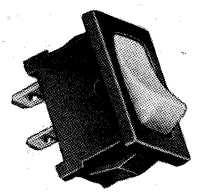
AMERICAN SWITCH CORP., 134 WATER STREET, WAKEFIELD, MA 01880 TWX 710-348-6756

ARCOLECTRIC

Many options are available such as colors, imprinting, protective splash guard covers, also matching indicator light.

For detailed information request our main catalog.

A full range of electrical approvals including UL, CSA, VDE, etc.

SNAP-IN MOUNTING ROCKER SWITCHES

SERIES	1300	1500	5500	8600
CIRCUITS	SPST, DPST INCLUDING ILLUMINATED	SPST, SPDT, DPST, DPDT, INCLUDING CENTER OFF MOMENTARY AND ILLUMINATED	DPST AND SPST IN DP CASE SIZE INCLUDING CENTER OFF, MOMENTARY AND ISOLATED CIRCUITS	SPST, SPDT, DPST, DPDT, INCLUDING CENTER OFF, MOMENTARY AND ILLUMINATED
ELECTRICAL RATINGS Amperage and HP ratings do not apply to all circuits.	16A 125/250V AC 20A 6/28V DC 150A IN RUSH	16A 125/250V AC 20A 6/28V DC ½HP 125V AC 1 HP 250V AC	16A 125/250V AC 20A 6/28V DC	10A 125/250V AC 10A 6/28V DC ½HP 250V AC
CONTACT MATERIAL	CURRENT CARRYING PARTS, COPPER ALLOY SILVER PLATED SILVER CONTACTS. FOR GOLD CONTACTS CONSULT FACTORY.			
TERMINALS	C 6.3mm tab T Solder	C 6.3mm tab G 6.3mm tab Postive lock H 4.8mm tab K 2.8mm tab T Solder	C 6.3mm tab T Solder	H 4.8mm tab J Right angle PCB T Solder X PCB
ACTUATORS	J Paddle P Illuminated spot A Contoured	P Illuminated spot A Contoured W Curved moisture resistant	A Contoured P Illuminated spot	V Curved
PANEL CUT OUT SIZES	Single pole A 12.2 x 27.2mm B 11.0 x 30.0mm T 11.5 x 28.2mm R 14.0 x 28.5mm Double pole A 22.3 x 27.2mm B 22.1 x 30.0mm T 22.3 x 28.2mm	Single pole A 12.2 x 27.2mm B 11.0 x 30.0mm T 11.5 x 28.2mm R 14.0 x 28.5mm Double pole A 22.3 x 27.2mm B 22.1 x 30.0mm T 22.3 x 28.2mm	B 22.1 x 30.0mm T 22.3 x 28.2mm	Single pole 12.9 x 19.1mm Double pole 19.1 x 21.9mm
	FOR FLANGE SIZES CONSULT FACTORY			
PANEL THICKNESS	Single pole .75mm min 2.5mm max Double pole .72mm min 3.3mm max		.75mm min 2.5mm max	.75mm min 3.0mm max

Specifications subject to change without notice. Not all combinations always available.

SEE OUR INDICATOR LIGHTS AD IN SECTION 2460 PGS. B•1130, 1131

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ARCOLECTRIC

Many options are available such as colors, imprinting and protective splash guard covers.

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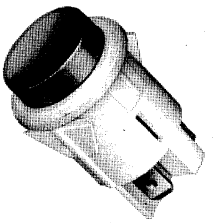
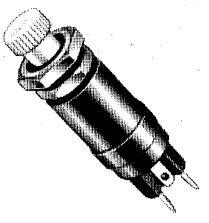
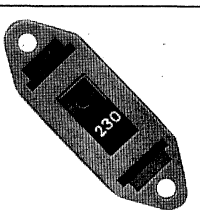
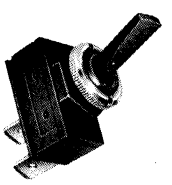
A full range of electrical approvals including UL, CSA, VDE, etc.









	PUSH BUTTON		SLIDE	TOGGLE
SERIES	**7000**	**900**	**2000**	**1700 NYLON 17000 METAL**
CIRCUITS	SPST, DPST INCLUDING MOMENTARY, ILLUMINATED ALTERNATE ACTION	SPST, SPDT, DP, ST MOMENTARY ONLY. Normally open and Normally closed	Single pole Double pole including two thru five position.	SPST, SPDT, DPST, DPDT, including center off, momentary
ELECTRICAL RATINGS Amperage and HP ratings do not apply to all circuits.	16A 125/250V AC ½ HP 125V AC 1 HP 250V AC 6A 6/28V DC	0.5A 125/250V AC 0.1A 6/28V DC	12A 125/250V AC	NYLON 16A 125/250V AC 20A 125/250V AC 1 HP 250V AC METAL 20A 125V AC 10A 250V AC 1½ H.P.
CONTACT MATERIAL For gold contacts consult factory.	Silver	Silver plated	Silver Plated	Silver plated or silver depending on model
TERMINALS	C 6.3mm tab H 4.8mm tab T Solder	C 6.3mm tab T Solder	K 6.3mm tab T Solder X PCB	6.3mm tab 6-32 screw
ACTUATORS	Round, Square, Flush, Projecting	Diameter 5.0mm to 22.0mm	Flush to 6.0mm	Various lever styles
PANEL CUT OUT SIZES	ROUND 25.0mm dia SQUARE 22.4 x 22.3mm	7.1mm dia to 12.7mm dia	Two hole center to center mtg. 2 Position 34.0mm 3 Position 38.0mm Snap in version 14.0 x 30.00mm Without two hole mounting various sizes depending on number of switching positions	12.7mm dia
PANEL THICKNESS	0.8mm 5.0 max Depends on model	2.5mm to 4.0mm	Snap in model 0.8 x 2.5mm	Nylon 3.5mm min Metal 7.93mm

Specifications subject to change without notice. Not all combinations always available.

SEE OUR INDICATOR LIGHTS AD IN SECTION 2460 PGS. B•1130, 1131

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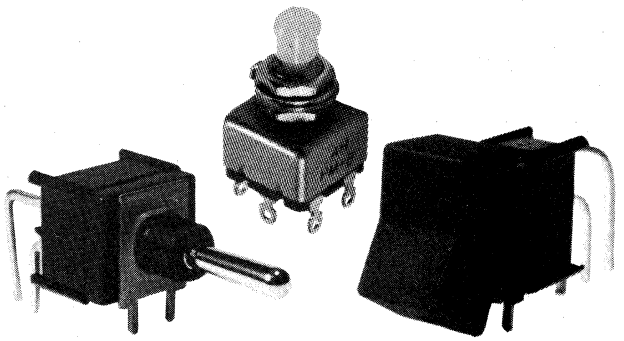
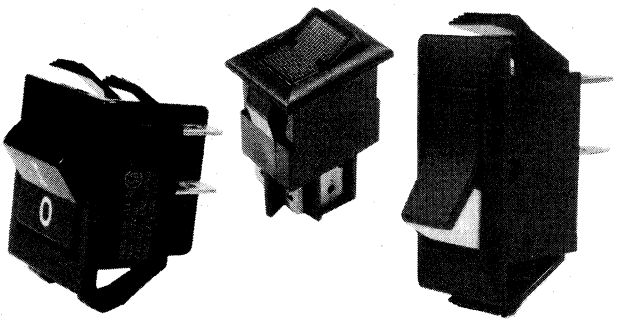
Arrow Hart
The Leader in Current Events.



Arrow Hart Control Switches

Arrow Hart offers a wide range of quality sealed switches for signal circuit applications. The "L" Series features a complete line of miniature washable switches compatible with PCB mounting, soldering, and cleaning processes, including those applicable to surface mount technology. All are 100% bubble tested to assure structural integrity. Also available are versions with anti-static capability up to 20,000V, and environmentally sealed threaded bushing mount switches.

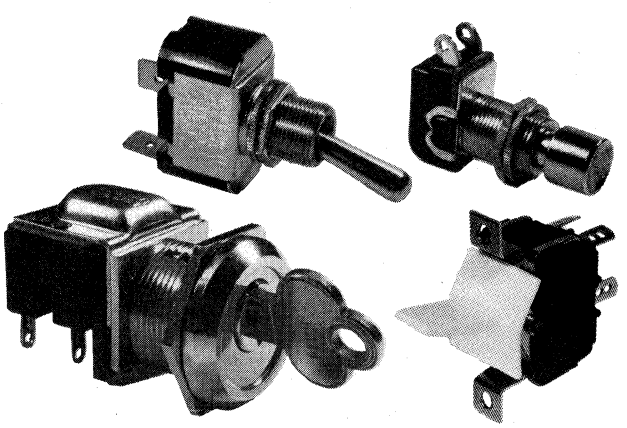
Arrow Hart control switches also include "TS" and "PM" miniature toggle and printed board switches as well as "TM" Series military toggle switches built to MIL-Spec 83731 and QPL'd under MS 75028 and MS 75029.



Arrow Hart Rocker Switches

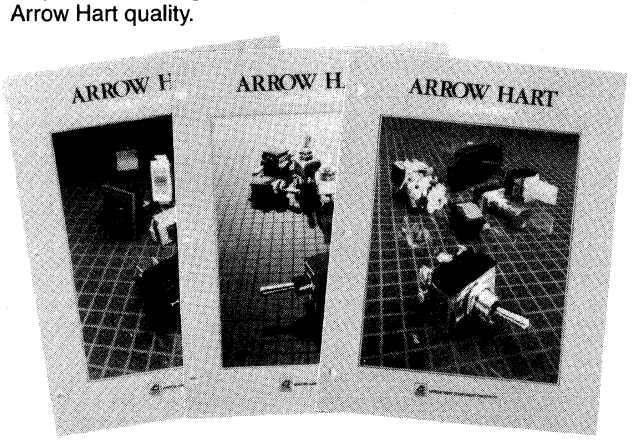
The complete line of rocker switches is designed to meet the industry's toughest needs with continually improved ratings, a wide range of circuit configurations, international approvals and innovative new product design.

From the 1600/2600 Series, the first rocker switch line to provide a full range of international approvals, to the 1500/2500 Series of contoured rockers featuring a contemporary look and feel. The mini rocker features high ratings in an aesthetically pleasing space saving package while the Hi-Lite 2-color rocker provides an "on" indication without being lighted. And the 92 Series, specially developed for applications where the positive response of a larger switch is required, all with traditional Arrow Hart quality.



Arrow Hart Power Switches

Arrow Hart offers a wide range of power switches rated from 1 ampere through 60 amperes at 125-600 V AC/DC. Designed for general purpose and heavy duty applications that require long service and dependability. Available in toggle, rotary, push button, slide and keylock variations. Built with Arrow Hart quality for superior performance.



Catalogs of Current Events

Each of our three catalogs includes selection tables, technical specs, factory and field modification charts, dimensional diagrams, key features and application information. For your free copy contact Arrow Hart Components, P.O Box 9050, Charlottesville, VA 22906-9050 974-5100 FAX (804) 973-2236.

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SERIES 20 SPECS.

SERIES 12 SPECS.

SERIES 22 SPECS.

SERIES 16 SPECS.

SERIES 11 SPECS.

SERIES 18 SPECS.

SERIES 14 SPECS.

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miniature
POWER
SWITCHES

TYPICAL USES

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INSTRUMENTS

AVIONICS

MEDICAL

MARINE

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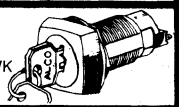
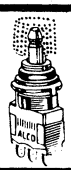
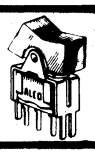
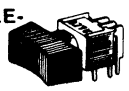
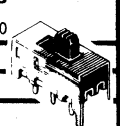
+105°C
+125°C
TEMP. RANGE

AUGAT® ALCOSWITCH® Switch

Quality and Innovation

SWITCH TYPE	# of Poles	# of Positions	Main-tained	Momen-tary	Alternate Action	Illumin-ated	CONTACTS Gold	CONTACTS Silver
DIP/SIP • Auto-Dip • Piano-Dip • Rotary-Dip • SS/SL Sip	1&2	2 thru 10 & 16	•				0.4VA 20 V	
KEYLOCKS  • SKFC, SKT, SWK	1&2	1-10	•	•			0.4VA 20V	3-5A @ 125 VAC
PUSHBUTTON-MINIATURE  • Green Series (MPA, etc.) • MPA-3 Series • MSPM • MPS • MPB • MSPF • MSP-5	1,2&4	2		•	•	•LED •Bicolor LED	0.4VA 20V	6A@ 125 VAC 3A@ 250VAC
PUSHBUTTON-SUBMINIATURE • TP Series • FSM Series • SMP Series • MLP • TP 200 Series	1&2	2		•	•	•LED •Reflector	0.4VA 20V	1A@ 125VAC
RELAYS •Blue-Line Series	1,2&4		•	•			•	1-2A @125 VAC
ROCKER/PADDLE - MINIATURE  • Gemini (A,AE) • Green (MHV, MRV, MLD) • TRD Series	1,2&4	2&3	•	•		•LED •Bicolor LED	0.4VA 20V	6A@ 125 VAC 3A@ 250VAC
ROCKER/PADDLE-SUBMINIATURE  • TR Series	1,2&4	2&3	•	•			0.4VA 20V	3A@ 125VAC
ROTARIES - MINIATURE • MRS	1,2&3	1-12	•				•	•
• MRC	1,2,3&4	1-10	•					•
SLIDE SWITCHES  • MSS, MHS, MSSA-1350	1thru12	1-5	•	•			0.4VA 20V	.300A @ 125V
• SL, SLS, SLSA	1,2	1-10	•					.3-.5A
• MSSA, TSS	1,2&4	1-4	•					.3-1A
• Auto-slide	1,2,4&6	1,2&3	•					.3A@ 125 VAC
TOGGLE-MINIATURE • Gemini Series (A, AE) • Green Series (MTA, etc.)	1,2&4	2&3	•	•		•LED	0.4VA 20V	6A@ 125 VAC 3A@ 250VAC
TOGGLE-SUBMINIATURE • TT Series • SMT Series • AT Series	1,2&4	2&3	•	•		•LED	0.4VA 20V	3A@ 125VAC

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Selector CHART

TERMINATIONS						MOUNTING						Process Compatible (withstands post solder wash)	Agency Approvals	Other
PC	WW	WL	SMD	RA	VRA	Panel Bushing	Panel Snap-in	Panel Other	PC Board	Sealed	Unsealed			
•			•	•					•	•	•	•		•Internal Resistors or Diodes
•		•				•					•		UL	•Medium & High Security
•	•	•		•			•		•					•Caps •Boot Seals •Guards
•	•	•	•	•	•	•			•	•	•	•		•Boot Seals •Guards •Tactile Feedback •0.100 Term Spacing
•									•	•	•	•		•High Sensitivity •Latching
•	•	•		•	•	•	•	•	•	•	•	•	UL CSA	•Custom Legends •Custom Colors
•	•	•		•	•	•			•					•Custom Legends •0.100 Term Spacing
•		•		•		•			•	•	•	•		•Adjustable Stops
•						•			•	•	•	•		
•				•					•		•	•		
•				•		•			•		•	•		
•				•					•		•	•		
•			•	•					•	•	•	•		•Machine Insertable
•	•	•		•	•	•	•	•	•	•	•	•	UL CSA	
•	•	•	•	•	•	•			•	•	•	•	UL	•0.100 Term Spacing

See our New Full Line Catalog for detailed information on all products.

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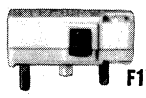
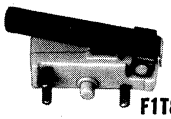
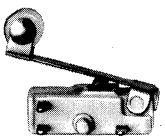

F1T8


F1T8Y1

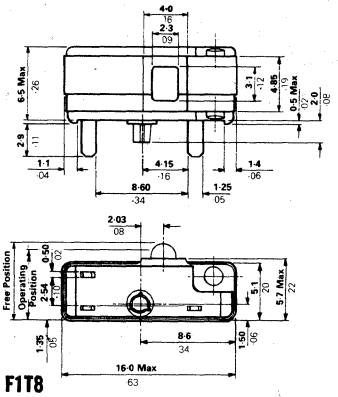

F1T8YR1

ULTRA MINIATURE MICRO SWITCHES
F1 SERIES

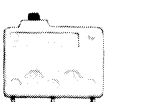
Low profile switches with side-protruding, gold-flashed terminals for printed circuit boards. Mounting by terminals assisted by moulded spigot. Low and standard force, changeover switching mechanisms. Contacts normally silver; add '-GP' to reference for gold. Plunger, plain lever or roller-lever may be depressed to case in overtravel.

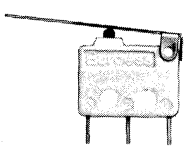
Ordering Reference	Actuator	Dimensions L	B	H	Actuating Force N	Ozf	Rec. max. Rating 125/250 VAC
F1T8	Plunger	16	10	7	1.4	5	5
F12T8	Plunger	16	10	7	0.5	1.8	2
F1T8Y1	Lever	20	10	11	0.5	1.8	5
F12T8Y1	Lever	20	10	11	0.2	0.6	2
F1T8YR1	Roller-lever	19	10	16	0.5	1.8	5
F12T8YR1	Roller-lever	19	10	16	0.2	0.6	2

A variety of different lever lengths (to 2¼") and shapes are available.



F1T8


F4T6

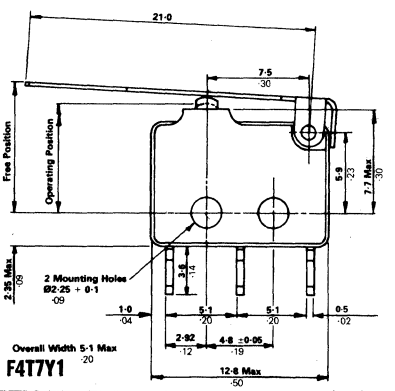

F4T7Y1

F4 SERIES

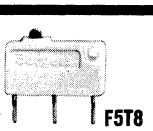
Similar to F5 Series but provided with side mounting holes. Changeover mechanism, recommended maximum rating 7 Amperes at 125/250 volts AC. Silver or gold contacts — add '-GP' to reference for the latter. Plunger, plain lever or cam-following lever actuators, all may be depressed to case in overtravel. 2 mm quick connect tab (QC in table) or solder tag terminals.

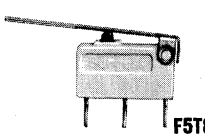
Ordering Reference	Actuator	Terminals	Dimensions L	B	H	Actuating Force N	Ozf
F4T6	Plunger	QC	13	5	18	1.2	4.3
F4T7	Plunger	Solder	13	5	15	1.2	4.3
F4T6Y1	Plain lever	QC	23	5	20	0.4	1.4
F4T7Y1	Plain lever	Solder	23	5	17	0.4	1.4
F4T6YC	Cam lever	QC	21	5	23	0.5	1.7
F4T7YC	Cam lever	Solder	21	5	21	0.5	1.7

MF4 Lug mounting frame for all F4 models. Switch secured without screws.



F4T7Y1


F5T8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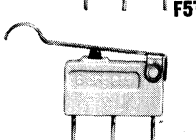
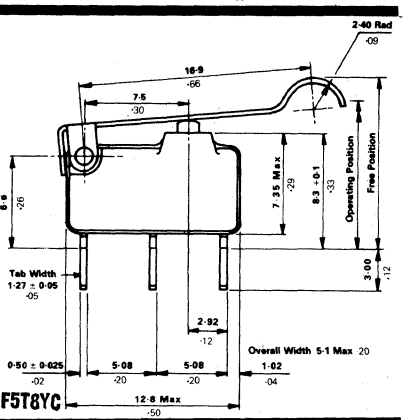

F5T8YC

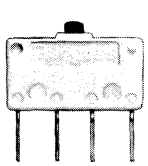
F5 SERIES

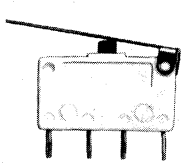
One of the world's smallest precision switches with power capabilities, the F5T8 has no mounting holes and may be mounted on a printed circuit board by means of its 5.08 mm pitched, gold-flashed, base-protruding terminal tags. Also available with plain or cam-following lever actuators. Changeover switching mechanism, recommended maximum rating 7 amperes at 125/250 volts AC resistive load. Silver contacts or add '-GP' to reference for gold. Actuators may be depressed to case in overtravel.

Ordering Reference	Actuator	Dimensions L	B	H	Actuating Force N	Ozf
F5T8	Plunger	13	5	12	1.2	4.3
F5T8Y1	Plain lever	23	5	14	0.4	1.4
F5T8YC	Cam lever	21	5	15	0.5	1.7



F5T8YC

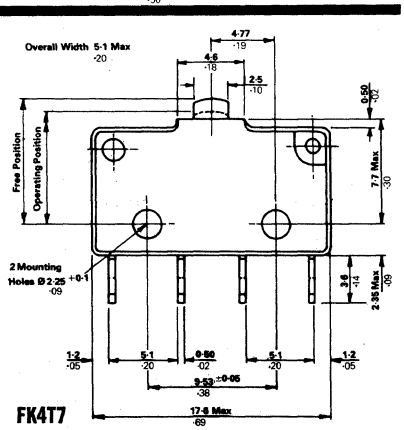

FK4T6


FK4T7Y1

FK4 SERIES

Double-break, two-circuit switches with four terminals. They are slightly smaller than V4 Series switches but have interchangeable mounting position. Lever actuators and terminals as for F4 Series. Recommended maximum rating 7 amperes, 125/250 VAC. Silver contacts, or add '-GP' to references for gold. All actuators may be depressed to case in overtravel.

Ordering Reference	Actuator	Terminals	Dimensions L	B	H	Actuating Force N	Ozf
FK4T6	Plunger	QC	18	5	18	1.5	5.4
FK4T7	Plunger	Solder	18	5	15	1.5	5.4
FK4T6Y1	Plain lever	QC	21	5	21	0.5	1.8
FK4T7Y1	Plain lever	Solder	21	5	18	0.5	1.8
FK4T6YC	Cam lever	QC	21	5	22	0.7	2.3
FK4T7YC	Cam lever	Solder	21	5	19	0.7	2.3



FK4T7

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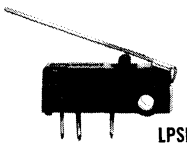
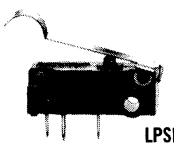
LPSP



LPSPY1

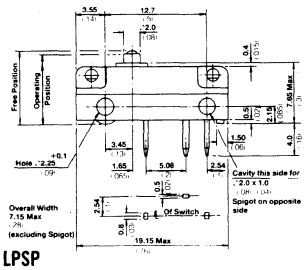


LPSPYC

LOW PROFILE SINGLE POLE MICRO SWITCHES LP SERIES - Sub-Miniature

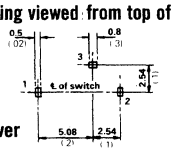
Low profile switches for printed circuit board mounting via the base, protruding gold flashed terminals changeover switching with silver or gold terminals (add-GP to reference for gold contacts). Four different actuating force variants and a wide selection of actuators available which can be fitted to all switches at either end of case.

Ordering Reference	Actuator	Dimensions L	B	H	Actuating Force N	OZF	Rec. max. Rating 125/250 VAC
LPHSP	Plunger	19		9	1.8	6.5	3
LPSP	Plunger	19		9	1.4	5.0	2
LP1SP	Plunger	19		9	0.75	2.7	1.5
LP2SP	Plunger	19		9	0.50	1.8	1.0
LPSPY1	Lever	19		14	0.50	1.8	2.0
LPSPYC	Cam lever	19		16	0.50	1.8	2.0

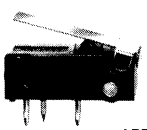


LPSP

Mounting viewed from top of switch



LPDP

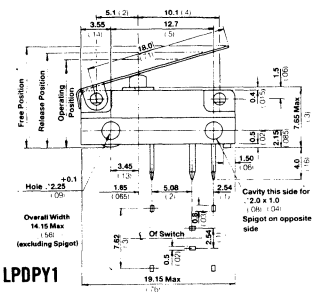


LPDPY1

LOW PROFILE DOUBLE POLE MICRO SWITCHES LPDP SERIES - Sub-Miniature

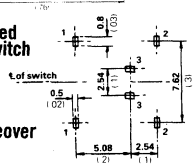
Similar to the above but double-pole consisting of two single-pole mechanisms mounted in one case and actuated by a common plunger. The two poles are electrically isolated and the switch terminals are pitched on the same 0.1 inch matrix. Add-GP to reference for gold contracts. Levers can be fitted at either end of case.

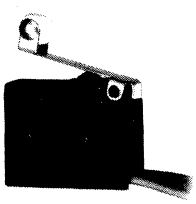
Ordering Reference	Actuator	Dimensions L	B	H	Actuating Force N	OZF	Rec. max. Rating 125/250 VAC
LPDP	Plunger	19		9	2.8	10.0	2
LP1DP	Plunger	19		9	1.5	5.4	1.5
LP2DP	Plunger	19		9	1.0	3.6	1
LPDPY1	Lever	19		14	1.0	3.6	2
LP1DPY1	Lever	19		14	0.5	1.8	1.5
LP2DPY1	Lever	19		14	0.4	1.5	1



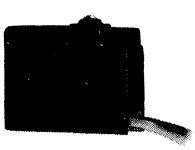
LPDPY1

Mounting viewed from top of Switch

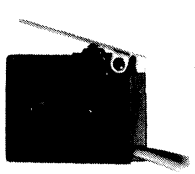




V4SYR1



V4S



V4SY1

SEALED MINIATURE MICRO SWITCHES FOR DIFFICULT ENVIRONMENTS

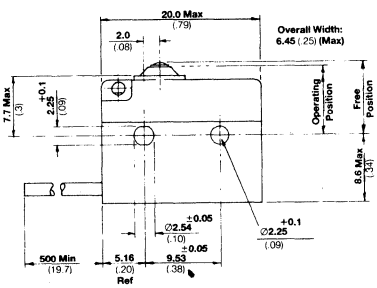
A range of single and multi-pole miniature and sub-miniature Micro Switches with mechanisms totally enclosed to the standard indicated by IEC Code EP67 and NEMA Type 6. Efficient sealing is proved by a pressure test. Explosion-proof models are included in the range. Single-pole switches have plunger actuators which may be used alone or with plain lever or roller-lever auxiliary actuators. Multi-pole models are available with either plunger or integral level actuators (plain or with roller). With one exception, all models are supplied with factory fitted, PVC insulated wires.

SINGLE POLE SUB-MINIATURE SWITCHES V4S MODELS

Glass-loaded nylon case and lid; acetal plunger; a neoprene cowl is fitted around the plunger and bonded to the lid. The well-proven Burgess V4 changeover mechanism is fitted within the enclosure. Three 16/0.2 mm p.v.c. insulated wires are potted in position. Silver contacts are standard. Temperature range – 10° to + 70°C and recommended maximum rating 3 amperes, 125/250 VAC. Silicone cowl/lead versions available for – 50°C operations.

Ordering Reference	Actuator	Dimensions L	B	H	Actuating Force N	OZF
V4S	Plunger	22*	7	18	2.5	9.0
V4SY1	Plain lever	22	7	23	0.9	3.2
V4SYR1	Roller lever	22	7	26	0.9	3.2

A variety of different lever lengths (to 2¼") and shapes are available; also auxiliary actuators in single and double pole configuration.
*excluding cables.



V4S

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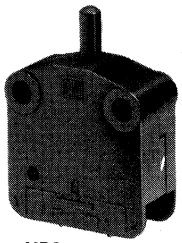
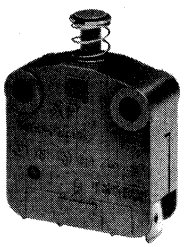
Telephone (219) 262-8608/FAX (219) 262-8819

American Electronic Components



XP2

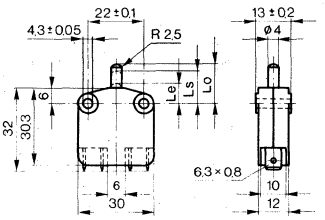


XP2-E1

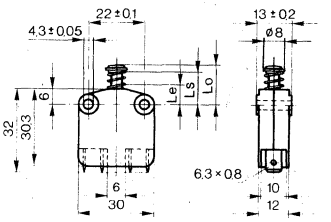
SECURITY SWITCHES BY SAIA
XP SERIES - SINGLE POLE

For use as a door interlock on office equipment, dispensing and industrial machinery. Normally open, normally closed changeover switching available, rated up to 16 amp 1250 VAC. Approvals include UL, CSA, VDE, SEV, SEMKO, NEMKO, DEMKO, and KEMA. Gold Contact (add-81) and elevated temperature (add-W) versions available. Mushroom plunger and additional security return spring (add-E1) ¼" Q.C. terminals.

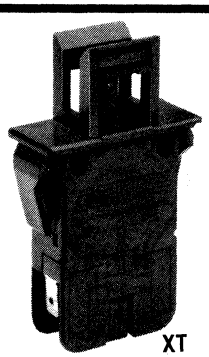
Ordering Reference	Actuator	Dimensions L	B	H	Circuit	Actuating Force	
XP2	Plunger	30	12	41	Changeover	300	10.5
XP42	Plunger	30	12	41	Normally Closed	175	6.2
XP52	Plunger	30	12	41	Normally Open	300	10.5
XP2-E1	Mushroom	30	12	41	Changeover	650	22.9
XP42-E1	Mushroom	30	12	41	Normally Closed	375	13.2
XP52-E1	Mushroom	30	12	41	Normally Open	650	22.9



XP2 / XP42 / XP52
XP2W / XP42W / XP52W



Versions with mushroom plunger
XP2-E1 / XP42-E1 / XP52-E1
XP2W-E1 / XP42W-E1 / XP52W-E1

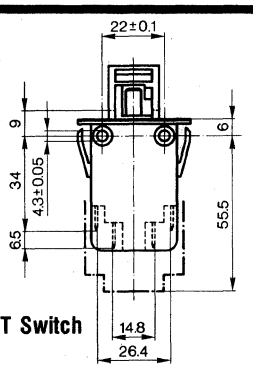


XT

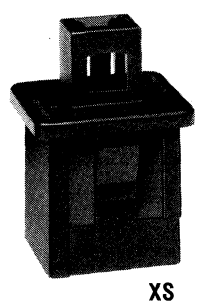
XT SERIES - DOUBLE POLE

Normally open double-pole interlock switch handles up to 15.5 A/250 VAC according to UL/CSA. Options for XT series include plug type, number of switching operations contact configuration and form. Also available without shroud.

Ordering Reference	Description
XTD22	50,000 operations according to CEE 24; 6.3 X 0.8 mm plug type
XTD66A	100,000 operations at 15.5 V/250 VAC; 4.8 X 0.5 mm plug type



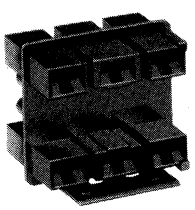
XT Switch



XS

XS SERIES - DOUBLE/TRIPLE POLE

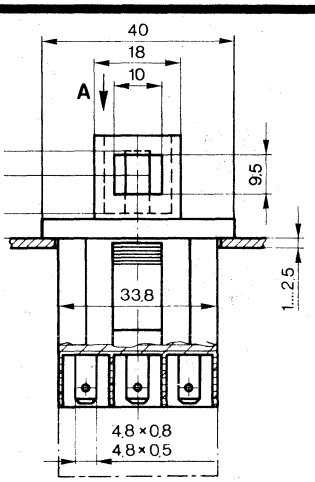
Available as either 2-pole or 3 pole for interlock use; 2-pole handles up to 15 amp, 125/250 VAC per pole with a low voltage 0.3 amp, 30 VAC/30 VDC pole to operate an indicator or electronics circuit. Optional 3-pole model handles up to 15 amp, 125/250 VAC on each pole. Normally open switching with reliable contact breaking by three reset springs acting independently. Convenient snap-in mount 8 mm contact gap and creepage which meets UL, CSA, VDE, SEMKO, DEMKO and BEAB; for use on office machines (UL114, IEC380/VDE 0806) cabinets, data processing and equipment requiring interlocking. Multiplug mating connector (¼" Q.C. terminals) and service key available.



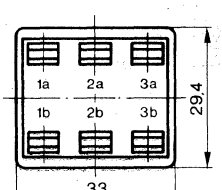
Multiplug Connectors

Service Key

Ordering Reference	Circuit - Detail / Description
XSC06ACAA	3-pole - circuit 1, low voltage gold contacts - circuit 2, 15 amp, 125/250 VAC silver contacts - circuit 3, 15 amp, 125/250 VAC silver contacts
XSC06AAAA	3-pole - circuit 1, 15 amp, 125/250 VAC silver contacts - circuit 2, 15 amp, 125/250 VAC silver contacts - circuit 3, 15 amp, 125/250 VAC silver contacts
XSC06AA0A	2-pole - circuit 1, 15 amp, 125/250 VAC silver contacts - circuit 2, not equipped - circuit 3, 15 amp, 125/250 VAC silver contacts
410451090	Multiplug housing
410948180	Service key



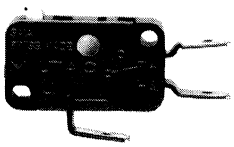
XS Switch



Multiplug Housing

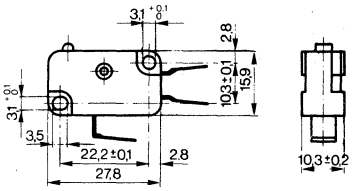
Burgess
SAIA
BURGESS/SAIA Precision Switches
1010 North Main Street/Elkhart, IN 46515
Telephone (219) 262-8608/FAX (219) 262-8819
American Electronic Components

SERIES XG SNAP-ACTION SWITCHES BY SAIA



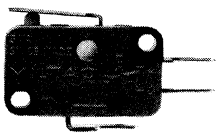
XGK2 Basic Type

Series XG and actuation data are according to the international standard DIN 41635, Form A. These switches are manufactured to very precise standards and with a dimentionally stable, thermoplastic case. They are available in a wide range of switching characteristics and terminal types. Up to 100 million operations assures a long mechanical life.



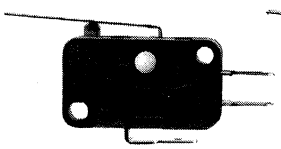
XG Case Dimmension Drawing

TECHNICAL DATA - SERIES XG

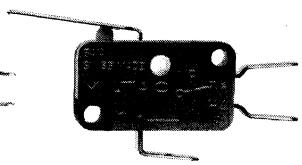


XGC6-J21

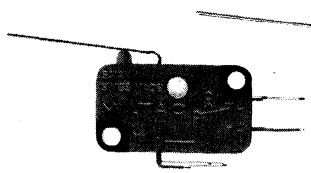
	XGK	XG	XGA	XGB	XGC	XGH
In compliance with UL/CSA	A/V 12/250	15/250	15/250	12/250	10/250	10/250
Mechanical life expectancy	10^6 30	2	2	30	50	100



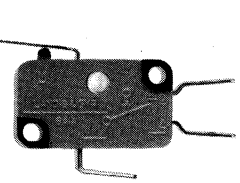
XGK6-J23



XGK2-J42



XGK6-J43

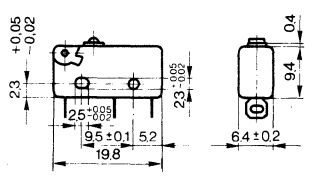


XGH2-J47

SERIES XC SNAP-ACTION SWITCHES

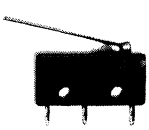
XC3 Basic Type

Series XC dimensions and actuation data are according to the international standard DIN 41635, Form B. These switches are available in a wide range of switching characteristics, terminal types and actuating devices. A tension spring snap-action mechanism provides a very high mechanical life expectancy, up to 50 million operations.



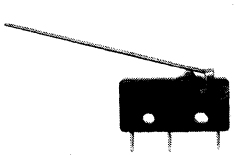
XC Case Dimmension Drawing

TECHNICAL DATA - SERIES XC

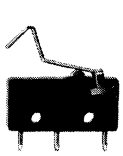


XC3-J2

	XC	XCF	XCK	XCC	XCH
In compliance with UL/CSA	A/V 5/250	10.1/250	5/250	2/250	1/250
Mechanical life expectancy	10^6 10	1	20	50	50

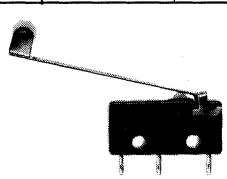


XC3-J5



XC3-L1

XC3-S1



XC3-S4

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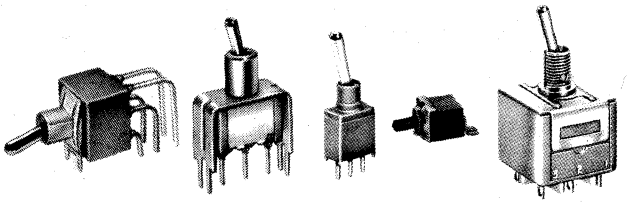
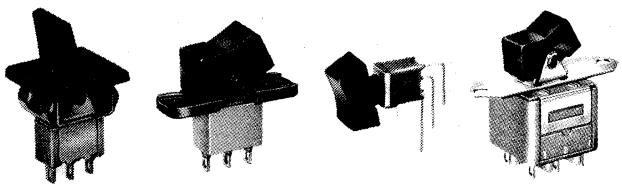
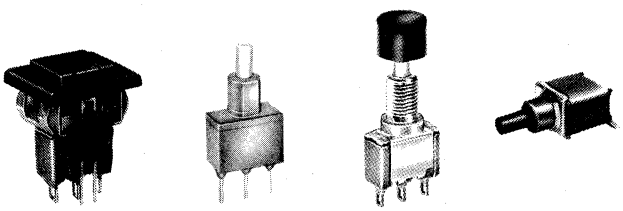
NEWTON DIVISION PRODUCTS



Toggle Switches
A full range of miniature, tiny and ultraminiature models for panel and P.C. mounting, including sealed/process compatible and surface mount. SP thru 4P models with many styles and options available.

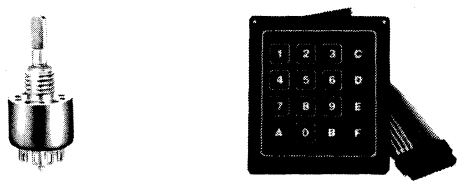


Rocker and Lever Handle Switches
A full range of miniature and tiny models for panel and P.C. mounting, including anti-static and sealed/process compatible designs. SP thru 4P models and many options available.



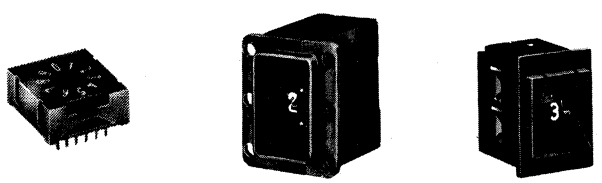
Pushbutton Switches
A complete line of miniature, tiny, subminiature and microminiature switches with momentary, snap-acting and alternate action functions—SP thru 4P. Surface mount and sealed/process compatible models available.

Slide Switches
A full range of miniature, tiny and ultraminiature models with many available options.



Half-Inch Rotary Switches
A full range of miniature instrument grade rotary switches in one and two pole models with 30 degree indexing (12 positions max) or 36 degree indexing (10 positions max).

Membrane Keypads
Available in 4 x 4 and 3 x 4 arrays with either embossed detented or flat nontactile keys.



Thumbwheel Switches
A full range of miniature, sub-miniature and mini-thumbwheel switches with snap-in front or rear panel mounting and P.C. mounting.

DIP Switches
LD Series available in 4, 6 and 8 positions. Low profile, machine insertable, surface mount or thru-hole P.C. terminations. Fully sealed/process compatible. BD Series available in 1 through 12 positions (except 11 pos.). The washable design can be wave soldered.

C&K COMPONENTS, INC. 15 Riverdale Ave. Newton, MA 02158-1082 Tel: (617) 964-6400, Telex: 92-2544, Fax: (617) 527-3062

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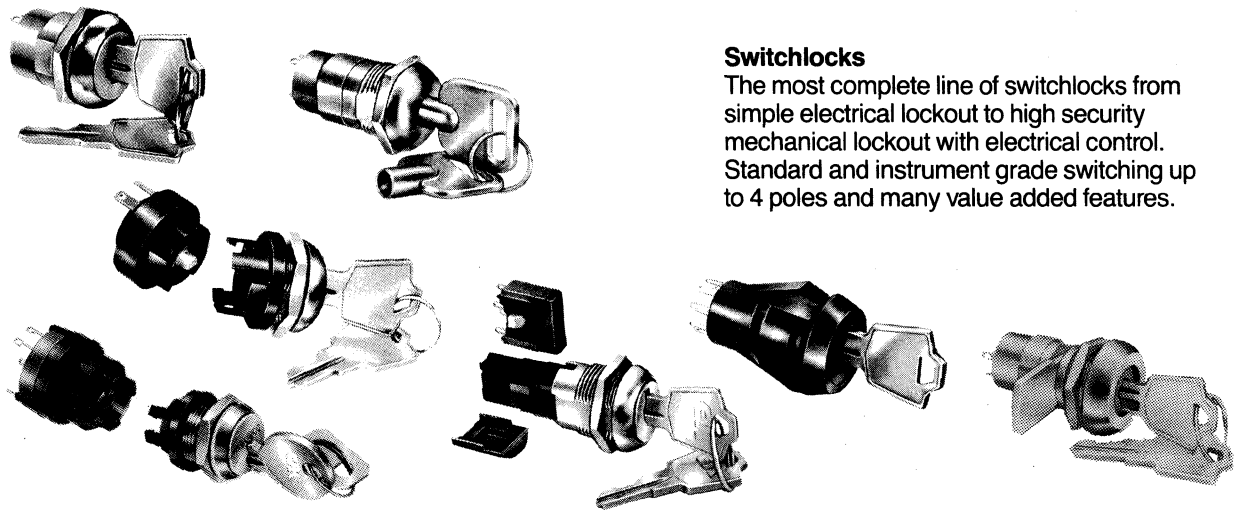
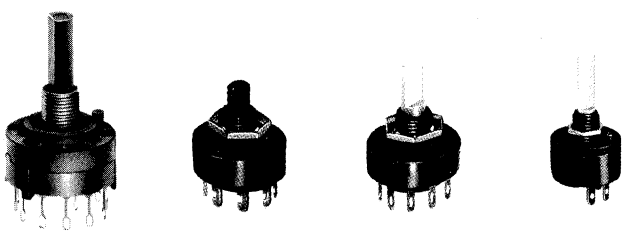
The Primary Source Worldwide®...

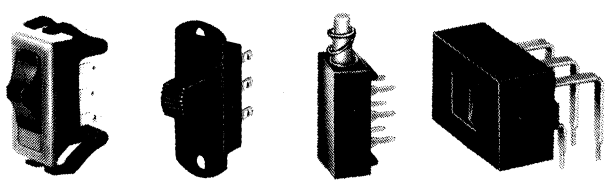
CLAYTON DIVISION PRODUCTS



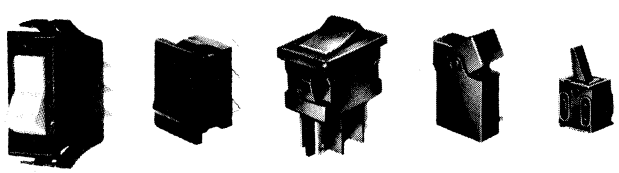
Switchlocks
The most complete line of switchlocks from simple electrical lockout to high security mechanical lockout with electrical control. Standard and instrument grade switching up to 4 poles and many value added features.



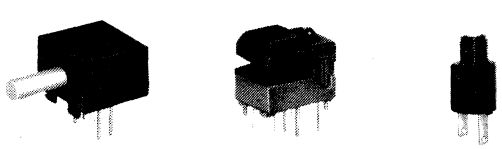
Rotary Switches
All plastic rotary switches adjustable from 2 to 12 positions. ROTA-SLIDE,® Power ROTA-SLIDE and Miniature ROTA-SLIDE rotary switches.



Slide Switches
Power and Line Voltage Select Slide Switches. Miniature and Snap-In Slide Switches.



Rocker and Lever Handle Switches
A full range of miniature power rocker and lever handle switches.



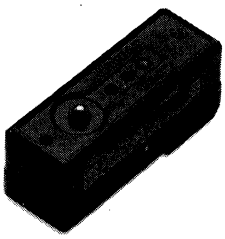
Pushbutton Switches
Pushbutton and mechanical pushbutton models and options for panel and P.C. mounting.

Illuminated Pushbutton Switches
Seven different styles of illuminated and non-illuminated pushbutton snap-acting switches with modular snap-together construction.

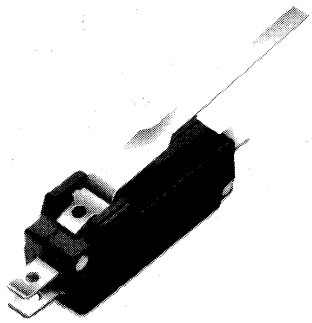
C&K COMPONENTS, INC. 2035 Highway 70 East, Clayton, NC 27520-0687 Tel:(919) 553-3131, Telex:579385, Fax:(919) 553-4758

C&K / Unimax™

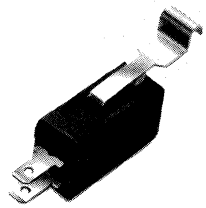
Snap-Acting Switches



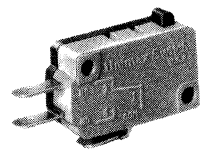
HB Series



A Series



TM Series

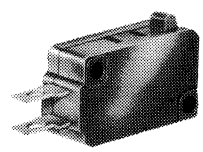


TF Series

Manually Operated Switches

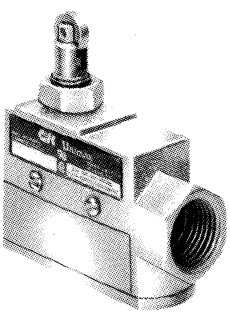
MM Series

LM Series

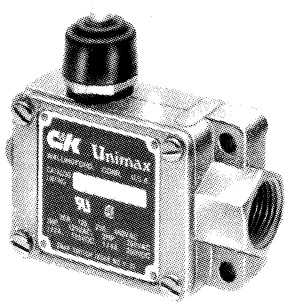


NS Series

Metal-Cased Switches

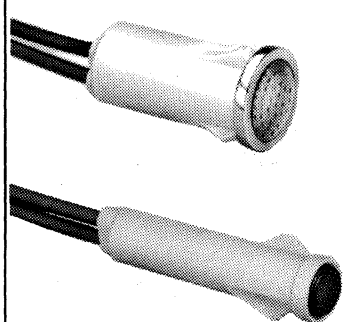


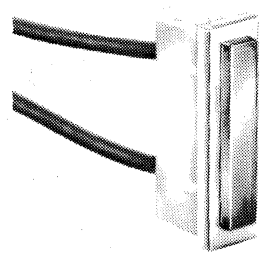
KS Series



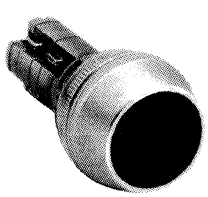
KL Series

Indicator Lights

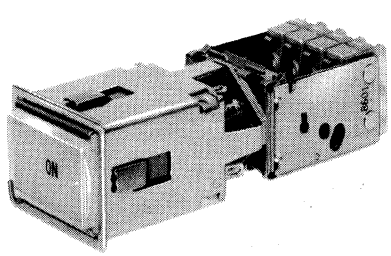




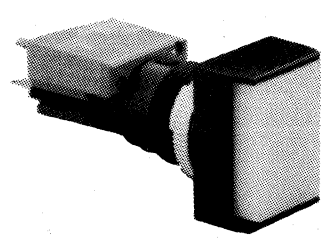
Illuminated Switches



TH Series



9 Series



TH Series

C&K / Unimax, Inc.

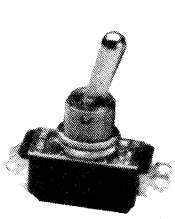
P.O. Box 152, Ives Rd., Wallingford, CT 06492-0152
TEL: (203) 269-8701 • TELEX: 963-485 • FAX: (203) 265-5398

C&K Unimax, Inc. is a wholly owned subsidiary of C&K Components, Inc.

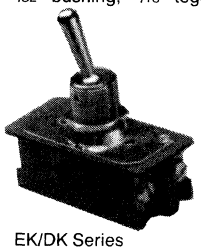
CARLINGSWITCH SWITCHES

GENERAL PURPOSE AC-DC TOGGLE SWITCHES

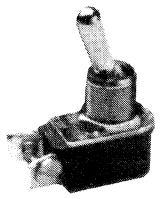
Quick make and break AC-DC rated 6 amps 125 VAC, 3 amps 250 VAC. UL listed and CSA certified 15/32" bushing, 11/16" toggle.



2B Series



EK/DK Series

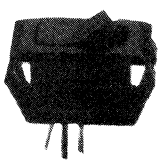


110 Series

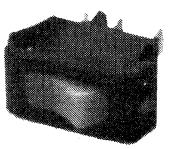
Type	Switch Action	Terminals
110-73	S.P.S.T. ON-NONE-OFF	Solder
110-S-73	S.P.S.T. ON-NONE-OFF	Screw
111-16-73	S.P.S.T. ON-NONE-OFF	Wire
32BB62-73	S.P.D.T. ON-NONE-ON	Solder
2BK62-73	D.P.S.T. ON-NONE-OFF	Solder
2BK65-73	D.P.S.T. ON-NONE-OFF	Wire
2BL62-73	D.P.D.T. ON-NONE-ON	Solder
HEAVY DUTY AC-DC TOGGLE SWITCHES 16 AMPS, 125 VAC 8 AMPS 250 VAC 1 HP 125-250 VAC		
DK284-73	D.P.S.T.	Screw
20 AMPS 125 VAC—10 AMPS 250 VAC—1½ H.P. 125-250 VAC		
EK204-73	D.P.S.T.	Screw

CURVETTE® SNAP-IN SWITCHES

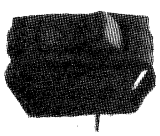
Slow make and break action, .250 quick connect terminals. 16 amps 125 VAC – 10 amps 250 VAC, 10(4) amps—250 W. UL listed, CSA and VDE certified. Rated life 50 M cycles @ rated load. Also features our unique Visi-Rocker®, two-color molded curved rocker for low cost "ON" indication.



R Series



LR Series



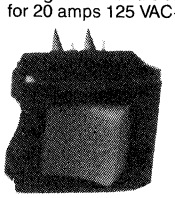
Visi-Rocker R Series

Type	Switch Action	Rocker Color
RA911-RB-B-0-N	S.P.S.T. ON-NONE-OFF	Black
RA911-VB-B-0-V	S.P.S.T. ON-NONE-OFF	Visi-Rocker*
RA911-VB-B-1-V	S.P.S.T. ON-NONE-OFF	Visi-Rocker* w/ON-OFF Imprint
RB911-RB-B-0-N	S.P.D.T. ON-NONE-ON	Black
RC911-RB-B-0-N	S.P.D.T. ON-OFF-ON	Black
LRA911-RS-B/120/N	S.P.S.T. ON-NONE-OFF Lighted	Red

*Curvette Visi-Rocker has a second color molded in for attractive low cost "ON" indication.
ON/OFF imprinting is available, consult factory.

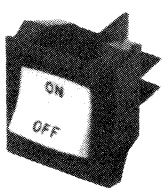
SC HIGH INRUSH CURVETTE SNAP-IN SWITCHES

Designed to handle current surges over 100 amps. UL listed and CSA certified for 20 amps 125 VAC—15 amps 250 VAC.



LRGSC Series

RSC Series



RGSC Series

Type	Switch Action	Rocker Color
RSCA711-RB-B-0-N	S.P.S.T. ON-NONE-OFF	Black
RGSCC711-RB-B-0-N	D.P.S.T. ON-NONE-OFF	Black
LRGSCK211-RS-B/120N	D.P.S.T. ON-NONE-OFF Lighted	Red

ON/OFF imprinting is available, consult factory.

MINIATURE CURVETTE SNAP-IN SWITCHES

These double-insulated miniature switches offer self-cleaning wiping action contact system rated @ 4 amps 250 VAC—8 amps 125 VAC, 6(4) amps 250 VAC. UL listed, CSA and VDE certified. Also features our unique Visi-Rocker two-color molded rocker for low cost "ON" indication.

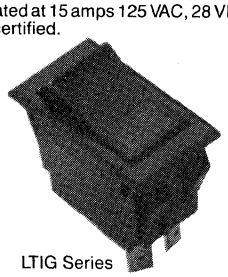
621 Series

Type	Switch Action	Terminals	Rocker Color
62111421-0-0-N	S.P.D.T. ON-NONE-ON	Solder	Black
62112421-0-0-N	D.P.D.T. ON-NONE-ON	Solder	Black
62116319-0-0-N* 11 amps 125 VAC	S.P.S.T. ON-NONE-OFF	.187 Tabs	Black
62115929-0-0-V**	D.P.D.T. ON-NONE-ON	.187 Tabs	Visi-Rocker
62116919-0-9-V**	S.P.S.T.	.187 Tabs	Visi-Rocker w/0-1 mtg.

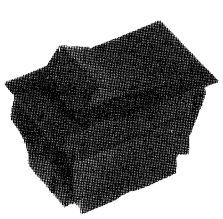
*UL listed and CSA certified for 11 amp 125 VAC ratings.
**Curvette Visi-Rocker has a second color molded in for attractive low cost "ON" indication.
ON/OFF imprinting is available, consult factory.

HEAVY DUTY ROCKER SWITCHES

These full-size rocker switches are designed for AC and low voltage DC applications. They include a slow-make, slow-break contact mechanism, nylon snap-in brackets and are available to resolve most insulation requirements. They are rated at 15 amps 125 VAC, 28 VDC, 10 amps 250 VAC, 3/4 H.P. UL listed and CSA certified.



LTIG Series



TIG Series

Type	Switch Action	Terminals	Rocker Color
TIGA51-6S-BL-NBL	S.P.S.T. ON-NONE-OFF	.250 Tabs	Black
TIGK54-6S-BL-NBL	D.P.S.T. ON-NONE-OFF	Screw	Black
LTILA51-6S-BL-RC-NBL (125 VAC lamp)	S.P.S.T. ON-NONE-OFF	.250 Tabs	Black w/red light

DRIP DRY ROCKER SWITCHES

We have modified the Tippette® Switches above to provide front panel dust and moisture protection with built in seal feature.

Type	Switch Action	Terminals	Rocker Color
TIGA51-6S-BL-WBL	S.P.S.T. ON-NONE-OFF	.250 Tabs	Black
TIGK54-6S-BL-WBL	D.P.S.T. ON-NONE-OFF	Screw	Black
LTILA51-6S-BL-RC-WBL (12V lamp)	S.P.S.T. ON-NONE-OFF	.250 Tabs	Black

ON/OFF imprinting is available, consult factory.

The information listed above is for standard Carlingswitch products. Consult Carlingswitch for additional product information.

CARLINGSWITCH, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156
(203) 793-9281 • FAX: (203) 793-9231 • 1-800-243-8556

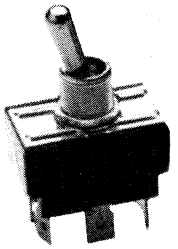
CARLINGSWITCH

SWITCHES

HEAVY DUTY AC RATED TOGGLE SWITCHES

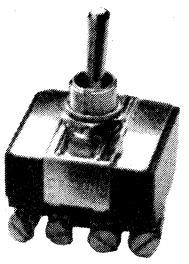
General purpose switches rated @ 15 amps 125 VAC and 28 VDC and 10 amps @ 250 VAC. UL listed and CSA certified in single, double, three and four pole configurations. All are rated 3/4 H.P.—15/32" bushing—11/16" toggle.

F Series



G Series

H Series



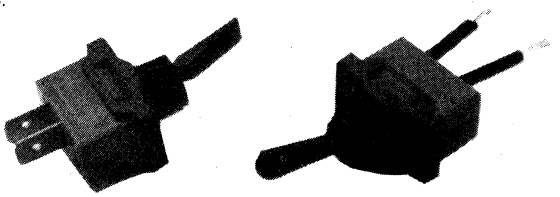
I Series

Type	Switch Action	Terminals
2FA53-73	S.P.S.T. ON-NONE-OFF	Solder
2FA53-73-TABS	S.P.S.T. ON-NONE-OFF	Spade
2FA54-73	S.P.S.T. ON-NONE-OFF	Screw
2FB53-73	S.P.D.T. ON-NONE-ON	Solder
2FB53-73-TABS	S.P.D.T. ON-NONE-ON	Spade
2FB54-73	S.P.D.T. ON-NONE-ON	Screw
2FC53-73	S.P.D.T. ON-OFF-ON	Solder
2FC53-73-TABS	S.P.D.T. ON-OFF-ON	Spade
2FC54-73	S.P.D.T. ON-OFF-ON	Screw
6FC54-73*	S.P.D.T. ON-OFF-ON	Screw
2GK50-73	D.P.S.T. ON-NONE-OFF	Solder
2GK51-73	D.P.S.T. ON-NONE-OFF	Spade
2GK54-73	D.P.S.T. ON-NONE-OFF	Screw
2GL50-73	D.P.D.T. ON-NONE-ON	Solder
2GL51-73	D.P.D.T. ON-NONE-ON	Spade
2GL54-73	D.P.D.T. ON-NONE-ON	Screw
2GM50-73	D.P.D.T. ON-OFF-ON	Solder
2GM51-73	D.P.D.T. ON-OFF-ON	Spade
2GM54-73	D.P.D.T. ON-OFF-ON	Screw
HK250-73	3.P.S.T. ON-NONE-OFF	Solder
HK251-73	3.P.S.T. ON-NONE-OFF	Spade
HK254-73	3.P.S.T. ON-NONE-OFF	Screw
HL250-73	3.P.D.T. ON-NONE-ON	Solder
HL251-73	3.P.D.T. ON-NONE-ON	Spade
HL254-73	3.P.D.T. ON-NONE-ON	Screw
HM250-73	3.P.D.T. ON-OFF-ON	Solder
HM251-73	3.P.D.T. ON-OFF-ON	Spade
HM254-73	3.P.D.T. ON-OFF-ON	Screw
IK250-73	4.P.S.T. ON-NONE-OFF	Solder
IK251-73	4.P.S.T. ON-NONE-OFF	Spade
IK254-73	4.P.S.T. ON-NONE-OFF	Screw
IL250-73	4.P.D.T. ON-NONE-ON	Solder
IL251-73	4.P.D.T. ON-NONE-ON	Spade
IL254-73	4.P.D.T. ON-NONE-ON	Screw
IM250-73	4.P.D.T. ON-OFF-ON	Solder
IM251-73	4.P.D.T. ON-OFF-ON	Spade
IM254-73	4.P.D.T. ON-OFF-ON	Screw

*Momentary On Action

NYLON INSULATED TOGGLE SWITCHES

Series D switches have self-cleaning wiping action contacts suitable for both power and low-level switching, nylon flat or bat lever actuators and bushing/frame super structure for double insulated requirements—UL listed, CSA certified. Series rated @ 10 amp 125 VAC 5 amp 250 VAC 1/2H.P. 125-250 VAC 10 amp 28 VDC.



D Series

PADDLE TOGGLE ACTUATOR

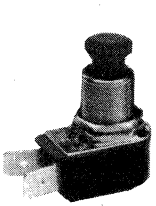
DA100-PB-B	S.P.S.T. ON-NONE-OFF	Solder/Spade
DA105-PB-B	S.P.S.T. ON-NONE-OFF	Wire
DB100-PB-B	S.P.D.T. ON-NONE-ON	Solder/Spade
DC100-PB-B	S.P.D.T. ON-OFF-ON	Solder/Spade

BAT TOGGLE ACTUATOR

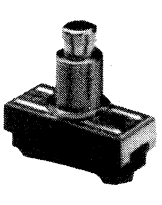
DA100-BB-B	S.P.S.T. ON-NONE-OFF	Solder/Spade
DA105-BB-B	S.P.S.T. ON-NONE-OFF	Wire
DB100-BB-B	S.P.D.T. ON-NONE-ON	Solder/Spade
DC100-BB-B	S.P.D.T. ON-OFF-ON	Solder/Spade

GENERAL PURPOSE PUSHBUTTON SWITCHES

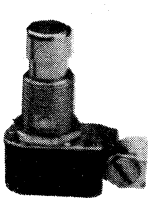
Slow-make/slow-break momentary AC only.



P27 Series



170 Series



110-SP Series

6 AMP 125 VAC—3 AMP 250 VAC UL LISTED AND CSA CERTIFIED

Type	Switch Action	Terminals	Caps
P26A-1D-RMB	S.P.N.O.	Solder	Metal
P26L-1D-RMB	S.P.N.C.	Solder	Metal
P27A-1D-BL	S.P.N.O.	Solder	Black
P27A-1D-RD	S.P.N.O.	Solder	Red
P27L-1D-BL	S.P.N.C.	Solder	Black
P27L-1D-RD	S.P.N.C.	Solder	Red

5 AMP 125 VAC—10 AMP 250 VAC

170	S.P.N.C.	Screw	Metal
172	S.P.N.O.	Screw	Metal

QUICK MAKE/QUICK BREAK MAINTAINED AC/DC
6 AMP 125 VAC—3 AMP 250 VAC UL LISTED AND CSA CERTIFIED

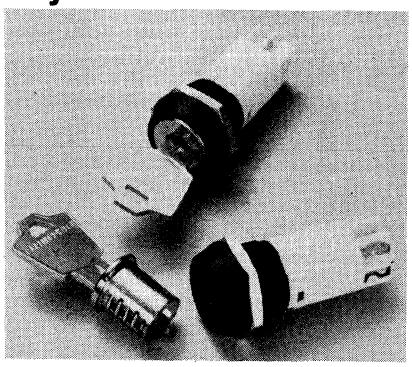
110-SP	S.P.S.T.	Screw	Metal
111-16P	S.P.S.T.	Wire	Metal

The information listed above is for standard Carlingswitch products. Consult Carlingswitch for additional product information.

CARLINGSWITCH, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156
(203) 793-9281 • FAX: (203) 793-9231 • 1-800-243-8556

CARLINGSWITCH KEYLOCK SWITCHES

Lockette® Keylock Switches



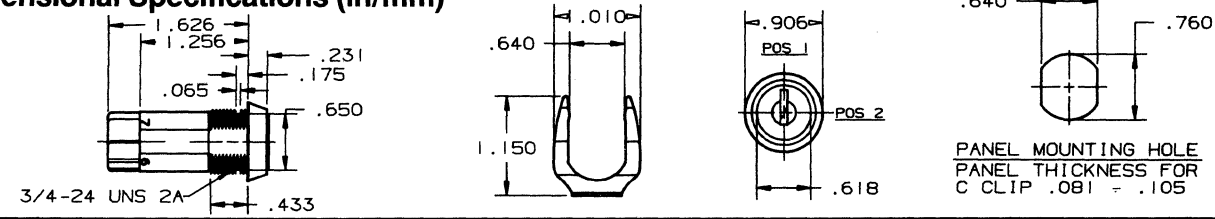
The Lockette Series rotary locking switches feature a unique replaceable lock core system that allows field changing of lock combinations. It also offers electrical ratings to 10 amps and standard 20 KV electro-static-discharge protection. The Lockette is available in popular single and double pole circuits and has a choice of quick connect, solder lug or PCB mount terminations.

Specifications

- UL, CSA*
- Dielectric Strength: 1,000V (minimum)
- Insulation Resistance: 100 megohms (minimum)
- Bezel Material: Metal or Thermoplastic
- Base: Polyester

*Due to ongoing technological advances, consult factory for agency specifications.

Dimensional Specifications (in/mm)



1 2 3 4 5 6 — 7 8 9 — 10 11 12 13

1. Series
K—Keylock—

2. Poles

CODE	NO. OF POLES AND 0° CIRCUIT
1	1 pole, no circuit at 0° position (open circuit between terminals 1 and 2)
5	1 pole "on" at 0° position (closed circuit between terminals 1 and 2)
6	2 pole "on" at 0° position (closed circuit between terminals 1 and 2, and terminals 5 and 6)

3. Rotation
Note: Maximum total degrees of rotation for 2 pole circuits is 90°—consult factory for additional keylock variations

CODE	TOTAL DEGREES	CODE	TOTAL DEGREES	CODE	TOTAL DEGREES
Z	360°	F	270°	M	180°
A	45°	G	315°	P	225°
B	90°	H	90°	T	270°
C	135°	J	135°	V	45° MOMENTARY
D	180°	L	180°	W	90° MOMENTARY
E	225°			X	SPECIAL

4. On Positions

CODE	"ON" POSITIONS	CODE	"ON" POSITIONS
A		C	
B		D	

Note: These "on" positions will exist only if within the rotation specified in selection 3; choose the first available selection which provides the "on" positions desired; numbers refer to the terminals connected—in a 2 pole switch terminals directly opposing will also be connected—consult factory for additional variations
"On" circuit at 0° specified in selection 2

5. Termination

Code	Style
A	.187 quick connects with terminal barriers
B	Solder lugs with terminal barriers
C	.080 quick connects/solder lug with terminal barriers
D	P.C. terminals
E	P.C. terminals, all available locations
F	Wire leads
M	P.C. terminals, with epoxy sealing
N	P.C. terminals, all available locations, with epoxy sealing
P	.187 quick connects, no terminal barriers
Q	Solder lugs, no terminal barriers
R	.080 quick connects/solder lug without terminal barriers
X	Special

6. Rating

Code	
1	0.4 VA max @ 20 VAC or VDC
3	3A 250VAC, 6A 125VAC, 6A 28VDC
5	5A 250VAC, 10A 125VAC, 10A 28VDC
6	1st pole: 3A 250VAC, 6A 125VAC, 6A 28VDC 2nd pole: 0.4VA max @ 20 VAC or VDC
9	1st pole: 5A 250VAC, 10A 125VAC, 10A 28VDC 2nd pole: 0.4VA max. @ 20VAC or VDC

7. Bezel

Code	
	Rounded, metal bezels
3	Nickel—removable bezel
5	Gold plated—removable bezel
	Angled, metal bezels
7	Nickel—removable bezel
9	Gold plated—removable bezel
0	Back panel mounting—decorative bezels may be ordered separately
	Matte finish thermoplastic bezels
X	Special
B	Black
W	White — Removable angled bezel
R	Red — —shipped unassembled
J	Beige
G	Gray
Z	Special
C	Black
V	White — Fixed angled bezel with 4 tumbler lock
S	Red — core, selection 10, codes L or 4, only
K	Beige
F	Gray

8. Mounting

Code	
0	No hardware (Back panel PC mount)
1	3/4" hole mounting with hex nut
2	Clip

9. Removal

Code	4 Tumbler:	Code	5 Tumbler:
1	0°, 90°, 180°, and 270°*	5	0°, 90°, 180° and 270°
2	0° and 180° only	6	0°, and 180° only
3	90° and 270° only	7	90° and 270° only

*Note: Codes 1 & 5 are standard; key is removable at the listed positions contingent upon rotation as specified in selection 3—distributor may stock codes 1 and 5, and obtain inserts to provide key removal codes 2, 3, 6, and 7—consult factory

10. Lock Core

Code	
L	Removable 4 tumbler lock (removable at 45°)
4	4 tumbler lock
M	Removable 5 tumbler lock (removable at 45°)
5	5 tumbler lock

Note: Options L and M not available with momentary versions

11. Code Marking
Standard: key code stamped on keys.

Code	
1	No key code on lockface, 1 key
2	No key code on lockface, 2 keys (standard)
4	Key code stamped on lock face, 2 keys

Note: Keys for lock core removal will be furnished depending upon quantities of keyed-alike removable cores ordered—core removal keys may be purchased separately if additional keys are needed, or order quantity does not qualify for core removal key.

12. Core Finish

Code	
1	Nickel or bright stainless (matching finishes)
2	Black
5	Gold plated
X	Special

13. Key Variations

Code	
01	Standard code

Other variations available, consult factory.

14. Optional Suffix Code
Special order, consult factory for pricing

Code	
-S	All unused terminal openings sealed

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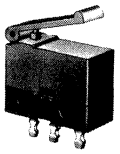
CHERRY ELECTRICAL PRODUCTS
3600 Sunset Ave., Waukegan, IL 60087
312/360-3500 • FAX 312-360-3566

Ultra - Subminiature
DH series*

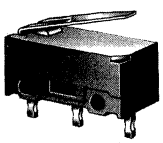


Series DH1C	50-500 mA
Series DH2C	5-50 mA

DH1C-B1AA
DH2C-B1AA
Switch body
.322″ x .244″
x .106″

DH1C-B1PA
DH2C-B1PA
Switch body
.322″ x .244″
x .106″

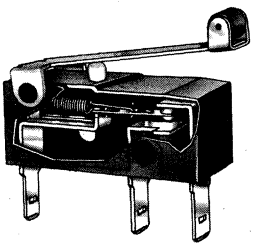
Sub - Subminiature
DG series*



Series DG1	3 amps
	2 amps
Series DG2	50 mA

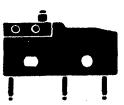
DG series
Switch body
.504″ x .255″ x .228″

Subminiature
DA3 series - Automated

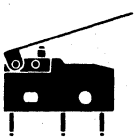


Series DA3	0.1 amps

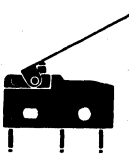
Switch body
.781″ x .375″ x .250″



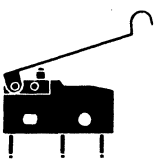
-F1AA



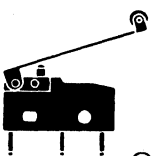
-F1LB



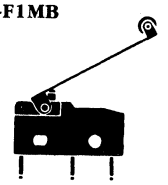
-F1MB



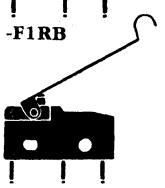
-F1SB



-F1RB

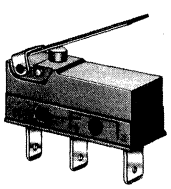


-F1TB

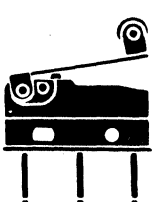


-F1UB

Subminiature International
DB series* - Automated



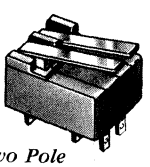
Series DB1	5 amps
Series DB2	10 amps
Series DB3	0.1 amps



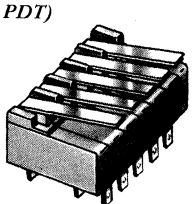
DB series
Switch body
.783″ x .380″
x .256″

* Silhouettes shown actual size

Subminiature Modules
HM series



Two Pole
(2 PDT)



Five Pole
(5 PDT)

Series E61	5 amps
Series E62	10.1 amps
Series E63	0.1 amps

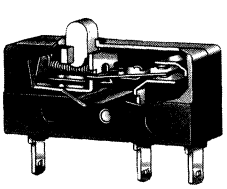
Switch body
2 PDT = .781″ x .483″ x .470″
3 PDT = .781″ x .483″ x .672″
4 PDT = .781″ x .483″ x .875″
5 PDT = .781″ x .483″ x 1.086″

Standard Ratio

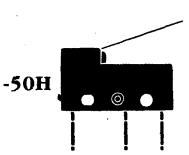
High Ratio

Subminiature
E series

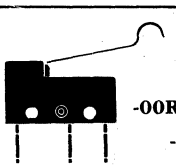
Series E61	5 amps
Series E62	10.1 amps
Series E63	0.1 amps



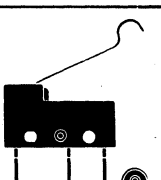
Switch body
.781″ x .375″ x .250″



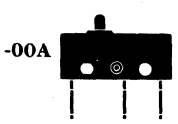
-50H



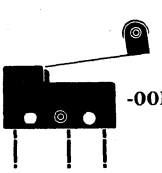
-00R



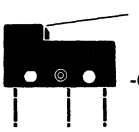
-50R



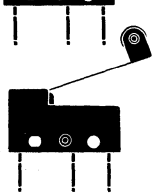
-00A



-00K



-00H



-50K

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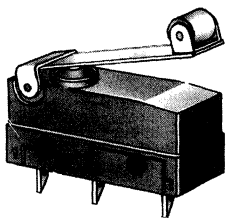
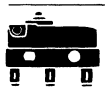
International Subminiature Waterproof

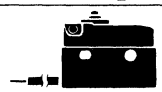


DC series

Series DC1	**5 amps**
Series DC2	**10.1 amps**
Series DC3	**0.1 amps**
Series DC4	**3 amps**



Solder Terminals
Switch body
.783″ x .397″
x .256″

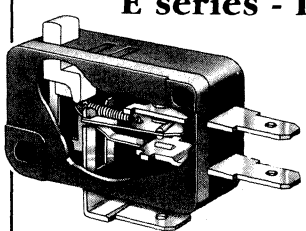


Wire Terminals
Switch body
.783″ x .602″
x .256″

Miniature

E series - Light Force (X Suffix)

Standard Force

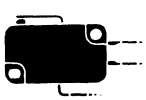


Series E21	**0.1 amps**
Series E22	**3 amps**
Series E23	**5 amps**
Series E31	**1 amp**
Series E33	**10 amps**
Series E34	**15 amps**
Series E35	**20.1 amps***

*Light Force only
Switch body
1.093″ x .625″ x .406″

-00A
-00AX

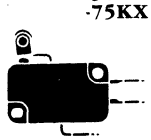
-50K
-50KX



-00H
-00HX

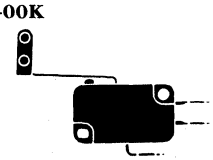
-50KL
-75KX

-50H
-50HX



-00K

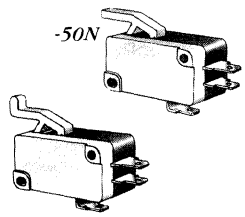
-75HX



-50P

Plastic Lever Actuator

for miniature E series
Light Force and Standard Force



-50N

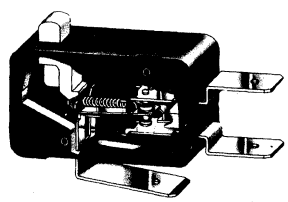
-90N

Series/prefix numbers, electrical ratings and switch body dimensions are the same as the E series models shown above.

Miniature International

D4 series Light Force (L-Suffix)

Standard Force (C-Suffix)

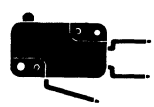


Series D41	**0.1 amps**
Series D42	**3 amps**
Series D43	**5 amps**
Series D44	**10 amps**
Series D45	**15 amps ***

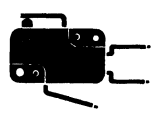
US part number suffix (straight terminals)
(International suffix) (dogleg terminals)

Switch body
1.095″ x .625″ x .406″
27.81 mm x 15.88 mm
x 10.31 mm

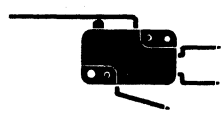
* International versions of D45 require larger terminals. Consult factory.



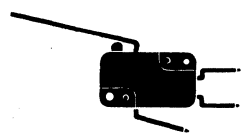
L-R1AA C-R1AA
(9-Q3AA) (3-Q3AA)



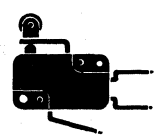
L-R1LA C-R1LA
(9-Q3LA) (3-Q3LA)



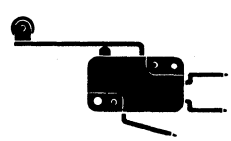
L-R1YD C-R1LD
(9-Q3YD) (3-Q3LD)



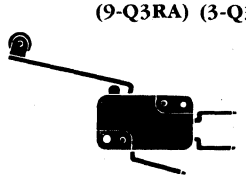
L-RIXD C-RIXD
(9-Q3XD) (3-Q3XD)



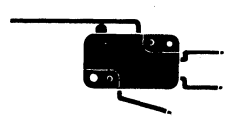
L-R1RA C-R1RA
(9-Q3RA) (3-Q3RA)



L-R1RC C-RIRC
(9-Q3RC) (3-Q3RC)



L-R1TC C-R1TC
(9-Q3TC) (3-Q3TC)



L-R1YL C-RIYL
(9-Q3YL) (3-Q3YL)

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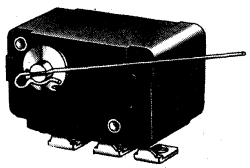
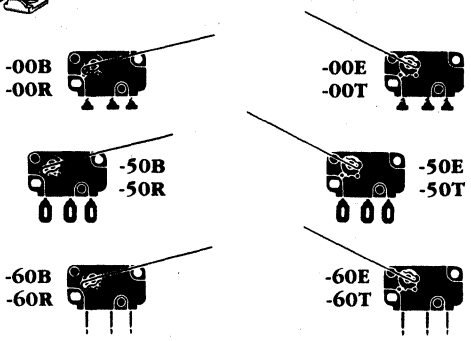
Low Torque
E series

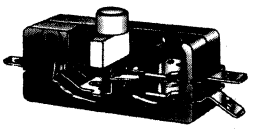


Series E51	6 amps
Series E53	0.1 amps

Switch body
1.218″ x .687″ x .580″

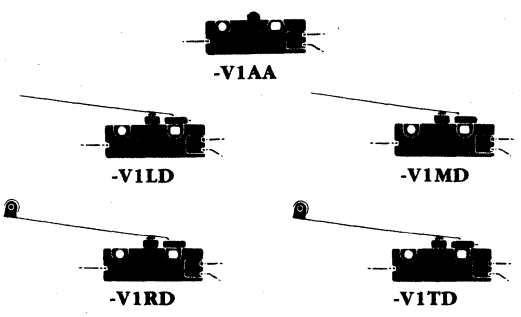


General Purpose
DL series - Automated

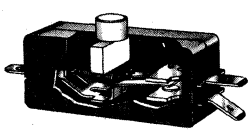


Series DL3	0.1 amps
Series DL4	15 amps
Series DL5	25 amps

Switch body
1.823″ x .640″ x .644″

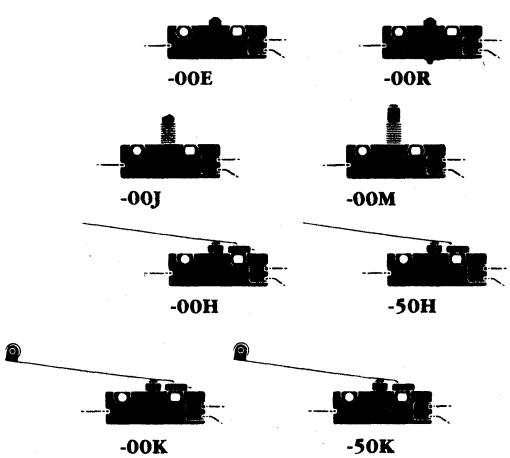


General Purpose
E series - Single Pole

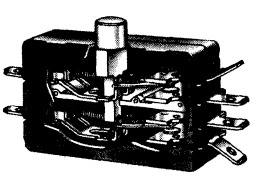


Series G13	0.1 amps
Series E13	15 amps
Series E14	25 amps
Series E30	30.1 amps

Switch body
1.823″ x .640″ x .644″

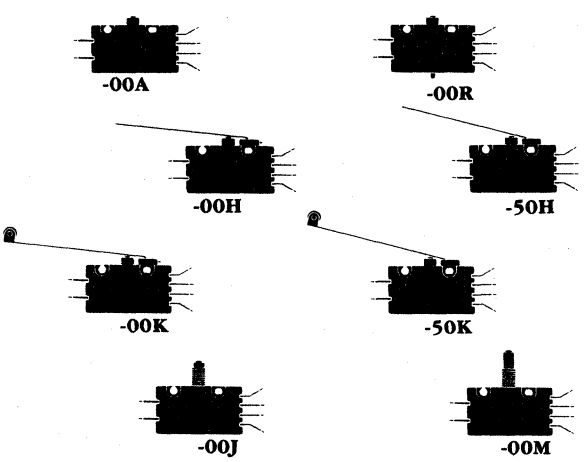


General Purpose
E series - Double Pole

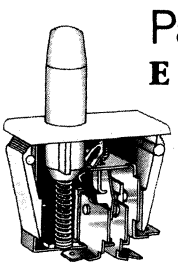


Series E19	15 amps
Series E19A	15 amps/ 0.1 amps
Series E20	20 amps
Series G20	0.1 amps

Switch body
1.813″ x 1.125″ x .640″

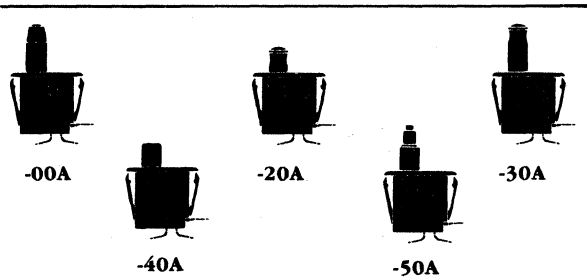


Panel Mount Pushbutton
E series - Single Pole



Series E65	16 amps
Series E68	0.1 amps
Series E69	10 amps

Switch body 1.25″ x 1.05″ x .680″



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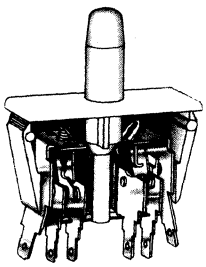
Panel Mount Pushbutton
E series - Double Pole



Series E75	16 amps
Series E77	10 amps/ 0.1 amps
Series E78	0.1 amps
Series E79	10 amps

Switch body 1.57″ x 1.05″ x .680″

-00A

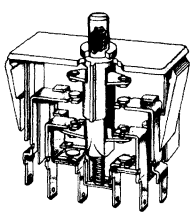
-20A

-30A

-40A

-50A

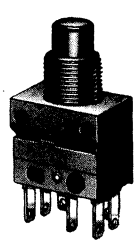
Line Interrupt
F80 series



Series F81	10 amps
Series F82	16 amps
Series F83	0.1 amps
Series F84	Combination of current ratings

Switch body 1.57″ x 1.16″ x .685″

Lighted Pushbutton Switches
P1 series

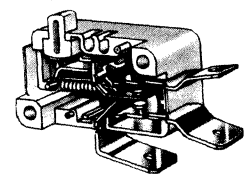


Series P162	10.1 amps
Series P163	0.1 amps

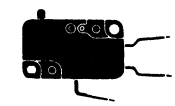
Switch body .844″ x .688″ x .578″

-C3RA Red button–LED, SPDT
-C3BU Black button–No light, SPDT
-D3RA Red button–LED, DPDT
-D3BU Black button–No light, DPDT

International Miniature
D3 series - Heavy Duty

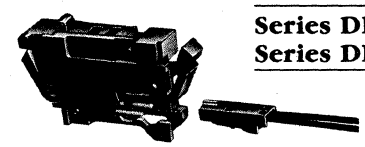


Series D36	4 amps
Series D37	10 amps
Series D38	16 amps

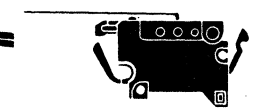


Switch body 1.094″ x .625″ x .406″

Terminator
DN series

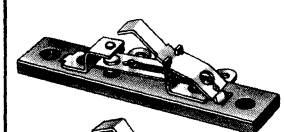


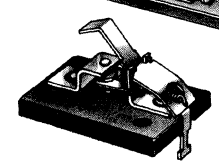
Series DN3	0.1 amps
Series DN6	3 amps



Switch body
1.337″ x .854″ x .406″

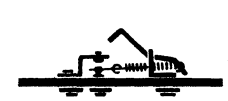
Open Switches
S series

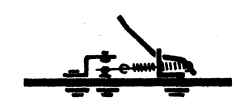




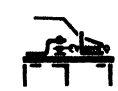
Series S23	5 amps
Series S25	10 amps
Series S30	10 amps
Series S31	0.1 amps

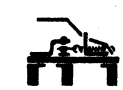
Switch body
S23, S25 2.125″ x .438″ x .094″
S30 1.062″ x .750″ x .093″
S31 1.031″ x .250″ x .062″


-00T

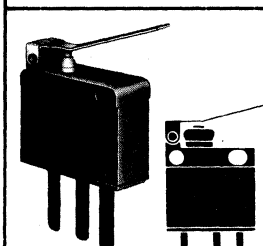

-60T

-00W


-20W


-20P

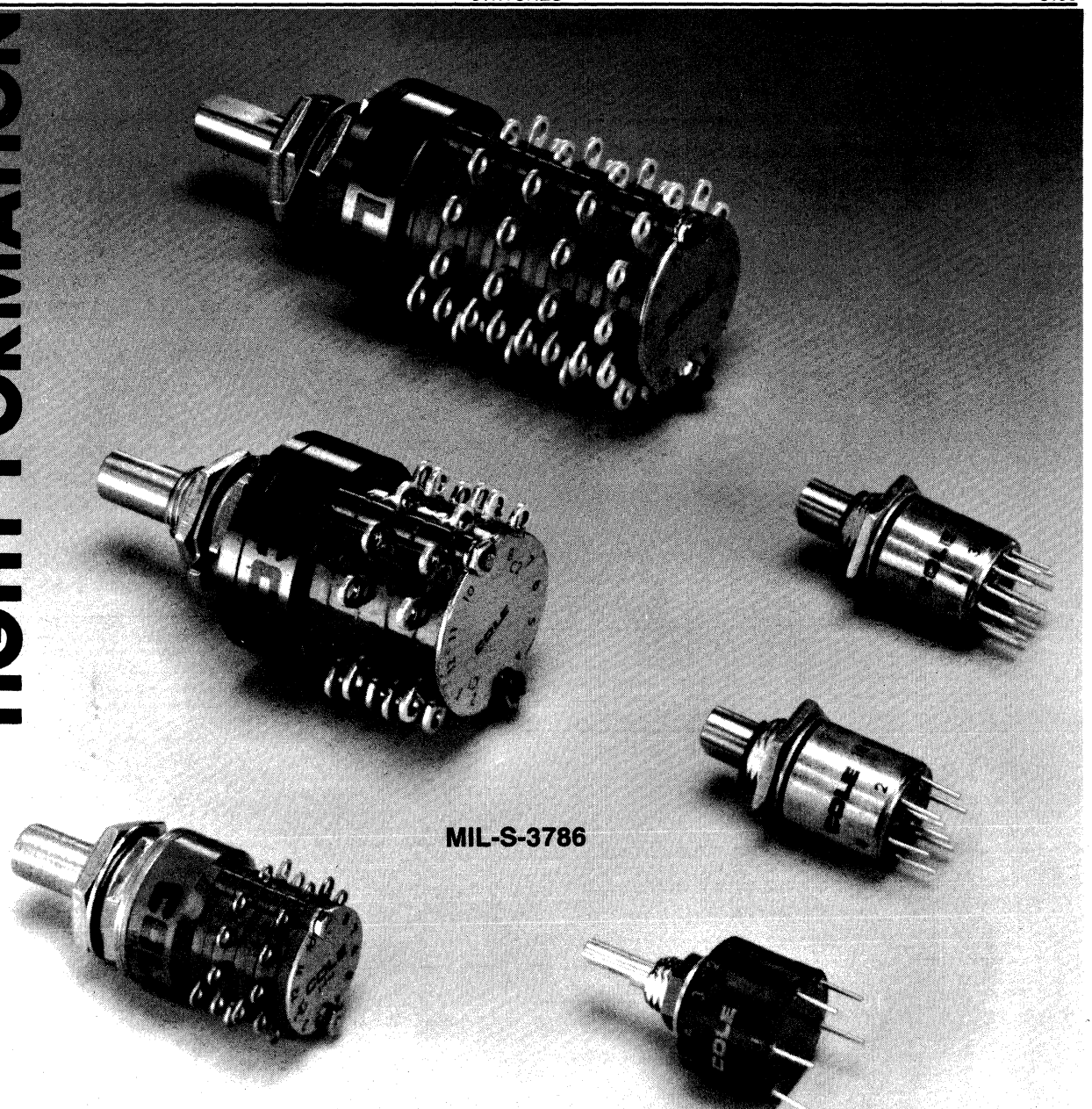
Weatherproof
E72 series



Series E72	10.1 amps
Series E73	0.1 amps

Switch body .915″ x .880″ x .385″

TIGHT FORMATION



MIL-S-3786 is no drill at COLE instrument Corp. It is the guiding principle of our rotary switch design engineering group. COLE gives you a complete choice of MIL-S-3786 certified configurations; /4;/20;/35;/39. An integrated family of miniature precision rotary switches with common, state-of-the-art features that others are trying to catch up with.

- FLUX, CONTAMINANT PROOF
- IMMERSIBLE; WASHABLE
- EMI/RFI PROTECTED
- PRE-TINNED TERMINALS, COMPATIBLE WITH DOD 2000 and WEAPON SYSTEMS SPECS
- LOW LEVEL AND DRY CIRCUIT SWITCHING
- DIGITAL, ENCODED MODELS FOR ALL SERIES

At Cole, our newly enlarged clean room facilities have been engineer-designed to produce zero defect products (with dock to stock philosophy). Cole rotary switch products are used on every new commercial aircraft, and on every front line fighter; these same Cole switches are utilized in the well-known SINCGARS (Single Channel Ground to Air Radio) Program. But our engineering does not end there. We design and manufacture commercial, military, and special purpose switches for unlimited applications and environments. Cole design/application engineering is as near as your phone or FAX. Call today for our latest catalog and published SPECS.

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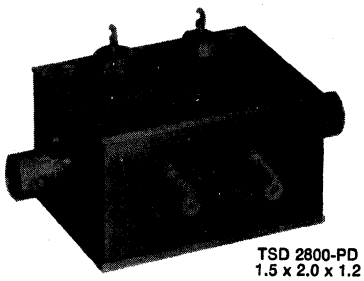
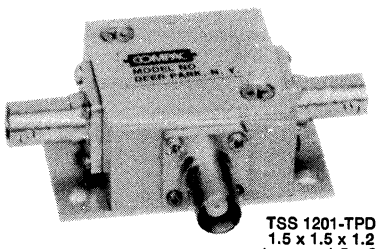
COMPAC™

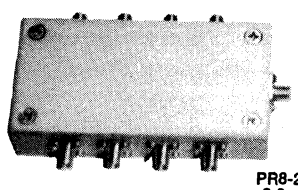
RF RELAYS & TRANSFER SWITCHES



TSD 2800-PD
1.5 x 2.0 x 1.2



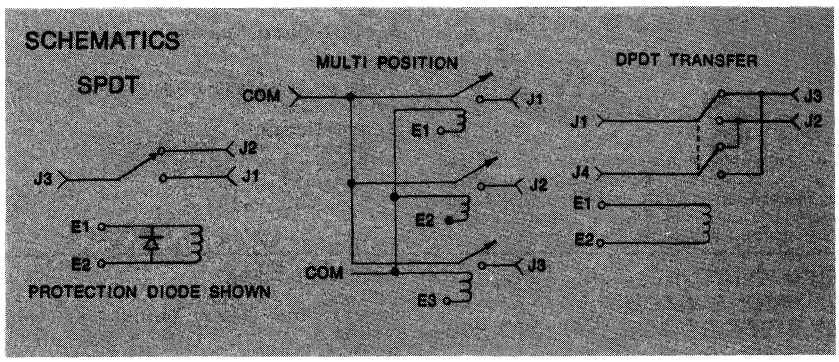
TSS 1201-TPD
1.5 x 1.5 x 1.2
ext. cover 1.5 x 2.25



PR8-2831-TTLF
3.0 x 5.0 x 1.5
ext. cover 3 x 5.75

Single Pole 2 to 16 Position
Double Pole Double Throw Transfer
Signal and Power Lever Units

- ☐ Lightweight
- ☐ Low Cost
- ☐ Small Size



SPECIFICATIONS:

	Signal Level	Power Level
Frequency Range	DC-500 MHz	DC-400 MHz
Power Level	1 Watt	75 Watts
VSWR	1.2 Typ.	1.3 Typ.
Isolation	40 dB	35 dB
Insertion Loss	0.3 dB	0.2 dB
Switching Speed	10 m Sec	15 m Sec
Operating Range	−55C to +71C	

DETAILED SPECIFICATIONS UPON REQUEST

HOW TO ORDER

TS 4 — 28 0 1 — TPD

SWITCH TYPE
TS — Signal
PR — Power

SWITCH CONFIGURED
D — Transfer
S — SPDT
3-16 — Multi Position

COIL VOLTAGE
05, 06, 12, 18, 24, 28

CONNECTOR TYPE
0 - BNC
1 - SMA
2 - TNC
3 - N

MOUNTING
0 - Flush
1 - Extended Flange

OPTIONS
T — Termination 50 ohm ⅛W STD
PD — Protection Diode POS COM STD
TTL — TTL Interface Active High STD
C — DC Connector D Submin Type STD
L — Latching
F — Failsafe
SPECIAL CONFIGURATIONS
Other Options Available

Also Available:
Custom Power Attenuators, Power Terminations, Flange mounted, no air flow required
50 — 800 watts
DC — 1 GHz

* OTHER OPTIONS AVAILABLE. CONSULT FACTORY *

COMPAC
1320-13 LINCOLN AVENUE
HOLBROOK, NEW YORK 11741
TELEPHONE (516) 585-3400
FAX (516) 585-3534

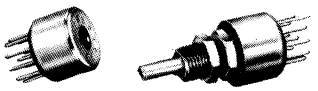
CRL Components, Inc.

Highway 20 West
Fort Dodge, Iowa 50501
Telephone: (515) 573-1300
FAX: (515) 573-1342

ROTARY SWITCHES

MICROMINIATURE ROTARY SWITCH OEM SERIES 910 AND 912

DISTRIBUTOR SERIES 2ASB AND 2ASA



CRL Components' microminiature rotary switches have compact size and low profile which make them suitable for mounting on pc cards, and on front panels where space is at a premium. Choice of actuation includes knob, screwdriver, lever and thumbwheel.

SPECIFICATIONS

GENERAL

Contact and Terminal Material: Gold over nickel over brass.

Insulation Material: Polyester.

ELECTRICAL

Current and Voltage Rating: 0.5A @ 12 VDC, 0.3A @ 24 VDC.

Dielectric Strength:
Terminal to terminal; 1000 VAC @ 60 Hz.
Terminal to case; 1000 VAC @ 60 Hz.

Capacitance:
Terminal to terminal; 1 pF.
Terminal to case; 2 pF.

Contact Resistance Max:
Center common; <20 milliohm.

MECHANICAL

Stop Strength: 28 in. oz.

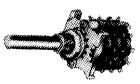
Allowable Axial Thrust: 30 lb.

Index Life: Center common; 100,000 operations.

Index Stops: Fixed.

SUBMINIATURE ROTARY SWITCH OEM SERIES 160, 180, AND 800

DISTRIBUTOR SERIES PSA AND PS



CRL Components' 1" diameter subminiature rotary switches offer a two-ball starwheel lateral thrust index with good torque control and feel. These switches are designed to meet the requirements of Military Switch Specification MIL-S-3786 Style SR05, and are available with ceramic, diallyl phthalate, or phenolic insulation material.

SPECIFICATIONS

GENERAL

Clips and Rotor Contacts Material: Brass, silver plated.

Insulation Material: Phenolic, MIL-P-3115P, Type BPEP; Ceramic, MIL-1-10A, Grade L-422; Glass Epoxy, MIL-P-18177, Type GEE; Diallyl Phthalate, MIL-M-14F, Type SDG.

ELECTRICAL

Current and Voltage Rating: Make and break resistive load 0.55 amp. @ 28 VDC, 0.25 amp @ 115 VAC.

Current Carrying Capacity: 7 amp.

Dielectric Strength: 750 VAC between current carrying parts and ground.

Contact Resistance: Average initial 5.0 milliohms.

Surface Resistivity: Average in excess of 900,000 megohms.

MECHANICAL

Construction: Open bolted.

Mounting: Single hole, bushing mount.

Mounting Hardware: Nut and lockwasher supplied.

Index: Dual-ball, side thrust.

Index Life: 50,000 cycles minimum.

Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.

Index Angle: Positive, 30°.

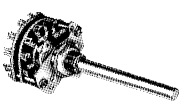
Index Stops: Adjustable.

Stop Strength: 10 in. lb. minimum.

Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

MINIATURE ROTARY SWITCH OEM SERIES 050

DISTRIBUTION SERIES SPRING RETURN



CRL Components' Series 050 has a star-wheel index utilizing a precision roller and coil spring to provide the optimum combination of both positive detent and reliable spring return. Four insulations are standard: phenolic, ceramic, diallyl phthalate or glass epoxy.

SPECIFICATIONS

GENERAL

Clips and Rotor Contacts Material: Brass, silver plated.

Insulation Material: Phenolic, MIL-P-3115P, Type BPEP; Ceramic, MIL-1-10A, Grade L-422; Glass Epoxy, MIL-P-18177, Type GEE; Diallyl Phthalate, MIL-M-14F, Type SDG.

ELECTRICAL

Current and Voltage Rating: Make and break resistive load 1.5 amp @ 28 VDC, 0.50 amp @ 115 VAC.

Current Carrying Capacity: 9 amp.

Dielectric Strength: 1500 VAC between current carrying parts and ground

Contact Resistance: Average initial 3.5 milliohms.

Surface Resistivity: Average in excess of 500,000 megohms.

MECHANICAL

Construction: Open bolted.

Mounting: Single hole, bushing mount.

Mounting Hardware: Nut and lockwasher supplied.

Index: Coil spring.

Index Life: 25,000 cycles minimum.

Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.

Index Angle: Spring return, 30°.

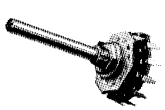
Index Stops: Fixed.

Stop Strength: 25 in. lb. minimum.

Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

MINIATURE ROTARY SWITCH OEM SERIES 070

DISTRIBUTOR SERIES PA-7000



CRL Components' Series 070 switches are economical single section switches using phenolic insulation. The formed spring index uses a small face plate area. These switches are available with up to twelve positions, and a low cost nylon shaft when ordered in large quantities.

SPECIFICATIONS

GENERAL

Clips and Rotor Contacts Material: Brass silver plated.

Insulation Material: Phenolic, MIL-P-3115P, Type BPEP; Ceramic, MIL-1-10A, Grade L-422; Glass Epoxy, MIL-P-18177, Type GEE; Diallyl Phthalate, MIL-M-14F, Type SDG.

ELECTRICAL

Current and Voltage Rating: Make and break resistive load 1.5 amp @ 28 VDC, 0.50 amp @ 115 VAC.

Current Carrying Capacity: 9 amp.

Dielectric Strength: 1500 VAC beteen current carrying parts and ground.

Contact Resistance: Average initial 3.5 milliohms.

Surface Resistivity: Average in excess of 500,000 megohms.

MECHANICAL

Construction: Open staked.

Mounting: Single hole, bushing mount.

Mounting Hardware: Nut and lockwasher supplied.

Index: Formed spring, hill and valley.

Index Life: 25,000 cycles minimum.

Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.

Index Angle: Positive, 30°.

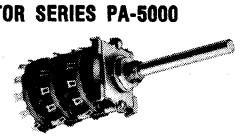
Index Stops: Fixed.

Stop Strength: 25 in. lb. minimum.

Material and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

MINIATURE ROTARY SWITCH OEM SERIES 550 AND 557

DISTRIBUTOR SERIES PA-5000



CRL Components' Series 550 and 557 offer more features than any comparable size switch in the industrial line. A dual-ball side thrust index provides a good torque control. Phenolic, ceramic, diallyl phthalate, and glass epoxy are standard insulations.

SPECIFICATIONS

GENERAL

Clips and Rotor Contacts Material: Brass silver plated.

Insulation Material: Diallyl Phthalate, IAW. MIL-M-14F, Type SDG.

ELECTRICAL

Current and Voltage Rating: Make and break resistive load 1.5 amp @ 28 VDC, 0.50 amp @ 115 VAC.

Current Carry Capacity: 9 amp.

Dielectric Strength: 1500 VAC between current carrying parts and ground.

Contact Resistance: Average initial 3.5 milliohms.

Surface Resistivity: Average in excess of 900,000 megohms.

MECHANICAL

Construction: Open bolted.

Mounting: Single hole, bushing mount.

Mounting Hardware: Nut and lockwasher supplied.

Index: Dual-ball, side thrust.

Index Life: 50,000 cycles minimum.

Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.

Index Angle: Positive, 30° and 60°.

Index Stops: Adjustable.

Stop Strength: 25 in. lb. minimum.

Material and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

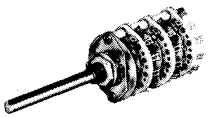
CRL Components, Inc.

Highway 20 West
Fort Dodge, Iowa 50501
Telephone: (515) 573-1300
FAX: (515) 573-1342

ROTARY SWITCHES

MINIATURE ROTARY SWITCH OEM SERIES 020 AND 024

DISTRIBUTOR SERIES PA-1000 AND PA-2000



CRL Components' Series 020 and 024 offers a small front plate with the quality feel of a ball and spring index mechanism. Phenolic, ceramic, glass epoxy, and diallyl phthalate insulations are available. Stops may be fixed or adjustable.

SPECIFICATIONS

GENERAL

QPL: MIL-S-3786, style SR02.
Clips and Rotor Contacts Material: Brass, silver plated.
Insulation Material: Phenolic, MIL-P-3115P, Type BPEP; Ceramic, MIL-1-10A, Grade L-422; Glass Epoxy, MIL-P-18177, Type GEE; Diallyl Phthalate, MIL-M-14F, Type SDG.

ELECTRICAL

Current and Voltage Rating: Make and break resistive load 1.5 amp @ 28 VDC, 0.50 amp 115 VAC.
Current Carrying Capacity: 9 amp.
Dielectric Strength: 1500 VAC between current carrying parts and ground.
Contact Resistance: Average initial 3.5 milliohms.
Surface Resistivity: Average in excess of 1 million megohms.

MECHANICAL

Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Single-ball, hill and valley.
Index Life: 25,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 30° and 60°.
Index Stops: Adjustable.
Stop Strength: 10 in. lb. minimum.
Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrision.

MINIATURE ROTARY SWITCH OEM SERIES 600 AND 602

DISTRIBUTOR SERIES PA-6000

CRL Components' Series 600 and 602 feature military qualifications under MIL-S-3786. Style SR03. Indexing is hill and valley ball type, available with phenolic, diallyl phthalate, ceramic, or glass epoxy insulation.

SPECIFICATIONS

GENERAL

QPL: MIL-S-3786, style SR03.
Clips and Rotor Contacts Material: Silver alloy treated for solderability.
Insulation Material: Phenolic, MIL-P-3115P, Type BPEP; Ceramic, MIL-1-10A, Grade L-422; Glass Epoxy, MIL-P-18177, Type GEE: Diallyl Phthalate, MIL-M-14F, Type SDG.

ELECTRICAL

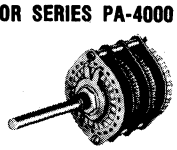
Current and Voltage Rating: Make and break resistive load 2.6 amp @ 28 VDC, 1.0 amp @ 115 VAC.
Current Carrying Capacity: 12 amp.
Dielectrical Strength: 1000 VAC between current carrying parts and ground.
Contact Resistance: Average initial 2.0 milliohms.
Surface Resistivity: Average in excess of 1 million megohms.

MECHANICAL

Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Single-ball, hill and valley.
Index Life: 25,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 30°.
Index Stops: Adjustable.
Stop Strength: 25 in. lb. minimum.
Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to meet 100 hour salt spray test.

MINIATURE ROTARY SWITCH OEM SERIES 670

DISTRIBUTOR SERIES PA-4000



CRL Components' Series 670 indexing is provided by a dual-ball hill and valley index. Angle of throw is 15° with 24 maximum positions. All multiple section switches have "wing type" rotor drive which minimizes rotational lag.

SPECIFICATIONS

GENERAL

Clips and Rotor Contacts Material: Brass, silver plated.
Insulation Material: Phenolic MIL-P-3115P, Type BPEP; Glass Epoxy, MIL-P-18177, Type GEE.

ELECTRICAL

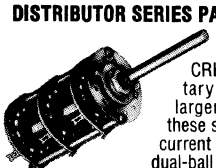
Current and Voltage Rating: Make and break resistive load 1.5 amp @ 28 VDC, 0.23 amp @ 115 VAC.
Current Carrying Capacity: 9 amp..
Dielectric Strength: 1000 VAC between current carrying parts and ground.
Contact Resistance. Average initial 5.0 milliohms.
Surface Resistivity: Average in excess of 500,000 megohms.

MECHANICAL

Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Dual-ball, hill and valley.
Index Life: 25,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 15°.
Index Stops: Adjustable.
Stop Strength: 25 in. lb. minimum.
Material and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

HEAVY DUTY ROTARY SWITCH OEM SERIES 300 AND 650

DISTRIBUTOR SERIES PA-3000, 1400 AND 2500



CRL Components' heavy duty rotary switches uses physically larger conductors which enable these switches to handle 50% more current than our miniature line. A dual-ball hill and valley index is standard. The Series 300 has a minimum of 12 positions with phenolic or ceramic insulation, and the Series 650 has a maximum of 18 positions with phenolic insulation.

SPECIFICATIONS

Clips and Rotar Contacts Material: Brass, silver plated.
Insulation Material: Phenolic, MIL-P-3115P, Type BPEP; Ceramic, MIL-1-10A, Grade L-422.

ELECTRICAL

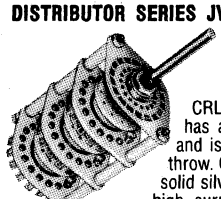
Current and Voltage Rating: Make and brake resistive load 2.25 amp @ 28 VDC, 1.0 amp @ 115 VAC.
Current Carrying Capacity: 9 amp.
Dielectric Strength: 1500 VAC between current carrying parts and ground.
Contact Resistance: Average initial 3.0 milliohms.
Surface Resistivity: Average in excess of 500,000 megohms.

MECHANICAL

Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Dual-ball, hill and valley.
Index Life: 25,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 30°.
Index Stops: Adjustable.
Stop Strength: 25 in. lb. minimum.
Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

POWER ROTARY SWITCH OEM SERIES 230

DISTRIBUTOR SERIES JV-9000



CRL Components' power switch has a maximum of 18 positions and is offered with a 20° angle of throw. Construction features include solid silver alloy contact surfaces for high current switching capability. A dual-ball hill and valley index provides high torque (100 in. oz. nominal) to ensure necessary acceleration to minimize contact arcing.

SPECIFICATIONS

GENERAL

Clips and Rotor Contacts Material: Silver alloy surface.
Insulation Material: Ceramic, MIL-1-10A. Grade L-422.

ELECTRICAL

Current and Voltage Rating: Make and break resistive load 11.0 amp @ 28 VDC, 9.0 amp @ 115 VAC.
Current Carrying Capacity: 17 amp.
Dielectric Strength: 3000 VAC between current carrying parts and ground.
Contact Resistance: Average initial 7.0 milliohms.
Surface Resistivity: Average in excess of 1 million megohms.

MECHANICAL

Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Dual-ball, hill and valley.
Index Life: 25,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 20°.
Index Stops: Adjustable.
Stop Strength: 25 in. lb minimum.
Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

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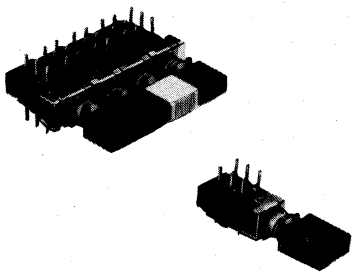
PUSHBUTTON SWITCHES

PBS SERIES



CRL Components' PBS Series pushbutton switches mount horizontally and are available in single or multiple switch assemblies. The modular construction of the basic switch module allows design flexibility when combined with a variety of options.

SPECIFICATIONS
GENERAL
Materials: Switch Enclosure: Phenolic UL94HB. Switch Actuator: Acetal UL94HB. Terminals: Silver plated copper. Contacts: Nickel silver alloy with coin silver overlay. Mounting Hardware: Plated steel.
ELECTRICAL
Switch Function: Non-shorting, double-throw.
Contact Rating (Switching): 1.0A @ 28 VDC resistive load.
Contact Rating (Non-Switching): 11.0A.
Contact Resistance (Load of 100mA @ 2 VDC): 4 to 6 milliohms typical initial.
Dielectric Strength: Terminal to terminal; 1500 VAC. Terminal to bracket; 1500 VAC. Pole to pole; 1250 VAC.
Switch Capacitance: Terminal to terminal; 0.5pF maximum. One terminal to all others grounded. 3.5pF maximum.
Insulation Resistance (Average):

Condition	Measured Between	Resistance (Megohms)
70% RH @ 23°C. 500VDC	Terminal to Bracket Terminal to Terminal Pole to Pole	100K
After 96 hrs. @ 95% RH @ 40°C. 500VDC	Terminal to Bracket Terminal to Terminal Pole to Pole	600 700 800

MECHANICAL
Switch Actuation: Momentary. Push-push.
Actuator Travel:

Actuation	Travel (Nominal)	Overtravel
Push-Push Momentary	.152 (3.86) .156 (3.96)	.050/.050 - (1.27/1.52)

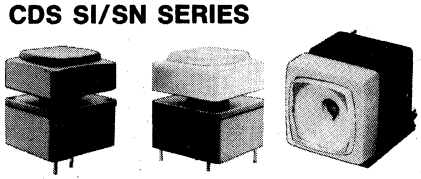
Actuator Force:

Poles	Silver Contact System
2	12-22 oz. (.34- .62) Kg
4	17-27 oz. (.48- .76) Kg
6	24-36 oz. (.68-1.02) Kg
8	30-46 oz. (.85-1.30) Kg

Button: Black button supplied attached.
CLEANING AND SOLDERABILITY
Solderability: Meets EIA standard RS-178-A.
Wave Flow Soldering: 10 seconds @ 260°C.
PC Board Cleaning: When cleaning boards in aqueous solutions, it is recommended that the switches be completely dry prior to the application of power.
Dry Time: 1 hour forced air dry at 52°C to 66°C.

NOTE: The performance of switches and the materials in the bracket are not adversely affected by the materials and processes encountered in typical wave soldering systems. Each customer must determine by direct experience which soldering and cleaning system is best suited to his particular needs.

CDS SI/SN SERIES

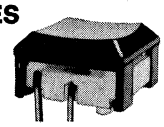


CRL Components' CDS SI (illuminated) and CDS SN (Non-illuminated) keyswitches features a sealed contact system. The SI Style offers a wide range of backlighted legends with a variety of LED and keycap color combinations.

SPECIFICATIONS
MATERIALS
Module: Polyamide, glass reinforced UL94V0.
Actuator: Polycarbonate.
Terminals: Silver plated brass with nickel underplating.
Contact: Silver plated beryllium copper.
Keycap: Polycarbonate.
Lens: Polycarbonate.
LEDS
Color: Red, green, or yellow.
Direct Current: 20mA.
Inverse Voltage: 4 VDC.
Direct Voltage: 2.4 VDC

MECHANICAL
Life: 2 million actuations.
Travel: .016" (0.40) nominal.
Actuation Force: 325 grams nominal.
Switching Action: Momentary.
ELECTRICAL
Contacts: SPST, N.O.
Voltage Rating: 24 VDC nominal—50 VDC maximum—100m VDC minimum
Current Rating: 125mA nominal.
Power Rating: 3W maximum (switched)
Contact Resistance: <20 milliohms @ 5 VDC and 10mA.
Contact Bounce: <5ms.
ENVIRONMENTAL
Operating Temperature: −25°C to +85°C. −13°F to +185°F.

CDS-PV SERIES



CRL Components' CDS-PV Series keyswitch is a versatile, economical, low profile switch. The module configurations is suited for automatic PCB insertion and is applicable to wave or drag soldering processes.

SPECIFICATIONS
MATERIALS
Module: Polycarbonate 20% glass fiber.
Contacts: Steel silver plated.
Dome Spring: Phosphor bronze silver plated.
MECHANICAL
Actuating Force: 275 gram (9.7 oz.).
Travel of Disc: 0.28-0.41mm (.011-.016 In.).
Maximum Mech. Overload: 5.45Kg (12 lb.), 60 sec. duration.
Life Expectancy: 3 million actuations.

ELECTRICAL
Contacts: SPST, N.O.
Maximum Voltage: 30 VAC.
Maximum Current: 10mA.
Contact Resistance: 100 milliohms initial, 1 ohm typical at 1 million actuations.
Operating Temperature: −20°C to +70°C (−40°F to +158°F).

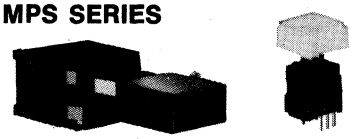
CDS-PR SERIES

CRL Components' CDS-PR Series 9mm keyswitch is an SPST, momentary, snap action dome switch developed for space limiting electronic applications. This keyswitch is adaptable for automatic insertion into PWB's and compatible with automatic soldering and cleaning processes.

SPECIFICATIONS
ELECTRICAL
Contacts: SPST, N.O. Momentary.
Max. Switched Power: 10 VA.
Contact Rating: 50mA @ 20 VDC.
Max. Voltage: 50 VDC.
Contact Resistance: <20 milliohms initial (100mA @ 2 VDC). 500 milliohms after electrical endurance.
Electrical Endurance: 5 x 10^5 actuations @ maximum switching power.
Contact Bounce: <5 milliseconds.
Insulation: 100 megohms.
Dielectric Strength: 100 VAC.
MECHANICAL
Life: 1 million actuations.
Travel: .305mm (.012")
Actuation Force: 160 gr. minimum, 270 gr. maximum initial.
Return Force: <90% actuation force.

MATERIALS
Snap Dome: Silver plated phosphor bronze—nickel underplating.
Terminals: Silver plated brass—nickel underplating.
Module and Actuator: Polycarbonate 10%—glass fiber.
ENVIRONMENTAL
Operating Temperature: −10°C to 70°C.
Storage Temperature: −30°C to 85°C.
Solderability: EIA RS-178-1.
Flammability: UL94V0 Class SE.1
CLEANING AND SOLDERABILITY
Cleaning of the fluxes from the circuit board after soldering can be done with Freon* TMS or TMC fluorocarbon or equivalent solvents. Aqueous cleaning can be employed to remove aqueous flux.
*Trademark of E. I. DuPont DeNemours & Co.

MPS SERIES



CRL Components' MPS Series pushbutton switches are designed to mount vertically into pc boards and can be specified in single or multiple bracketed switch assemblies. The MPS Series offers a lighted version featuring a spot indicator of full lens illumination. Illumination is provided by an LED or an incandescent lamp.
NOTE: All products are available through distribution.

SPECIFICATIONS
GENERAL
Switch Enclosure: Molded UL94V-0 polyester.
Switch Actuator: UL94HB acetal.
Terminals: Tinned copper alloy with gold inlay.
Contacts: Gold alloy inlay on beryllium copper.
Brackets: Plated steel.

ELECTRICAL
Contacts: SPST, SPDT, and DPDT non-shorting.
Contact Rating (25 Watts Maximum): 0.5 amps resistive load @ 50 VDC or VAC. .125 amps resistive load @ 110-120 VAC.
Contact Resistance (With Load of 100 Milliamps @ 2 VDC): 50 milliohms maximum.
Contact Bounce: .5 milliseconds typical closing, 1.0 milliseconds typical opening.
Dielectric Strength: Terminal to terminal: 1250 VAC @ 60 Hz RMS for 1 minute. Bracket to terminal: 1250 VAC @ 60 Hz RMS for 1 minute.
Insulation Resistance (Average Reading):

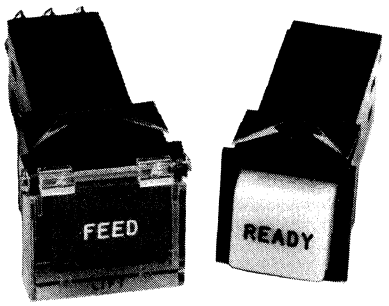
Condition	Measured Between	Resistance (Megohms)
70% RH @ 23°C, 100 VDC	Terminal to ground Pole to Pole	1000 1000
After 96 hrs. @ 95% RH @ 40°C, 100 VDC	Terminal to ground Pole to Pole	10 10

MECHANICAL
Switch Actuation: Momentary, Push-Push.
Actuator Travel: 144 ±.004 (3.66 ±0.10).
Actuation Force At .135 (3,43) Travel):

Switch Actuation	Typical Ounces (Grams)
Momentary SPST (N.O.)	2.82-3.88 (80-110)
Momentary Single Pole, DPST (N.O.), DPDT Push-Push—Single Pole	6.7-9.15 (190-260)
Push-Push—Double Pole	9.87-12.3 (280-350)

CLEANING AND SOLDERABILITY
Solderability: Meets EIA Standard RS-178-A.
Wave Flow Soldering: 10 seconds @ 260°C.
PC Board Cleaning: When cleaning boards in aqueous solutions, it is recommended that the switches be completely dry prior to the application of power.
Maximum Dry Time: @ +18°C to +24°C, 40-50% RH is 24 hours; @ +66°C to +93°C, 0-10% RH is 2 hours; @ +121°C to +177°C, 0-10% RH is 15 minutes (not to exceed 1 hour).

COMPUTER GRADE ILLUMINATED PUSHBUTTON SWITCHES



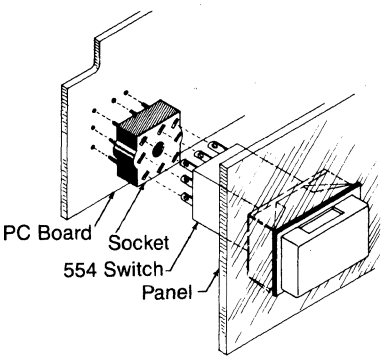
Ideal for all types of equipment, in addition to computers, our computer grade illuminated pushbutton switches (Series 554) offer long life, independent incandescent or LED illumination and outstanding design flexibility. Bright cap illumination provides quick identification of switch status, while independent lamp circuitry can be used to denote required operator action. Fingertip grips on caps also simplify lamp replacement in the field. Available in a wide variety of combinations. Choose from four contact ratings (including Solid State Hall Effect), ten cap styles (including LED illumination and split screen), momentary or alternate action mechanisms, matching indicators and two mounting styles. Optional wave-solderable and washable sockets are available for PC board applications. Optional side barriers and Kap-Guard™ device minimize the chance of accidental actuation. U.L. listed. CSA certified.

Specifications

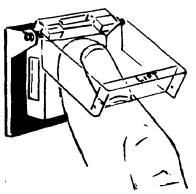
Electrical Ratings
Snap-action silver, snap-action gold, wiping-action gold and solid state up to 7 amps at 125 VAC or 30 VDC; 2 amps at 250 VAC.

Operating Life
750,000 operations (momentary), 250,000 (alternate action) and 1,000,000 operations minimum (solid state).

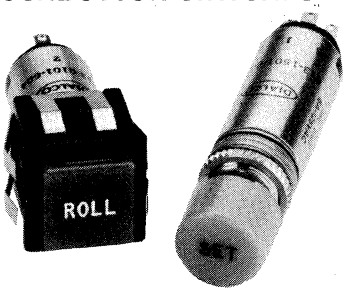
Materials
Gold plate and/or silver contacts, high temperature U.L. approved plastic housing and high impact plastic caps.



Protective Kap-Guard™



COMMERCIAL GRADE ILLUMINATED PUSHBUTTON SWITCHES



Highly dependable contact mechanisms and rugged metal bodies make our commercial grade lighted pushbutton switches (Series 513) ideal for applications requiring more rigid switch construction. Bright cap illumination provides quick identification of switch status, while independent incandescent illumination can be used to denote required operator action. Fingertip grips on caps also simplify lamp replacement in the field. Choose from thousands of combinations, including momentary, snap or non-snap, alternate action; two contact ratings; over 100 cap styles; ten cap colors; engraving, hot stamping or replaceable film legends; and snap-in or rear-panel mounting. U.L. listed.

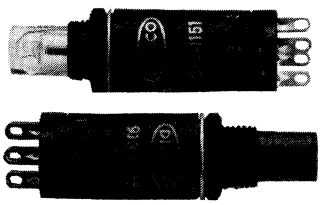
Specifications

Electrical Ratings
Standard and Low-level up to 5 amps resistive at 125 VAC or 30 VDC.

Operating Life
Up to 100,000 operations.

Materials
Gold plated coined silver contacts, anodized aluminum housing and high-impact plastic caps with a nickel plated brass shank.

LED AND NEON ILLUMINATED PUSHBUTTON SWITCHES



Our led and neon illuminated pushbutton switches (Series 913) feature a high brightness LED with current-limiting resistor for 5 VDC operation, or neon lamp for 125 VAC operation. Their integral cap prevents unintentional removal. While their highly reliable momentary switching mechanism has a typical life of one million actuations. Specifically designed for attractive rear-panel mounting, these switches require no sub-panels and a minimum of hardware, reducing both material and labor costs.

Specifications

Electrical Ratings
0.1 amp resistive at 125 VAC or 30 VDC.

Operating Life
1,000,000 operations.

Materials
Gold plated contacts and black anodized aluminum housing.

CRL Components, Inc.

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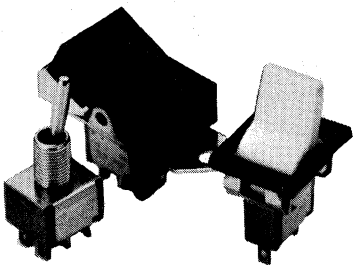
CRL SWITCHES

PASSIVE COMPONENTS, ACTIVELY ENGINEERED

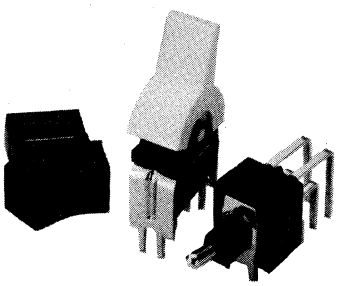
MINIATURE ROCKER/ TOGGLE SWITCHES



Available in over one million combinations, our miniature rocker, toggle and lever switches (Series 570) offer maximum design flexibility. Choose from low-level, 5-ampere and combination ratings; up to four poles; nine switching functions; nine colors and numerous mounting and terminal styles to meet your unique parameters. Miniature size saves valuable space, particularly where PC boards are utilized. Ideal for telecommunications, industrial control, computer peripherals and many other applications where high reliability, easy visual identification of switch functions, and low cost are prime objectives. U.L. listed and CSA certified.

Specifications
Electrical Ratings
Standard, Low-level and Combination up to 5 amps resistive at 120VAC or 28 VDC; 2 amps resistive at 250 VAC.
Electrical Life
Up to 100,000 operations.
Materials
Gold and/or silver contacts and terminals, stainless steel housing, chrome plated brass toggle and nylon rockers and levers.

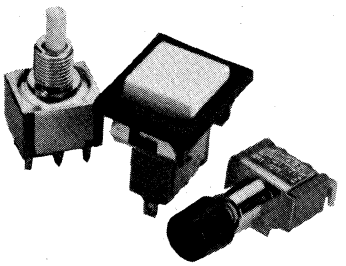
SEALED ROCKER/ TOGGLE SWITCHES



Three-way sealing process utilizing epoxy, rubber o-rings and ultrasonics allows our rocker, toggle and lever switches (Series 578) to be wave soldered and cleaned without contamination. They install easily into PC boards along with other components, reducing labor costs. And they can be used as direct replacements for unsealed switches, eliminating the need for redesign. They also come in a wide variety of styles, colors, contact ratings, functions and mounting configurations.

Specifications
Electrical Ratings
Standard, Low-level and Combination up to 7.5 amps resistive at 120 VAC or 28 VDC; 3 amps resistive at 250 VAC.
Electrical Life
40,000 operations.
Materials
Gold and/or silver contacts and terminals, high temperature U.L. approved plastic case, chrome plated brass toggle and nylon rockers and levers.

MINIATURE SNAP-ACTION PUSHBUTTON SWITCHES



The extremely short pre-travel of our miniature pushbutton switches (Series 580) offers near-instant response. While their snap-action mechanism provides positive user feedback. Small in size, they have a minimum rear projection, too. Available with numerous mounting options, including rear-panel and front snap-in. Can be used with or without four attractive snap-on caps available in a choice of 9 colors. All switches also come with epoxy-sealed terminals to prevent flux entry from the rear of the switch during soldering. U.L. listed.

Specifications
Electrical Ratings
Combination and Low-level up to 1 amp resistive at 120 VAC or 28 VDC.
Electrical Life
60,000 operations minimum.
Travel
.025″ typical.
Materials
Gold or gold over silver contacts and terminals, stainless steel housing and glass filled polyester plunger.

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A Cambridge Electronic Industries Company

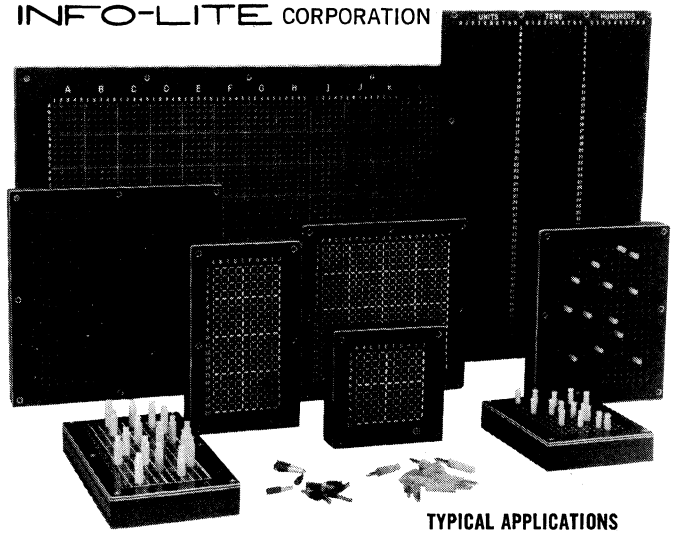
CRL

CROSSPOINT

THE PROGRAMMING PRODUCTS DIVISION OF
INFO-LITE CORPORATION

PROGRAMMING PRODUCTS

MATRIX PINBOARDS



INFO-LITE has developed a most convenient, compact and economical system for reliable programming and switching • The Matrix Program Board allows a wide variety of switching/programming functions to be performed by simply inserting programming pins (shorting or diode type) into a 2 to 10 deck contact matrix • No accessories such as "read" "write" equipment are required • Matrix Board features have led them to be favored over such devices as patchboards, card readers, toggle and thumbwheel switches, mag/punched tape and electronic memories • The two basic uses for Matrix Program Boards are: (1) Cordless patching (input-output switching), using shorting pins; (2) Programmable diode matrices (logic memories), using diode pins • Units with up to 100 x 100 crosspoints can be supplied to meet your requirements, whether for prototype or production quantities.

See Data Sheet MB3 for detailed specifications.

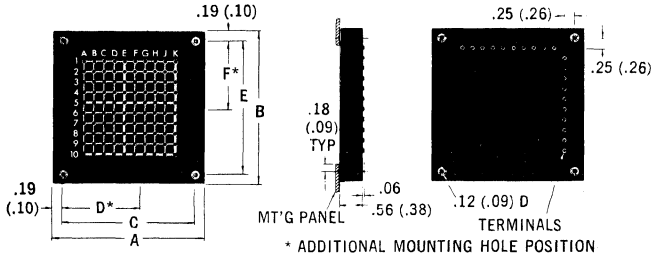
FEATURES

- Reliable closed entry contac.
- Rugged programming pins that will not bind
- Rapid and convenient method of programming/switching
- Permits insertion of components into network without soldering
- Replaces costly complex switching hardware
- Attractive and compact package
- Low capacitance for high frequency applications
- Ease of visual program checking

TYPICAL APPLICATIONS

Numeric Controlled Equipment
Logic Memories
Power Distributors
Circuit/Component Test Programmers
Lighting Systems
Code Generators
Programmable Diode Matrices
Communications Distributors
Status Indicators
Data Logging
Vending Machine Control
Thermo-Couple Selectors
Batching Programmers
Function Generators
Sequence Programmers
Pulse Code Programmers

STANDARD SPECIFICATIONS & STOCK MATRICES FOR 1000 & 2000 SERIES



* ADDITIONAL MOUNTING HOLE POSITION

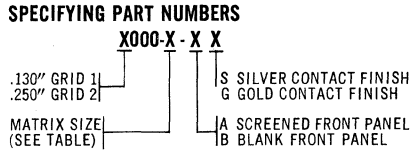
Matrix Size	Dash #	2000 Series — .250" Grid						1000 Series — .130" Grid					
		A	B	C	D	E	F	A	B	C	D	E	F
10 x 10	—1	3.69	3.69	3.25	—	3.25	—	2.02	2.02	1.82	—	1.82	—
10 x 15	—2	3.69	4.94	3.25	—	4.50	—	2.02	2.67	1.82	—	2.47	—
10 x 20	—3	3.69	6.19	3.25	—	5.75	2.75	2.02	3.32	1.82	—	3.12	—
10 x 25	—4	3.69	7.44	3.25	—	7.00	3.50	2.02	3.97	1.82	—	3.77	1.82
10 x 50	—5	3.69	13.69	3.25	—	13.25	4.50	2.02	7.22	1.82	—	7.02	3.51
20 x 20	—8	6.19	6.19	5.75	2.75	5.75	2.75	3.32	3.32	3.12	—	3.12	—
25 x 25	—9	7.44	7.44	7.00	3.50	7.00	3.50	3.97	3.97	3.77	1.82	3.77	1.82
50 x 50	—10	14.44	14.19	14.0	7.00	13.75	7.00	**7.48**	**7.35**	**7.28**	**7.15**	**3.64**	**3.51**

STANDARD SPECIFICATIONS

1 — Contact Type: Closed Entry
2 — Contact Material: Be-Cu, Alloy 25
3 — Contact Finish: a - .0002" Ag over Cu Flash
b - .00002" Min. Au over Ni Flash
4 — Contact Support Material: Silicone Rubber
5 — Contact Resistance: .040 Ohm, typ.
6 — Contact Capacitance: 1 uuf [2 uuf]/in. at 1 MHz, typ.
7 — Bussing: 1st (top) Deck Vertical; 2nd Deck Horizontal
8 — Breakdown Voltage: 1000 VRMS
9 — Current Rating: 5 [2] Amps standard; 10 [4] Amps available
10 — Terminals: Combination Taper Pin Socket/Solder Cup [Solder Cup]
11 — Panel Material: Black XX Grade Phenolic
12 — Panel Marking: Alpha-Numeric/Grid, White Epoxy Ink Screened

NOTE: Values in brackets [ ] are for 1000 Series if two values are given.

SPECIFYING PART NUMBERS

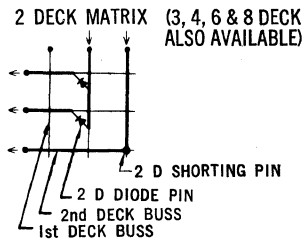


EXAMPLE: A 20 x 20, .250" grid matrix with silver contacts and blank front panel would have Part Number 2000-8-BS. U.S. Patent No. 3,631-374

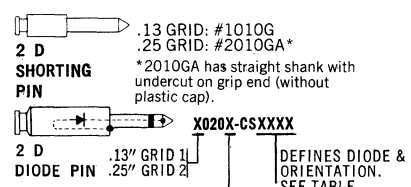
Programming Pins Diode Pins 1000 Series (.13" Grid)	Specifications Diode	Anode To†
1020S-CS0001/-CS0002	1N4151	Tip/Sleeve
1020G-CS0003/-CS0004	1N4151	Tip/Sleeve
2000 Series (.25" Grid)	†On Std. Matrices Tip makes W/2nd Deck.	
2020S-CS0006/CS0007	1N270	Tip/Sleeve
2020S-CS0010/CS0011	1N4151	Tip/Sleeve
2020G-CS0012/CS0025	1N4151	Sleeve/Tip
2020S-CS0014/CS0024	1N4004	Sleeve/Tip
Shorting Pins 1010G & 2010GA		

† Sold in multiples of 25 pieces.

SCHEMATIC

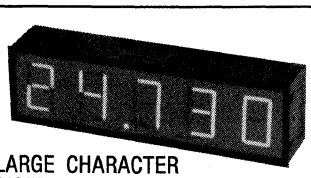


PROGRAMMING PINS



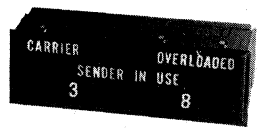
Diode orientation shown: Anode to Sleeve (1st Deck)

OTHER INFO-LITE PRODUCTS



LARGE CHARACTER DIGITAL DISPLAYS

MULTI-MESSAGE LIGHTED INDICATORS



DIGITAL INSTRUMENTS & SYSTEMS

SEE OUR PAGES IN EEM SECTION 2450

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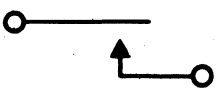
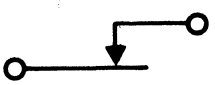
MINIGLOSSARY
RELAY CONTACT FORMS

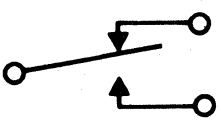
A
Make
SPST-NO



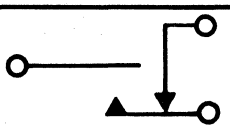
B
Break
SPST-NC



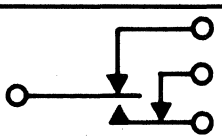
C
Break, Make
(Transfer)
SPDT



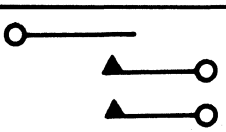
D
Make, Break
(Continuity
Transfer)



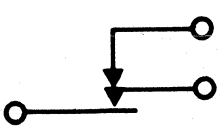
E
Break,
Make,
Break



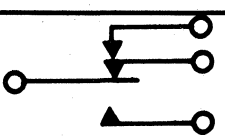
F
Make,
Make



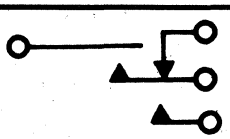
G
Break,
Make



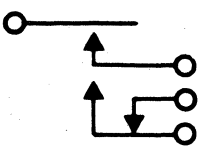
H
Break,
Break,
Make



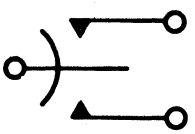
I
Make,
Break,
Make



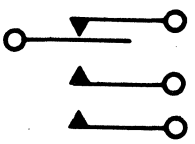
J
Make,
Make,
Break



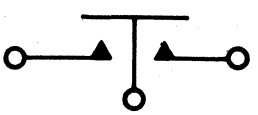
K
Center off
SPDT



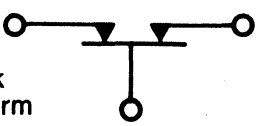
L
Break,
Make,
Make



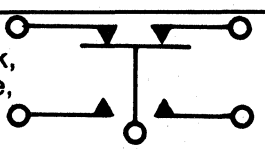
U
Double
make
Contact
on arm



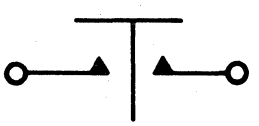
V
Double break
Contact on arm



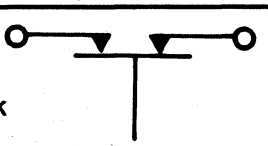
W
Double break,
Double make,
Contact
on arm



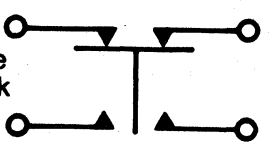
X
Double
make



Y
Double break

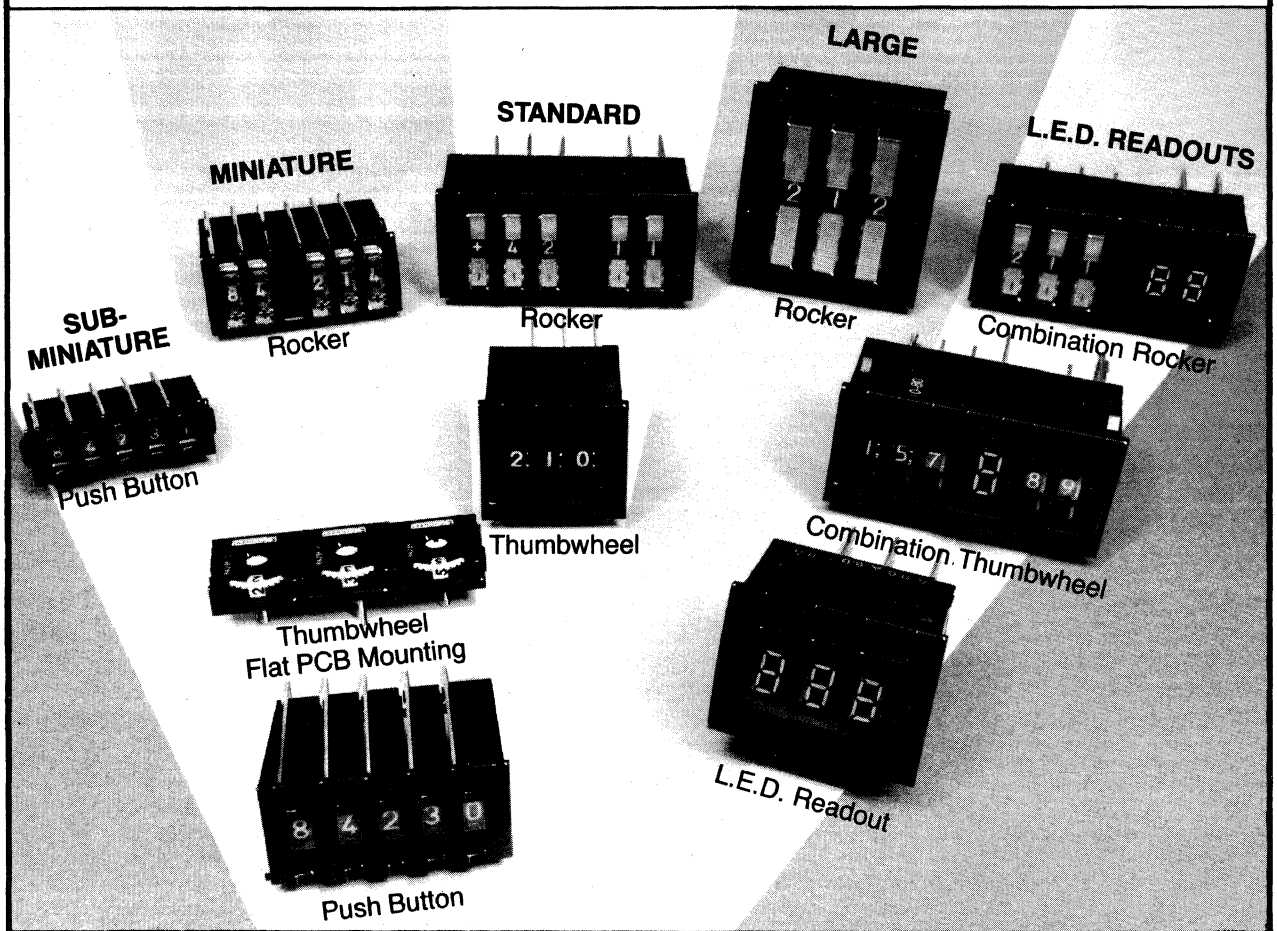


Z
Double make
Double break
SPDT-DB



Digital Switches

Thumbwheel, Rocker, Push Button, L.E.D. Readouts



THUMBWHEEL	• Standard Size: .31″(8)W x 1.30″(33)H – 84 210 Series • Flat PCB Mounting – 84 235 Series
ROCKER	• Miniature Size: .30″(7.62)W x .95″(24)H – 84 214 & 84 218 Series • Standard Size: .39″(10)W x 1.30″(33)H – 84 211 & 84 213 Series • Large Size: .49″(12.5)W x 2.28″(58)H – 84 212 Series
PUSH BUTTON	• Sub-Miniature Size: .30″(7.62)W x .59″(15)H – 84 231 Series • Miniature Size: .30″(7.62)W x .94 ″(24)H – 84 230 Series
L.E.D. READOUT MODULES	• Compatible with Standard Size Digital Switches 84 215 – 84 216 – 84 217 Series

CODES:
Decimal
BCD
BCD + Complement
BCD complement
BCD Excess 6 + Complement
Repeating (+/−) or (0/5)
Hexadecimal BCD
Hexadecimal BCD + Complement
Hexadecimal BCD complement

OPTIONS:
Short or long circuit board
Various case and wheel colors
Solder pins
Wire wrap terminations
Stops

ACCESSORIES:
End caps
Spacers
Encoded dummy modules
Separators
Connectors

SNAP ASSEMBLY – NO TOOLS, NO HARDWARE NEEDED

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CTS® CORPORATION*

SWITCH DIVISION, PASO ROBLES

CTS SERIES 207 AUTO-DIP™ SWITCH

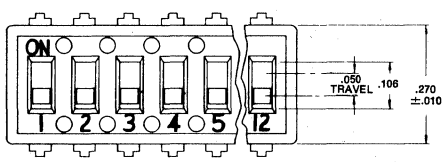
AUTOMATICALLY INSERTABLE, WAVE SOLDERABLE, BOARD WASHABLE DIP SWITCH

FEATURES

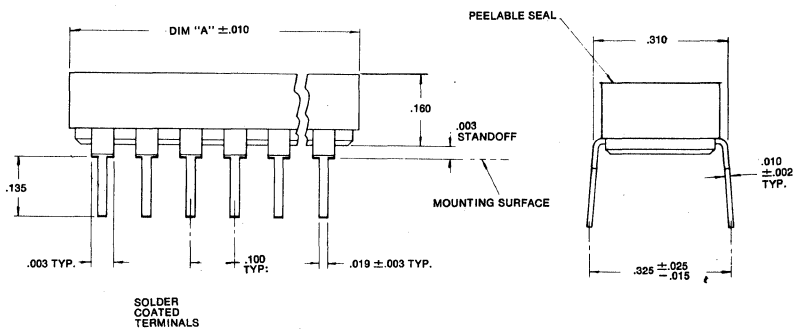
Optimized Contact System
- Redundant, wiping contacts
- Contactor does not rub on plastic or deflect during actuation

Optimized Mechanical Features
- Fully sealed to withstand insertion shock, wave solder temperatures, board washing
- Positive detent separate from contactor
- Closed windows prevent particle contamination
- .050″ actuator travel
- Molded .300″ integrated circuit package outline

Premium Materials
- Gold contacts, solder coated terminals
- Beryllium copper contactor
- 260°C housing heat deflection temperature assures contact and seal integrity after wave soldering
- All plastics rated UL 94 V-0
- Permanent laser marking

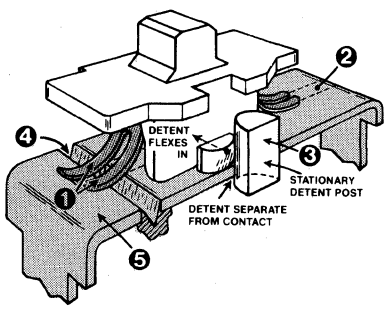


"A" Overall Dim.	No. of Switch Sections	Part No.
.258	2	207-2LPST
.358	3	207-3LPST
.458	4	207-4LPST
.558	5	207-5LPST
.658	6	207-6LPST
.758	7	207-7LPST
.858	8	207-8LPST
.958	9	207-9LPST
1.058	10	207-10LPST
1.158	11	207-11LPST
1.258	12	207-12LPST



GENERAL TOLERANCES:
Decimal dimensions ±.005″

Switch reliability that is the best ever!



1. Redundant gold contacts dramatically enhance contact reliability.
2. Positive wiping contacts assure low and consistent contact resistance. (.050″ travel)
3. Detent function separated from contacts to optimize both designs.
4. Gold contacts never abraded or contaminated by sliding over polymer surfaces. Contacts never touch a nongold surface.
5. No contactor deflection for the life of the switch. Constant contact force eliminates overstressing of contacts for greater reliability.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

Contact Resistance
25 milliohms maximum initial
50 milliohms maximum at end of life

Actuation Life
5000 cycles switching
50 mA @ 6 VDC or 2 mA @ 50 mVDC

Nonswitching Rating
100 mA or 50 VDC

Insulation Resistance
1 x $10^9\Omega$ minimum between insulated terminals

Dielectric Strength
200 VAC minimum

Switch Capacitance
5 pF maximum between adjacent closed switches

Temperature Range
0 to 85%C operating
−40 to 70°C storage

Allowable Wave Solder Time
Up to 4 seconds with 260°C solder

Shock
No mechanical damage or changes of switch settings with 25 G applied for 6 milliseconds

Vibration
No mechanical damage or changes of switch settings during or after testing, when tested in 3 mutually perpendicular planes at 10-50 Hz sweep or at 60 Hz constant vibration. Amplitude .06″

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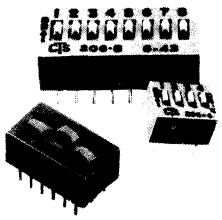
SWITCH DIVISION, PASO ROBLES

CTS SERIES 206

CTS DIP PROGRAMMABLE SWITCHES



FEATURES

- Contact wiping on make and break
- Suitable for flow soldering on PC board or mounting with standard DIP sockets
- Long term contact corrosion resistance provided by gold plated contact arms
- All U.L 94V-O plastic used
- Integral terminal and contact locked into plastic base rails
- Crisp, positive slide actuators
- Types 206-02 through -10 approved to MIL-S-83504/4 upon request
- Available with flush (low profile) actuators — SPST styles

Description

From 2 thru 12 SPST; 1 thru 6 SPDT; 1 thru 6 DPST; 1, 2 or 3 DPDT and 1, 2 or 3 4PST slide switches per switch package on .100″ x .300″ DIP centers

Initial Contact Resistance

50 miliohms

Maximum Contact Resistance

100 milliohms after 10,000 cycles switching 50 mA @ 24 VDC

Maximum Non-Switching Rating

100 mA or 50 VDC

Insulation Resistance

Across open switch and between adjacent closed switches: 1 x 10^5 ohms

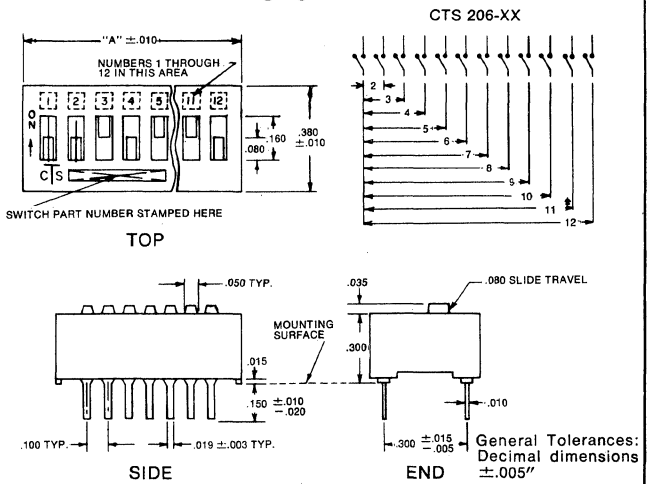
Dielectric Breakdown

Between adjacent switches minimum: 500 VDC

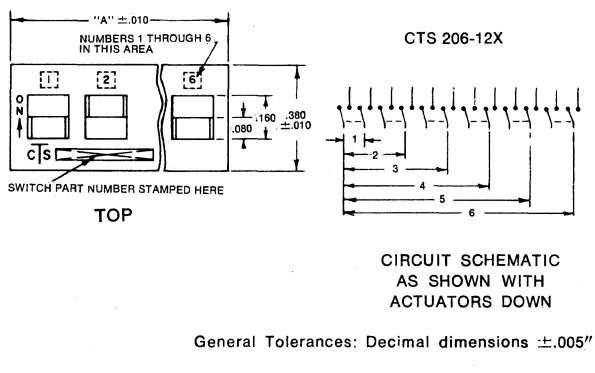
Switch Capacitance

Between adjacent switches maximum: 5.0 pF

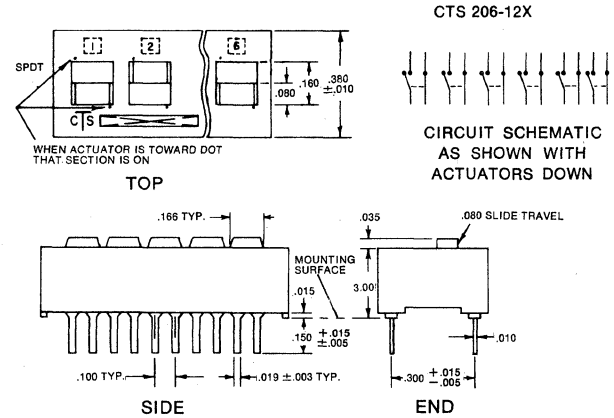
SPST



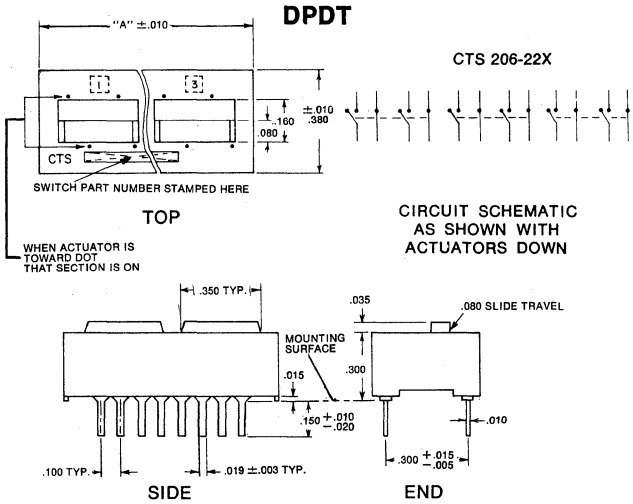
DPST



SPDT



DPDT



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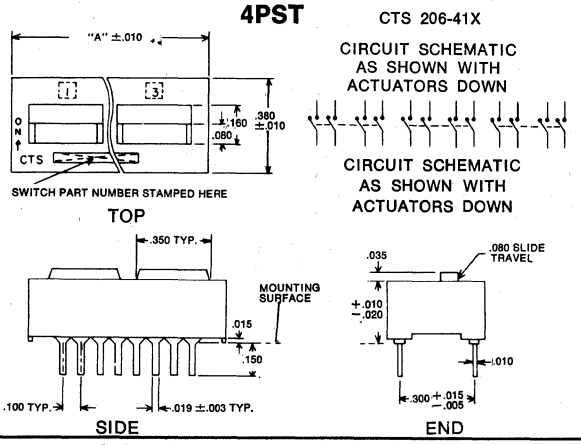
CTS® CORPORATION*

SWITCH DIVISION, PASO ROBLES

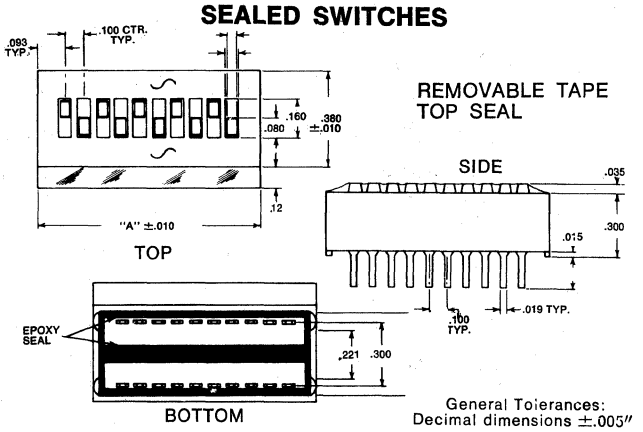
CTS DIP PROGRAMMABLE SWITCHES

4PST

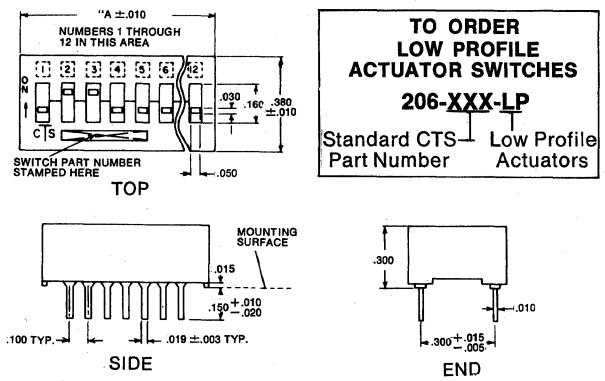
CTS 206-41X



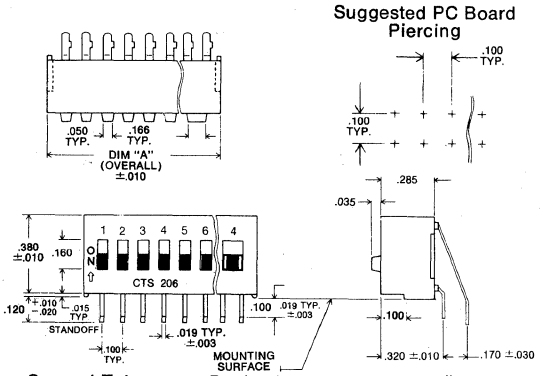
SEALED SWITCHES



LOW PROFILE ACTUATORS



RIGHT ANGLE PANEL MOUNT — 206RA



STANDARD "OFF THE SHELF" PART NUMBERS

"A" Overall Dimension	Number of Switch Sections	Actuation	Part Number	Low Profile Bottom & Top Sealed	Both Bottom & Top Sealed	Right Angle Mount Sealed Bottom & Top
.286	2	SPST	206-2	206-2LPST	206-2ST	206-2RAST
.386	3	SPST	206-3	206-3LPST	206-3ST	206-3RAST
.486	4	SPST	206-4	206-4LPST	206-4ST	206-4RAST
.586	5	SPST	206-5	206-5LPST	206-5ST	206-5RAST
.686	6	SPST	206-6	206-6LPST	206-6ST	206-6RAST
.786	7	SPST	206-7	206-7LPST	206-7ST	206-7RAST
.886	8	SPST	206-8	206-8LPST	206-8ST	206-8RAST
.986	9	SPST	206-9	206-9LPST	206-9ST	206-9RAST
1.086	10	SPST	206-10	206-10LPST	206-10ST	206-10RAST
1.286	12	SPST	206-12	206-12LPST	206-12ST	206-12RAST
.286	1	SPDT	206-121		206-121ST	206-121RAST
.486	2	SPDT	206-122		206-122ST	206-122RAST
.686	3	SPDT	206-123		206-123ST	206-123RAST
.886	4	SPDT	206-124		206-124ST	206-124RAST
1.086	5	SPDT	206-125		206-125ST	206-125RAST
1.286	6	SPDT	206-126		206-126ST	206-126RAST
.286	1	DPST	206-211		206-211ST	206-211RAST
.486	2	DPST	206-212		206-212ST	206-212RAST
.686	3	DPST	206-213		206-213ST	206-213RAST
.886	4	DPST	206-214		206-214ST	206-214RAST
1.086	5	DPST	206-215		206-215ST	206-215RAST
1.286	6	DPST	206-216		206-216ST	206-216RAST
.486	1	DPDT	206-221		206-221ST	206-221RAST
.886	2	DPDT	206-222		206-222ST	206-222RAST
1.286	3	DPDT	206-223		206-223ST	206-223RAST
.486	1	4PST	206-411		206-411ST	206-411RAST
.886	2	4PST	206-412		206-412ST	206-412RAST
1.286	3	4PST	206-413		206-413ST	206-413RAST

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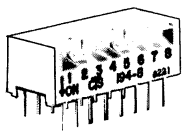
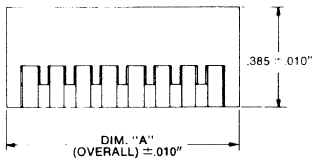
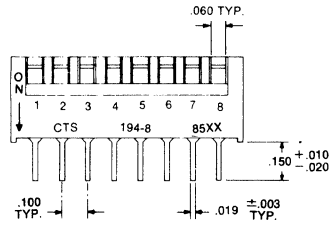
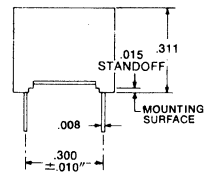
CTS SERIES 194

CTS DIP SWITCHES









SPST Switches

"A" Overall Dimensions	Number of Switch Sections	Standard Bottom Sealed Part Number	Bottom and Top Sealed Part Number
.286	2	194-2MS	194-2MST
.386	3	194-3MS	194-3MST
.486	4	194-4MS	194-4MST
.586	5	194-5MS	194-5MST
.686	6	194-6MS	194-6MST
.786	7	194-7MS	194-7MST
.886	8	194-8MS	194-8MST
.986	9	194-9MS	194-9MST
1.086	10	194-10MS	194-10MST
1.286	12	194-12MS	194-12MST

FEATURES

- Electrical switching occurs at 50% of actuator rotation angle
- Contact wiping on make and break
- Enclosed actuators shield contacts from foreign particles throughout life of switch
- The gold plated, over-center design provides positive detent action
- Reliable tape top seal optional/ bottom epoxy seal standard
- Insert molded base halves of thermoset material ensure mechanical integrity of contacts and terminals through soldering operations
- All U.L. 94 V-O plastics used

Description

Side actuated 4, 8 or 10 section SPST switching functions per package on .100″ x .300″ DIP centers

Initial Contact Resistance

50 milliohms maximum

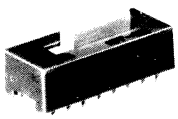
Insulation Resistance

Across open switch and between adjacent closed switches: 1 x 10^9 ohms minimum

Maximum Contact Resistance

100 milliohms after 7000 cycles switching 50 mA @ 24 VDC

CTS SERIES 197



FEATURES

- Designed for automatic insertion
- Integral terminal and contact locked into thermoset base rails
- Contact wiping on make and break
- Break before make contacts
- Useful in "service/operate" applications, low level signal routing, digital circuit programming, etc.
- Long term contact corrosion provided by gold plated/inlaid contacts
- All U.L. 94 V-O plastics used

Description

4PDT slide actuated switch package on .100″ x .300″ DIP centers

Initial Contact Resistance

50 miliohms maximum

Maximum Contact Resistance

100 milliohms after 2000 cycles switching 50 mA @ 24 VDC

Insulation Resistance

Across open switch and between adjacent closed switches: 1 x 10^9 ohms minimum

Dielectric Breakdown

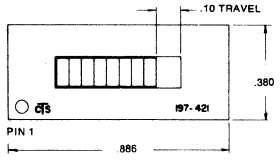
Between adjacent switches minimum: 500 VDC

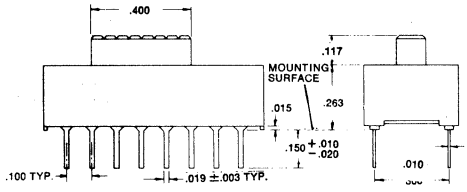
Switch Capacitance

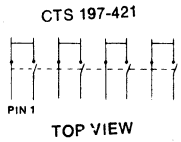
Between adjacent switches maximum: 5.0 pF

STANDARD "OFF THE SHELF" PART NUMBERS

Function	Part Number
4 pole double throw	197-421







General Tolerances: Decimal dimensions ±.005″

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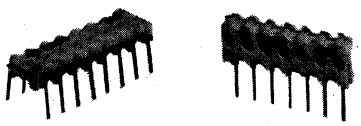
CTS SERIES 198

CTS PROGRAMMABLE DIP/SIP SHUNT NETWORKS



Description
Low cost matrix programming. DIPs offered in 4-24 terminal configurations; SIP's in 2-12 terminal packages

Current Rating
1.0 amp maximum

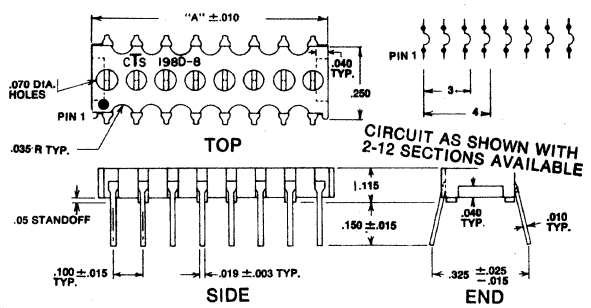
Insulation Resistance
1 x 10^{11} ohms minimum between any 2 electrically isolated terminals

Dielectric Breakdown Voltage
500 VDC minimum between any 2 electrically isolated terminals

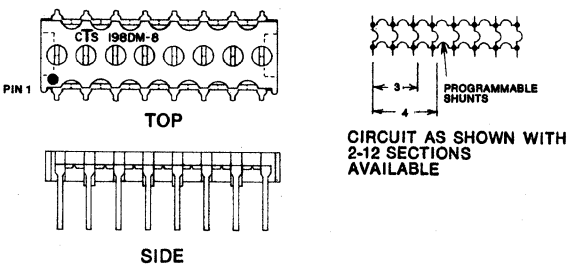
Insulation
UL recognized 94 V-O rated high temperature thermoplastic

Metal Parts
Solder plated copper alloy. (Gold plated terminals optional)

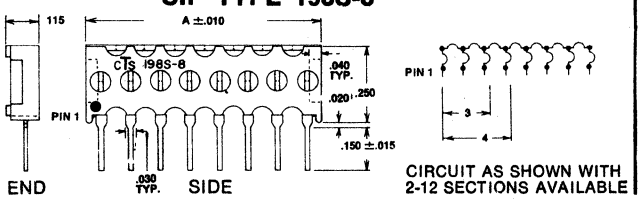
DIP TYPE 198D-8



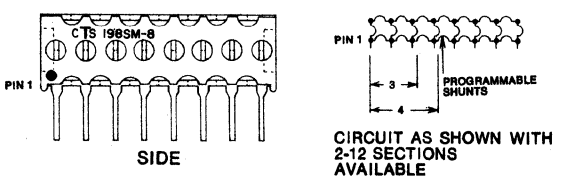
DIP TYPE 198DM-8



SIP TYPE 198S-8



SIP TYPE 198SM-8



No. of Sections	2	3	4	5	6	7	8	9	10	11	12
"A" DIM.	.200	.300	.400	.500	.600	.700	.800	.900	1.000	1.100	1.200

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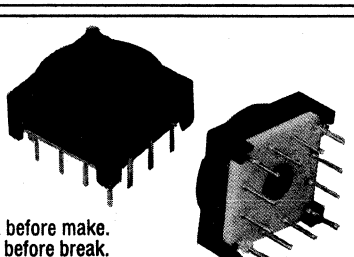
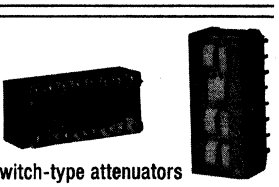
SERIES 235
Enclosed Miniature .500" Square Rotary Switches



Switch Functions:
1. Single pole, 11 positions, break before make.
2. Single pole, 11 positions, make before break.
3. Binary up to hexadecimal (0-15).
4. Other functions and combinations are available with special tooling.

Electrical and Mechanical Specifications:
1. Contact resistance varies with switch style: Typical values for 11 positions break before make. 0.1 ohm initial contact resistance, 0.15 ohm after 1000 cycles of 360° rotation.
2. Standard operating temperature range: −55°C to +85°C.
3. Rotational life: 1000 cycles of 360° rotation.
4. Wiping action on contact.
5. 360° rotation.
6. Small size: .5" x .5" square.
7. 250" profile from mounting plane to top of package.
8. Enclosed construction excludes dust and foreign material.
9. Terminal pull strength: 5 lbs. minimum.

SERIES 196
Switchable DIP Attenuator



- Reliable replacement for thumbwheel switch-type attenuators (at substantial savings)
- 75 ohm and 600 ohm unbalanced PI or T configuration networks
- .100" x .300" DIP packages
- Standard thick film ceramic modules; custom thin film modules available upon request
- Sealed bottom or top/bottom versions optional; assures contaminate-free switch operation after flow soldering and cleaning
- Standard values from .1 dB to 16 dB in increments of .1 dB to 2 dB

Electrical and Environmental Specifications
(all are absolute maximum ratings)

Electrical:
Impedance Tolerance ..... ±2%
Power Rating (maximum input signal) ..... 20 dBm
Insertion Loss ..... .02 dB

Environmental:
Storage Temperature ..... −40°C to +85°C
Operating Ambient Temperature ..... 0°C to +70°C
Lead Temperature (soldering 10 seconds) ..... 300°C maximum

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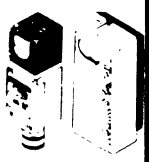
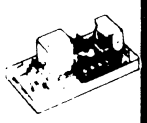
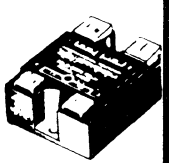
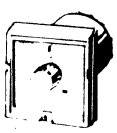

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS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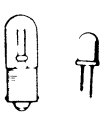
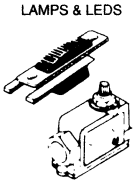

LAMPS & LEDS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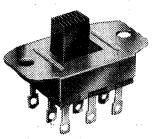
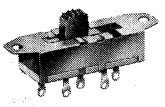
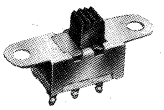
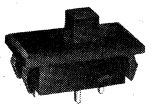
Slide Switches

	 Standard Switches	 Miniature Switches	 Micro Miniature Switches	 Fully Enclosed Micro Miniature Switches
Circuitries	SPST, SPDT, DPST, DPDT, 3PDT, 4PDT, SP3POS, DP3POS, 3P3POS, 4P3POS, DP4POS.	SPST, SPDT, DPST, DPDT, 3PDT, SP3POS, DP3POS, 3P3POS, 4P3POS, SP4POS, DP4POS, DP5POS.	SPST, SPDT, DPDT, SP3POS.	SPST, SPDT (Plug-in or snap-in versions)
Ratings	3A AC/.5A DC @125V through 13A AC/.5A DC @125V	.5A AC/.5A DC @125V through 8.5A AC/.5A DC @125V	.5A AC/.5A DC @125V	.5A AC/.5A DC @125V
Momentary Versions	SPST, SPDT, DPDT, 3PDT. Also, SP3POS, DP3POS and 3P3POS are available momentary in only one direction.	SPST, SPDT, SP3POS, DP3POS.	SP3POS (momentary both directions to center)	Not Available
Side Actuated Versions	SPDT (maintained or momentary), DPDT, DP3POS.	SPDT, DPDT, 3PDT, SP3POS, DP3POS, SP4POS, DP4POS, DP5POS.	SPDT	SPST
Terminal Options	Solder, Wirewrap, PC, Faston	Solder, Wirewrap, PC.	Solder, Wirewrap, PC.	Solder, PC, Faston
Button Options	.344″ (Standard) .031″ through .750″ (optional). Black is standard; optional colors available.	.200″ (Standard) .125″ through .453″ (optional). Black is standard; optional colors available.	.120″ through .250″ Black is standard; optional colors available.	.110″ through .250″ Black is standard; optional colors available.
Agency Listings	UL, CSA	UL, CSA	UL	UL, CSA
Endurance	10,000 cycles no load (minimum) 6,000 cycles rated load (minimum)	10,000 cycles no load (minimum) 6,000 cycles rated load (minimum)	10,000 cycles no load (minimum)	6,000 cycles at rated load (minimum)
Bifurcated/Redundant Contacts	DPDT, 4PDT. Make before break or break before make.	SPDT (maintained or momentary), DPDT, SP3POS. Make before break or break before make.	Not Available	Not Available
CW Catalog	S2120-II/S2120-VIIA	S2120-III/S2120-VII	S2120-IV	S2120-V

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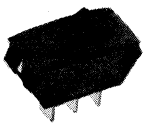
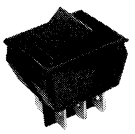
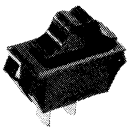
Panel Mount Power Switches

	"Mini-Rocker" Switch	 "Soft-Styled" Rocker Switch	 "Hi Gloss" Rocker Switch	 Panel Mount Slide Switch
Circuitries	SPST, SPDT, DPST, DPDT, SPDT-Center Off, DPDT-Center Off	SPST, SPDT, SPDT-Center Off	SPST, SPDT, DPST, DPDT	SPST, SPDT
Mounting	Pop-In	Pop-In	Pop-In	Pop-In or Chassis Mount
Ratings	8A @125V AC/4A @250V AC 13A @125V AC/10A @250V AC ½HP @125V-250V AC 16A @125V AC/16A @250V AC ¾HP @125V-250V AC 10A @14V (T)/3A @125V (L) 10 (4)A 250~(VDE)	8A @125V AC/4A @250V AC 13A @125V AC/10A @250V AC ½HP @125V-250V AC 5A @14V (T)/6A @125V (L) 16A @125V AC/12A @250V AC ¾HP @125V-250V AC 10A @14V (T) 12 (6)A 250~(VDE)	8A @125V AC/4A @250V AC 13A @125V AC/10A @250V AC ½HP @125V-250V AC 5A @14V (T)/6A @125V (L) 16A @125V AC/12A @250V AC ¾HP @125V-250V AC 10A @14V (T) 12 (6)A 250~(VDE)	8A @125V AC/4A @250V AC 13A @125V AC/10A @250V AC ½HP @125V-250V AC 5A @14V (T)/6A @125V (L) 16A @125V AC/12A @250V AC ¾HP @125V-250V AC 10A @14V (T) 12 (6)A 250~(VDE)
Panel Cutout	.756″ × .508″	.550″ × 1.125″	.550″ × 1.125″ (Single Pole) .872″ × 1.071″ (Double Pole)	.550″ × 1.125″ (Pop In) 1.125″ Mounting Centers (Chassis Mount)
Panel Thickness	.050″ To .150″	.025″ To .180″ (up to .170″ for Center Off and Illuminated)	.025″ To .180″ (Single Pole) .025″ To .150″ (Double Pole)	.025″ To .180″
Momentary Versions	SPST, SPDT, DPST, DPDT, SPDT-center off, DPDT—center off	SPDT—center off	Not Available	Not Available
Illuminated Versions	SPST, SPDT, DPST, DPDT	SPST	Not Available	Not Available
Lamp Options	Neon 125V (STD) Neon 250V Incandescent 14V	Neon 125V (STD) Neon 250V Incandescent 14V	Not Available	Not Available
Agency Listings	UL, CSA, VDE	UL, CSA, VDE	UL, CSA, VDE	UL, CSA, VDE
Endurance	100,000 cycles no load, minimum 25,000 cycles rated load (up to 16A 125V AC) 10,000 cycles rated load @16A 250V AC	100,000 cycles no load, minimum 25,000 cycles rated load (up to 16A 125V AC)	100,000 cycles no load, minimum 25,000 cycles rated load	100,000 cycles no load, minimum 25,000 cycles rated load
Button/Rocker Options	Color, Markings	Color, Markings	Color, Markings	.260″ Button (std.); .344″, .500″, .625″, .750″ also available/ Color/Markings/Toppers Available
Housing Options	Color, Markings	Color, Markings	Color, Markings	Pop-In Mount or Chassis Mount, Color, Markings
Insulation Barriers	Optional	Optional	Optional	Optional
For additional information request Catalog S212186-Rev A-87				

Completely American Made

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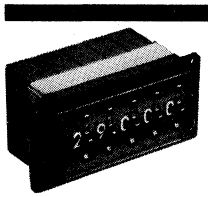
PRESENTING THE LONGEST-RUNNING SERIES IN THE BUSINESS

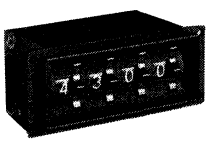
Innovative, Quality-Engineered Thumbwheel Switches Available Off-The-Shelf At Unbeatable Prices.



29000 SERIES
ECONOMY MINISWITCH

An economical miniswitch for high package density. Extra large in-line character readout. Width, .350" (8.9) and cutout height 1.020" (25.9)

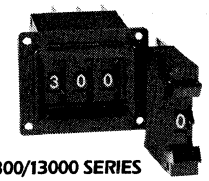
- 10, 12 or 16 Dial Positions
- Many Output Codes and Configurations
- Message Units for Longer Legends
- Optional Dial Stops to Limit Rotation
- Rear-Mounted



43000/44000/45000 SERIES
MINISWITCH

These low cost switches feature optional LED lighting and snap-together assembly. Field installable stops to limit dial rotation. Printed circuit boards with solder or pin terminations.

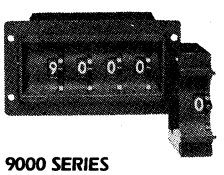
- Available in Most Popular Codes
- 10 Dial Positions
- .200" High, Up-Front Dial Characters
- 43000 —
- 500" (12.7) W x .980" (24.89) H
- 44000 —
  .315" (8.0) W x 1.220" (31.0) H
- 45000 —
  .315" (8.0) W x .961" (24.4) H



300/13000 SERIES
GENERAL PURPOSE DIGISWITCH

One of the most widely used thumbwheel switches, with more available options, output codes and special termination features than any other switch.

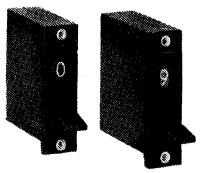
- 8, 10, 12 or 16 Dial Positions
- RFI Shielding Available
- Easy to Replace MIL-Spec Lighting
- Message Units for Longer Legends
- 13000 is Front-Mounted Version
- 300 —
  .500" (12.7) W x 1.380" (35.05) H
- 13000 —
  .500" (12.7) W x 2.00" (50.8) H



9000 SERIES
DIGISWITCH

The 9000 offers more available options, output codes and special termination features than any other fully-sealed MIL-spec switch. Rear-mounted, qualified to MIL-S-22710/12.

- 8, 10, 12, or 16 Dial Positions
- RFI Shielding Available
- Optional Replaceable MIL-Spec Lighting
- Dial Stops to Limit Dial Rotation
- Dimensions —
  .600" (15.24) W x 1.375" (34.93) H



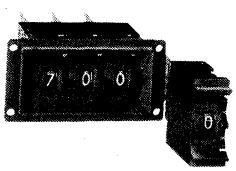
24000/28000 SERIES
LEVER SWITCH

24000: Bi-directional front panel sealed switch built to perform in any hostile environment qualified to MIL-S-22710/24.

- Optional, Replaceable MIL-Spec Lighting
- Individually Mounted Switches
- 24000 —
  .480" (12.19) W x 1.175" (29.84) H

28000: Minilever commercial switch that can be actuated in either direction.

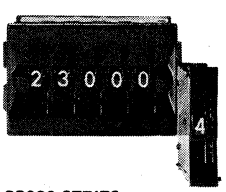
- "Upper" or "Lower" Window Location
- 90° Full Lever Travel
- 10 and 12 Dial Positions
- 28000 —
  .500" (12.7) W x .980" (24.89) H



200/700/8000 SERIES
MINISWITCH

Small switches for hostile environments, virtually impervious to sand, dust, oils, high humidity, salt spray and explosive atmospheres. Series 200 has potted wire leads, 700 — P.C.B. both qualified to MIL-S-22710/15 and /20.

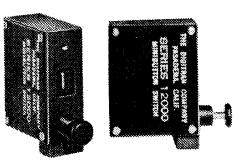
- 8, 10, 12 or 16 Dial Positions
- RFI Shielding Available
- Optional, replaceable MIL-Spec Lighting
- 8000: Commercial Version
- Dimensions:
  .500" (12.7) W x .980" (24.89) H



23000 SERIES
"SNAP-IN" SLIMSWITCH

For applications where maximum panel density, good reliability and error-proof positive setting action are required. Switch width only .315" with cutout height of 1.221"

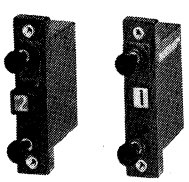
- 10 Dial Positions
- Snap-in, Front Mount — No Tools Required
- Large (.170" High) In-Line Characters



12000/53000 SERIES
MINIBUTTON

Reliable, contamination-proof switches for applications requiring panel sealing per MIL-S-22710. No supplemental panel cover or boot is required for sealing.

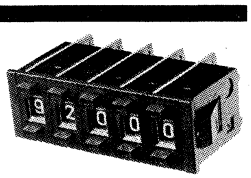
- Individually Mounted Switches
- Glass Window that Seals Switch Interior
- Metal Case —
  Facilitates R.F.I. Shielding
- Optional Replaceable MIL-Spec Lighting
- 12000 Series:
  Qualified to MIL-S-22710/17
- 12000 —
  .500" (12.7) W x .83" (21.08) H
- 53000 —
  .350" (8.89) W x 1.020" (25.91) H



63000/64000 SERIES
BI-DIRECTIONAL MINIBUTTON

Two-button bi-directional switches designed to meet all performance requirements of MIL-S-22710. Rear-mounted, panel sealed.

- 63000 — 8, 10, 12 Dial Positions
- 64000 — 16 Dial Positions
- Metal Case —
  No RFI Shielding Required
- Optional Replaceable MIL-Spec Lighting
- Individually Mounted Switches
- 63000 —
  .410" (10.41) W x 1.230" (31.25) H
- 64000 —
  .460" (11.68) W x 1.312" (33.53) H



92000/93000/62000 SERIES
DOUBLE PUSHBUTTON

These commercial switches are designed for applications where speed and ease of settings are important.

- Snap-together Assembly
- L.E.D. Lighting Available (92000)
- Low Cost, High Quality, High Reliability
- 10 and 16 Dial Positions Available
- Dial Stops to Limit Dial Rotation
- 92000 —
  .300" (7.62) W x .551" (14.2) H
- 93000 —
  .300" (7.62) W x .886" (22.5) H
- 62000 —
  .315" (8.00) W x .945" (24) H

NOTE: Numerals in brackets indicate millimeter equivalents.

More military and commercial thumbwheels and greater code selection than anybody else. And it's all under one roof to maintain the very highest standards of product quality and delivery.

DIGITRAN®

A DIVISION OF XCEL CORPORATION

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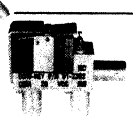
DowKey® Microwave CORPORATION

DOW-KEY SERIES NO.	CONTACT ARRANGEMENT	CONNECTOR OPTIONS	IMPEDANCE (OHMS)	FREQUENCY (MAX)	INSERTION LOSS (dB TYP OPERATING)	ISOLATION (dB TYP OPERATING)	POWER RATING (CW) AT 100 MHz	POWER RATING (CW) AT MAX FREQ.
RF SWITCHES								
60	SPDT	BNC N UHF C	50	2000 MHz	0.1	50	1000W	200W
260	DPDT	BNC N UHF	50	2000 MHz	0.1	50	1000W	200W
61	SPDT	BNC	50	2000 MHz	0.1	50	150W	50W
66	SPDT	F	75	1000 MHz	0.1	70	100W	20W
77	SPDT	F BNC	75 50	2000 MHz	0.1	40	100W	20W
54	SPDT	BNC TNC	50	4000 MHz	0.1	70	100W	50W
55	SPDT	BNC TNC	50	4000 MHz	0.1	70	100W	50W
56	SPDT	BNC TNC	50	4000 MHz	0.1	70	100W	50W
62	SPDT	BNC TNC	50	4000 MHz	0.1	70	100W	50W
46 164	DPDT SPDT	BNC SMB SMA	50	4000 MHz	0.1	50	125W	50W
78	MULTI-THROW MANUAL	BNC UHF	50	2500 MHz	0.1	50	1000W	200W
115 116	SP3T SP4T	BNC SMA	50	3500 MHz	0.1	50	200W	50W
167	TRANSFER	N UHF	50	1000 MHz	0.1	40	1000W	100W
169	SPDT	BNC	50	1000 MHz	0.1	50	100W	20W
HIGH POWER SWITCHES								
310	SPDT	SC N HN	50	1000 MHz	0.1	30	2000W	500W
312	BYPASS	SC N HN	50	1000 MHz	0.1	30	2000W	500W
313	TRANSFER	SC N HN	50	1000 MHz	0.1	30	2000W	500W
MICROWAVE SWITCHES								
401	SPDT	SMA	50	26.5 GHz	.1 TO .5	70	200W	25W
403	SPDT	SMA	50	26.5 GHz	.1 TO .5	70	200W	25W
411	TRANSFER	SMA	50	26.5 GHz	.1 TO .5	70	200W	25W
402	SPDT	BNC N TNC	50	16.0 GHz	.1 TO .5	70	1000W	100W
412	TRANSFER	BNC N TNC	50	16.0 GHz	.1 TO .5	70	1000W	100W
IN-LINE SERIES OF MULTITHROW SWITCHES								
443	SP4T	SMA	50	18.0 GHz	0.4	60	100W	10W
453	SP5T	SMA	50	18.0 GHz	0.5	60	100W	10W
463	SP6T	SMA	50	18.0 GHz	0.6	60	100W	10W
473	SP7T	SMA	50	18.0 GHz	0.7	60	100W	10W
483	SP8T	SMA	50	18.0 GHz	0.8	60	100W	10W
493	SP9T	SMA	50	18.0 GHz	1.0	60	100W	10W
4A3	SP10T	SMA	50	18.0 GHz	1.0	60	100W	10W
4B3	SP11T	SMA	50	18.0 GHz	1.0	60	100W	10W
4C3	SP12T	SMA	50	18.0 GHz	1.0	60	100W	10W

60 SERIES

260 SERIES


61 SERIES

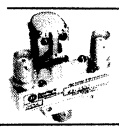
66 SERIES

77 SERIES

54 SERIES

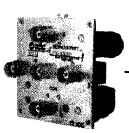
55 SERIES

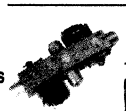
56 SERIES

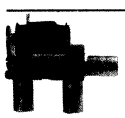

62 SERIES

46/164 SERIES

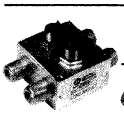
78 SERIES

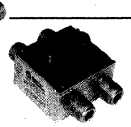

115/116 SERIES


167 SERIES

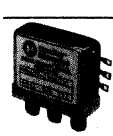

169 SERIES

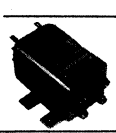
310 SERIES


312 SERIES

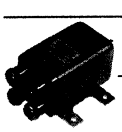

313 SERIES

401 SERIES


403 SERIES


411 SERIES

402 SERIES


412 SERIES

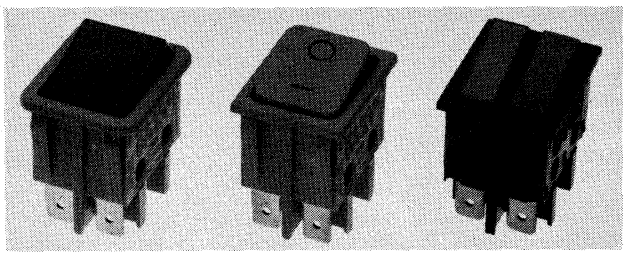
IN LINE MULTITHROW SERIES

1667 Walter Street Ventura, CA 93003-5641 (805) 650-0260 FAX: (805) 650-1734

Dreefs

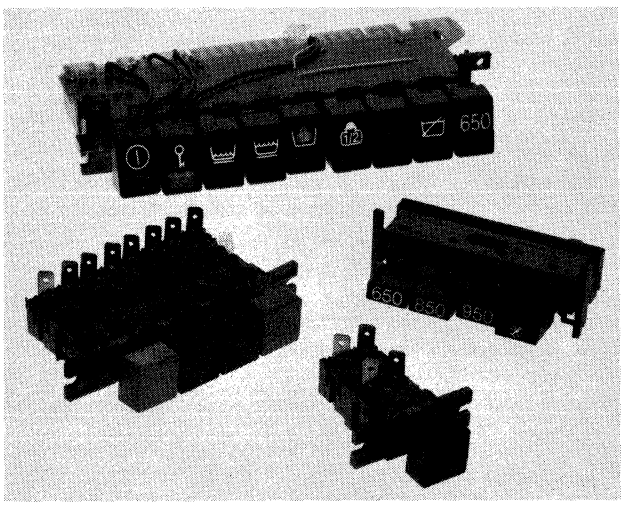
The Worldwide Choice

Rocker Switches



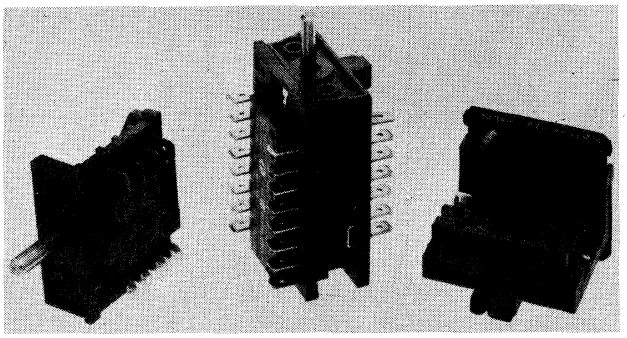
The Dreefs line of power rocker switches ranges from subminiature to full size. Shown above are a few configurations standard within the Dreefs 2WiXII Series. Rated at 16 (4) amperes @250 VAC INDUCTIVE, or 25 amperes @125 VAC INDUCTIVE, this series features an inrush capability of up to 125 amperes (typical). A wide variety of bezel styles and colors, along with many choices for standard and customized rockers (illuminated or non-illuminated) are available.

Pushbuttons

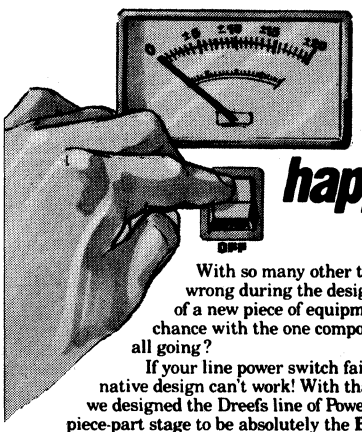


The unique terminal arrangement and building block technique used in the design of these pushbuttons allows easy accommodation of special switching requirements. Each terminal station along the standard heavy-duty thermoplastic housing contains its own set of double contacts, for high reliability and great versatility in switching applications. Each terminal station is rated at up to 16 amperes @125/250VAC. Solid silver, AgCd0 or Au contacts are standard. Operation is momentary, push-push, interlock or cancelling action.

In-Line, Cam Actuated Switch System



The camshaft technique of rotary-to-linear conversion to open spring-loaded NC contacts provides the crisp action, reliability and weld-breaking advantages of make/break contacts, along with high inrush and high current-carrying capabilities. Up to 26 separate SPST switches, each controlling an individual circuit, may be actuated along a single cam, with one to 26 rotational positions. Contacts are rated at 16 amperes @125/250 VAC. High-inrush or dry circuit contacts are available.



What *happened?*

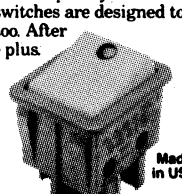
With so many other things that can go wrong during the design and development of a new piece of equipment, why take a chance with the one component that gets it all going?

If your line power switch fails, the most imaginative design can't work! With that thought in mind, we designed the Dreefs line of Power Rockers from the piece-part stage to be absolutely the **BEST** available on the market.

All switches carry a wide array of international approvals, including **VDE, UL** and **CSA.**

Electrical and mechanical specifications are fully described in a newly updated catalog. A telephone call or a note from you will get one into your hands quickly.

By the way, the *outside* of these switches are designed to make your control panel look great too. After the hard part gets done, that's a nice plus.



Dreefs Switch Inc.
3782 Hawthorn Court, Waukegan, IL 60087
312-662-7667 or 800-323-9605
Fax: 312-662-0906

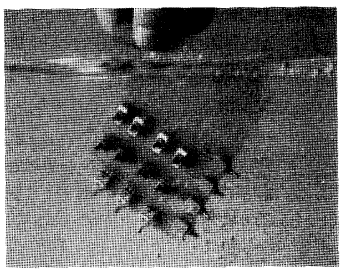
SABS MITI AUS

For complete information on the products shown above, contact: Ed Magiera, **Dreefs Switch Inc.,** 3782 Hawthorn Court, Waukegan, Il. 60087. (312) 662-7667 or 800-323-9605. FAX: 312-662-0906

QUALITY SWITCHES of MIYAMA DSA

ULTRA MINIATURE PCB MOUNT TOGGLE SWITCHES (Operating Life 100,000 Cycles)

MODEL: MS-200

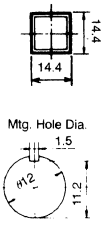


TERMINAL PITCH IS 1/10 INCH (2.54mm)
SWITCH IS FULLY SEALED FOR WATER RESISTANT
SIZE OF BODY: RIGHT ANGLE 7.4mm VERTICAL 10mm
LENGTH OF KNOB: METAL 5mm PLASTIC 3.8mm

3 P SPDT	ON	—	ON	6 P DPDT	ON	—	ON
	ON	—	ON		ON	—	(ON)
	ON	OFF	ON		ON	OFF	ON
	ON	OFF	(ON)		ON	OFF	(ON)
	(ON)	OFF	(ON)		(ON)	OFF	(ON)

ILLUMINATED SWITCHES. Long Life (Electrical 50,000 Operations, Mechanical 100,000 Operations.)

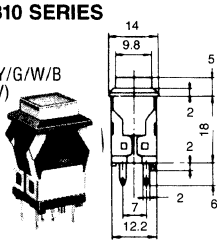
DS-700 (ALTERNATE)
DS-710 (MOMENTARY)



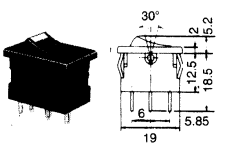
LED
FILAMENT LAMP

MS-800, 810 SERIES

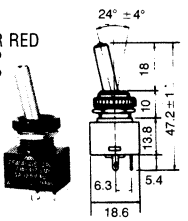
LED; R/Y/G
F. LAMP; R/Y/G/W/B
(6V, 12V, 28V)



SNAP-IN ROCKER
W/LED DS-850
FRAME: BLK, WHT or GRAY

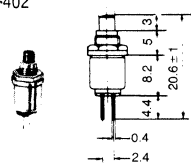


LED
GREEN OR RED
DS-415 2P
DS-417 3P

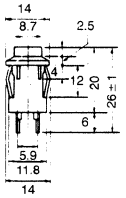


PUSH BUTTON, ROCKER, TOGGLE AND SLIDE SWITCHES

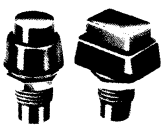
TINY PUSH-ON
MS-402

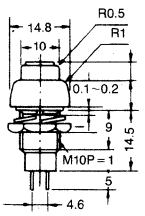


INTERCOM-PUSH
DS-430 PUSH-(ON)
DS-431 PUSH-(OFF)



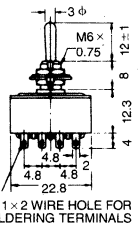
P-SERIES
DURABLE-PUSH
DS-450 TO 475





MS-500M(9P)
MS-500N
(C09P)-B
3PDT

MS-500P(12P)
MS-500R
(C012P-B)
4PDT

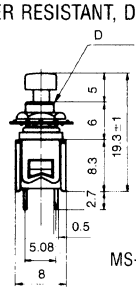


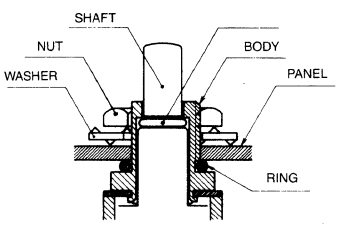
1×2 WIRE HOLE FOR SOLDERING TERMINALS

PUSH-BUTTON SWITCHES

MINIATURE WATER RESISTANT, DUST PROOF

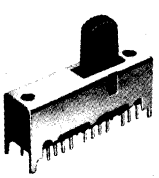
MS-650L





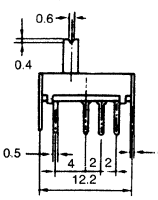
MS-651 GOLD PLATED LOW CURRENT CONTACTS

SLIDE SWITCHES

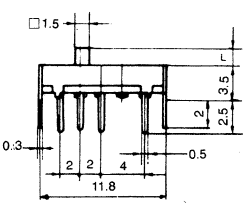


4P3T, 6P3T
8P3T, 10P3T

SPDT,
DPDT, SP3T
DP3T, 4PDT



SPDT, SP3T



Part No.	DS-700 (alt) DS-710 (mom)	MS-200	MS-800 (alt/mom) MS-810 (alt/mom)	DS-850	DS-415 DS-417	MS500W2P	MS-402	DS-430 DS-431	P-Series DS-450	MS-500M MS-500P	MS-650 MS-651	Slide Switches
Model Type	Illuminated Push Button Switches LED (Red, Green, Yellow) Filmt Lamp (6V, 12V, 28V) R/G/Y/W/B Available also W/O Lamp or LED			Rocker LED Color: Red, Yellow, Green	Toggle LED/red, green	—	Push-button	Push-button	Push-button	—	—	Available in vary size, pole position
Rating	1A 250V AC 3A 125V AC	0.4VA (20mV-28V) 0.1mA-0.1A	0.1A 30V DC	3A 250VAC 5A 125VAC	3A 125VAC	6A 125V AC	0.5A 125V AC	1A 125VAC 0.5A 250V	3A 125VAC 1A 250VAC	6A 125V AC	3A 125V AC 0.4VA (MS-651)	DC30V 0.03A DD12V 30.1A
Circuit	SPDT DPDT	See Chart	A DPST off-on B DPST off-(on) C DPST on-off D DPST on-(off)	2P SPST	2P (SPST) on-off 3P (SPDT) on-on	—	2P (SPST)	2P (SPST) DS-430 Push-(on) DS-431 Push-(off) Color: R/B/W	2P (SPST) DS-450-462 on-off DS-463-475 Push-(on) R/W/B/Slvr	—	—	many type of Slide Switches are available PLS Call
Switching Function	on-on ALTN on-(on) MOM	See Chart	E SPDT on-on F SPDT on-(on)	on-off		on-on on-(on) on-off-(on)	Push-(on) Momentary			off-on on-on on-off-on	off-(on) on-(on)	
Contact Resistance	2.5VDC 1A 10mΩ max.	1mA, 0.1μW 50mΩ max.	2.5VDC 10mA 50mΩ max.	2.5VDC 1A 20mΩ max.	2.5VDC 1A 20mΩ max.	20mΩ max.	2.5VDC 1A 20mΩ max.	2.5VDC 1A 10mΩ max.	2.5VDC 1A 20mΩ max.	20mΩ max.	50mΩ max.	DC5V, 1A 20mΩ max.
Insulation Resistance	DC.500V 100MΩ min.	DC500V 1000MΩ min.	DC.500V 500MΩ min.	DC.5000V 100MΩ min.	DC.500V 100MΩ min.	DC500V 100MΩ min.	DC.500V 100MΩ min.	DC.500V 100MΩ min.	DC.500V 100MΩ min.	DC500V 100MΩ min.	DC500V 100MΩ min.	DC.500V 100MΩ min.
Voltage Breakdown	AC 1500V 1 minute	AC 500V 50/60Hz 1 min.	AC 500V 1 minute	AC.1000V 1 minute	AC.1000V 1 minute	AC 1000V min.	AC1000V 1 minute	AC1500V 1 minute	AC1500V 1 minute	AC 1000V min.	AC 1000V min.	AC500V 1 minute
Mounting Hole Dia. mm	12		12.6 square	13 × 19	12	—	5.2 dia.	12.4×11.2	All Model 10.2 dia.	6.2	5	vary size

DSA offers a complete line of switches including Slide, Multi-Push, Subminiature, Lever, Rocker, Toggle and Illuminated Types. For Complete Information on our Wide Range of Products Please Contact:
For more information please call: 212-691-9050

SEE DSA PAGE IN EEM-SECTION 2100.

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DSA INC. **Dai-Ichi Shoji of America, Inc.**
150 Fifth Avenue, Suite 845, New York, NY 10011 **FAX 212-807-1598**

Hermetic Switches & Sensors

Tilt
Motion Sensing
Position Sensing
Specials/Assemblies

DURAKOOL INC.
An American Electronic Components Company

From Standards to Specials, Durakool Engineers a Dependable Switch to Fit Your Application.

When your application calls for a switch with long contact life and quiet, dependable performance, ask for Durakool. The industry leader in mercury technology and hermetic sealing for over 50 years, Durakool has established a reputation of quality and engineering expertise which gives added value to *your* product.

When you choose a Durakool switch, you can be confident that it has been manufactured using the most modern, cost-effective methods and equipment. Durakool also utilizes modern quality assurance procedures including Statistical Process Control (SPC).

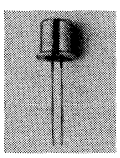
So, whether you need motion sensing, position sensing, or general power switching capabilities, Durakool sales engineers will work with you to provide the switch that best suits your application.

The products listed below are representative of hundreds of available designs.

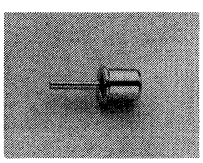
A 1/2 Series

Applications:
Small appliances (Electronic irons)
Auto vanity mirror light
Auto door handle control switch
Man-down alarms
Geophone Position Sensor

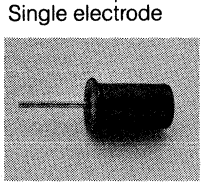
A 1/2 Short-4770
Tip-over/position
Dual electrode



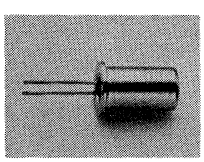
A 1/2 Short-4929
Tilt/motion/position
Single electrode



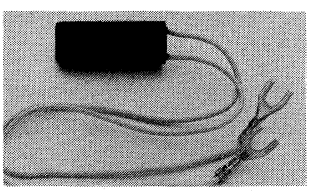
A 1/2 N-3677
Tilt/motion/position
Single electrode



A 1/2-4859
Tilt/motion/position
Dual electrode



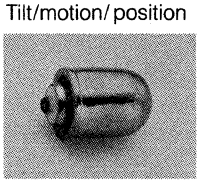
A 1/2-001
Tilt/motion/position
(Cased)



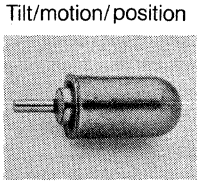
A1 Series

Applications:
Auto trunk light
Freezer lid light
Gas and water meter tamper sensor
RV automatic leveling device
Auto cruise control deceleration sensor
Outboard motor ignition safety shut-off

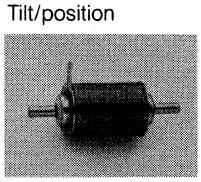
A1 Short-009
Tilt/motion/position



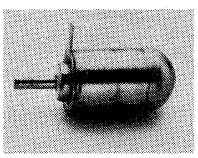
A1N-2622
Tilt/motion/position



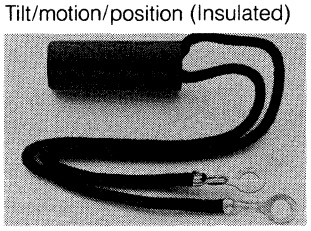
A1-SPDT-3619
Tilt/position



A1-3018
Anti-vibration/ tilt



A1-001
Tilt/motion/position (Insulated)



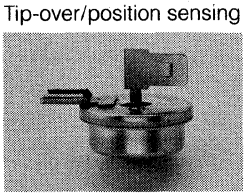
G-Series

Applications:
Tilt switches for general power switching
7 amps to 65 amps

TO3 Series

Applications:
Space heater safety shut-off
Auto seat belt activation sensor
Spotlight on/off power control
Dangerous incline indicator for lawn equipment/RV
Gasoline pump impact safety shut-off

TO3-1016
Tip-over/position sensing

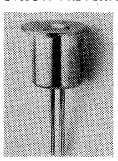


TO3-Specials
Tip-over/motion sensing

TO7 Series

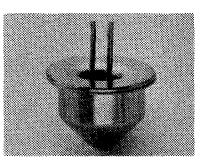
Applications:
Fence perimeter alarm sensor
Parking meter tamper sensor

TO7-4765
Jitter/vibration · Single electrode



TO8 Series

Applications:
Telephone privacy/mute switch
Auto seat belt activation sensor
Gas meter tamper sensor
Vending machine tamper sensor
VCR theft alarm

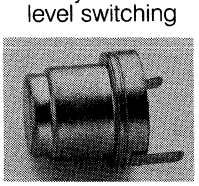


TO8-4539
Tip-over
Omni-directional

TO8-Specials · Motion sensors

Wide Angle Series

Wide hysteresis for liquid level switching



4236 Wide angle tilt

Specialty Switches and Custom Molded Assemblies

Applications:
Liquid level control for sump pumps
Military gyro systems
Liquid level control for gasoline and misc. fluids

For information on the full line of Durakool hermetic switches and sensors, or for engineering or selection assistance, contact Durakool today.

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Elkhart, Indiana 46515
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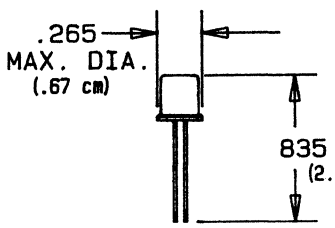
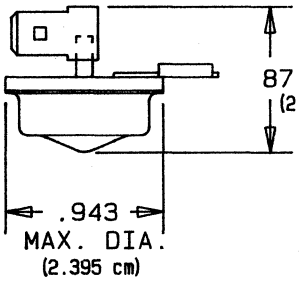
American Electronic Components

Below is a sample listing of technical specifications of some of Durakool's standard switches. The drawings are actual size.

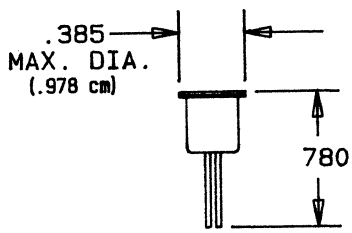
Tip-Over Switches/Motion Sensors



A1/2S-4770
Normally closed
Contact rating:
0.5 Amp @ 12VDC max.
Contact resistance:
20 Ohms @ 1mA max.

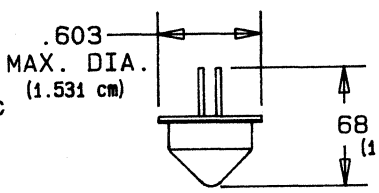


TO3-1016
Normally closed
Electrical ratings:
12.5 Amps @ 120VAC
6 Amps @ 240VAC



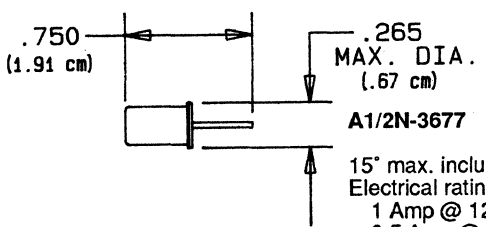
TO7-4765
Normally closed
opens at >40°
Contact rating:
0.1 Amp @ 24VDC
Contact resistance:
1 Ohm @ 1mA/
4VDC max.

TO8-4539

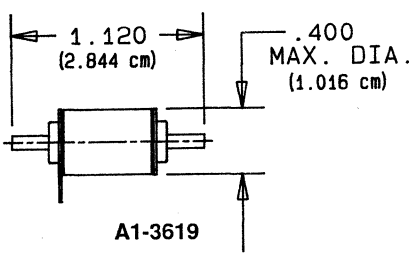


Normally closed
Electrical rating:
1.7 Amps @ 120VAC
Vertical & horizontal
break angles

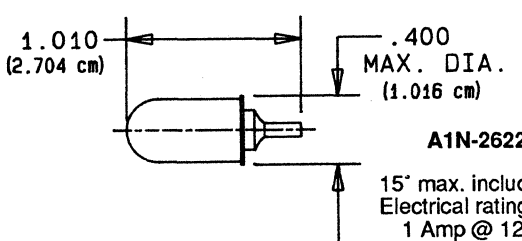
Tilt Switches/Position Sensors



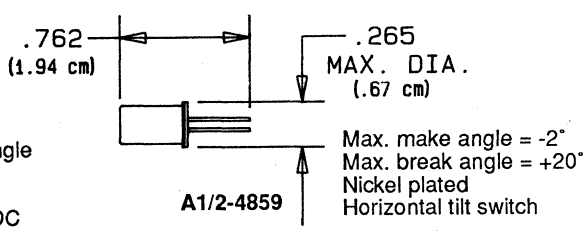
A1/2N-3677
15° max. included angle
Electrical ratings:
1 Amp @ 120VAC
0.5 Amp @ 120VDC



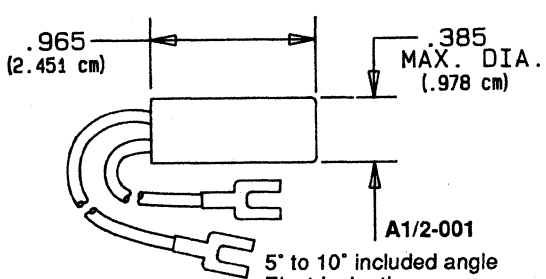
A1-3619
Double-ended, makes
before break, each end
Electrical rating:
1 Amp @ 120VAC
0.5 Amp @ 120VDC



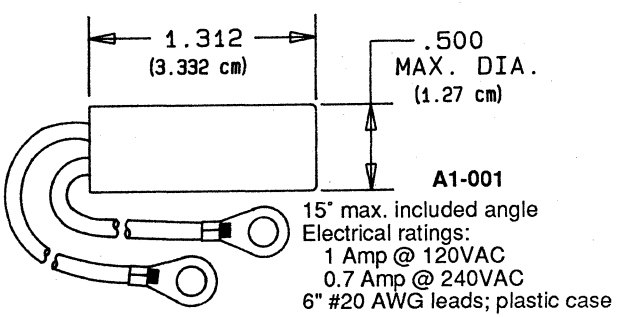
A1N-2622
15° max. included angle
Electrical ratings:
1 Amp @ 120VAC
0.5 Amp @ 120VDC



A1/2-4859
Max. make angle = -2°
Max. break angle = +20°
Nickel plated
Horizontal tilt switch



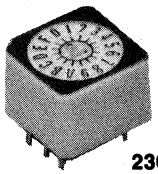
A1/2-001
5° to 10° included angle
Electrical ratings:
1 Amp @ 120VAC
0.4 Amp @ 240VAC
6" #26 AWG leads; plastic insulated case

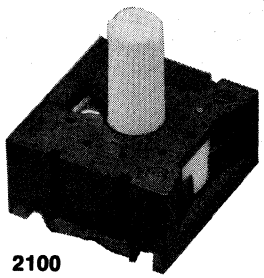


A1-001
15° max. included angle
Electrical ratings:
1 Amp @ 120VAC
0.7 Amp @ 240VAC
6" #20 AWG leads; plastic case

DURAKOOL INC.
(219) 264-1116

EECO® PCB SWITCHES


2300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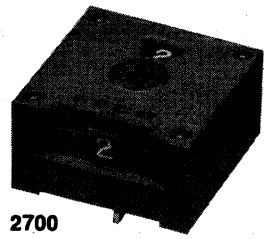
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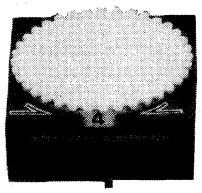
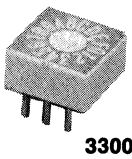
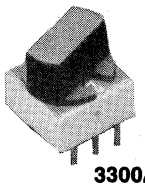
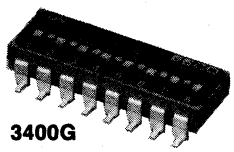
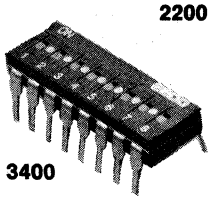

2200


3300/3500


3300/3500


3400G


3400

2300 Series MICRO-DIP®

Advanced in concept, the 2300 Series rotary coded switch is a space-saving yet economical device for equipment programming. Ideal for address encoding or presetting of PROM's and data entry devices.

Number of Positions ..... 10 and 16
Life ..... 10,000 Detents
Electrical Rating
Non-Switching Load ..... 1.0 Amp
Switching Load ..... 0.100 Amp
Contact Resistance ..... 0.100 Ohm
Dielectric Withstanding V . 250 V rms
Dimensions
Height ... 0.239- 0.394 (6.07 -10.01)
Width ... 0.376 - 0.450 (9.55 - 11.43)
Length . 0.396 - 0.450 (10.06 - 11.42)
Actuation Method
Screwdriver ..... Standard
Shaft ..... Available
Binary Coded Output ..... Standard
Special Purpose Codes .... Available

3300 Series MICRO-DIP®

A low-profile, fully-sealed version of the original 2300 Series MICRO-DIP switch, this switch has all of its features, plus full sealing to withstand automated soldering and cleaning processes.

Number of Positions ..... 10 and 16
Life ..... 10,000 Detents
Electrical Rating
Non-Switching Load ..... 1.0 Amp
Switching Load ..... 0.100 Amp
Contact Resistance ..... 0.100 Ohm
Dielectric Withstanding V . 250 V rms
Full Environmental Seal ... Standard
Dimensions
Height ..... .200 (5.08)
Width 0.380 (9.65)
Length 0.380 (9.65)
Actuation Method
Screwdriver ..... Standard
Shaft ..... Available
Knob ..... Optional
Binary Coded Output ..... Standard

2400 Series MINI-DIP®

The exclusive gold-on-gold cleaning/wiping action contacts assure low contact resistance while allowing end stackability and maintaining .100-in. pin centers. The fully sealed model allows actuation and position identification through a clear, flexible membrane.

Number of Positions ..... 2 to 10
Life ..... 2,000 Detents
Electrical Rating
Non-Switching Load ..... 1.0 Amp
Switching Load ..... 0.125 Amp
Contact Resistance ..... 0.050 Ohm
Dielectric Withstanding V . 500 V rms
Full Environmental Seal .... Optional
Dimensions
Height 0.375 (9.52)
Width 0.385 (9.78)
Length ... 0.200 - 1.000 (5.08 - 25.4)
Actuation Method ..... Rocker
Standard Options
Special Marking ..... Yes
Seal ..... Yes

3400 Series MINI-DIP®

The 3400 Series process sealed DIP switches are available in both machine insertable and surface mount configurations. The series is based on a TO-116 package style (standard dual in-line package.) The 3400 Series features bifurcated contacts plated with 30 microinches of gold. The surface mount version features liquid crystal polymer actuators, allowing the switch to resist temperatures of 240°C.

Number of Positions ..... 2 to 8
Life ..... 2000 Detents
Electrical Rating
Non-Switching Load ... .1 Amp at 50 VDC
Switching Load ..... .1 Amp at 20 VDC
Contact Resistance 20 Milliohms Max.
Dielectric Withstanding V .. 500 VDC
Dimensions
Height ..... .160 (4.06)
Width ..... .300 (7.62)
Length .... .215 to .840 (5.46 to 20.7)
Actuation Method ..... Slide

3500 Series MICRO-DIP®

The new fully sealed 3500 Series is the extended life, high-temperature version of our 3300 MICRO-DIP. It offers the same space-saving features of our original MICRO-DIP in the world's lowest profile binary-coded switch package. Ideal for harsh environments or where attachment processes vary, the subminiature size allows high density packaging.

Number of Positions ..... 10 and 16
Life ..... 20,000 Detents
Electrical Rating
Non-Switching Load .. 1.0 Amps at 50 VDC
Switching Load ..... .1 at 28 VDC
Contact Resistance .. 100 Milliohms Max.
Dielectric Withstanding V... 250 VAC
Full Environmental Seal ... Standard
Dimensions
Height ..... .200 (5.08)
Width ..... .380 (9.65)
Length ..... .380 (9.65)
Actuation Method
Screwdriver ..... Standard
Shaft ..... Optional
Knob ..... Optional
Binary Coded Output ..... Standard

2100 Series STRIPSWITCH®

A printed circuit board thumbwheel switch offering the most economical method of handsetting coded values. Requires a minimum of space, no mounting hardware, and can be "ganged" up to four stations in a strip. Two legend locations provide readability.

Number of Positions ..... 10 and 16
Life ..... 250,000 Detents
Electrical Rating
Non-Switching Load ..... 3.0 Amps
Switching Load ..... 0.125 Amp
Contact Resistance ..... 0.100 Ohm
Dielectric Withstanding V . 500 V rms
Dimensions
Height 0.430 (10.92)
Width 0.775 (19.68)
Length 0.800 (20.32)
Actuation Method
Thumbwheel ..... Standard
Screwdriver ..... Standard
Shaft ..... Optional
Binary Coded Output ..... Standard

2200 Series STRIPSWITCH®

This switch offers all of the features of the proven 2100 Series STRIPSWITCH in a low-profile, fully-sealed unit. The easy-to-read thumbwheel has a built-in screwdriver slot.

Number of Positions ..... 10 and 16
Life ..... 100,000 Detents
Electrical Rating
Non-Switching Load ..... 3.0 Amps
Switching Load ..... 0.125 Amp
Contact Resistance ..... 0.100 Ohm
Dielectric Withstanding V . 500 V rms
Full Environmental Seal ... Standard
Dimensions
Height 0.360 (9.14)
Width 0.790 (20.07)
Length 0.790 (20.07)
Actuation Method
Thumbwheel ..... Standard
Screwdriver ..... Standard
Binary Coded Output ..... Standard
Seal ..... Yes

2700 Series STRIPSWITCH®

The 2700 unit withstands enormous temperature variations and maintains an impervious seal to contamination. Thumbwheel adjust and large characters allow easy manipulation and position identification.

Number of Positions ..... 10 and 16
Life ..... 100,000 Detents
Electrical Rating
Non-Switching Load ..... 3.0 Amps
Switching Load ..... 0.125 Amp
Contact Resistance ..... 0.100 Ohm
Dielectric Withstanding V . 500 V rms
Full Environmental Seal ... Standard
Dimensions
Height 0.430 (10.92)
Width 0.790 (20.7)
Length 0.790 (20.7)
Actuation Method
Thumbwheel ..... Standard
Screwdriver ..... Standard
Shaft ..... Optional
Binary Coded Output ..... Standard
Seal ..... Yes

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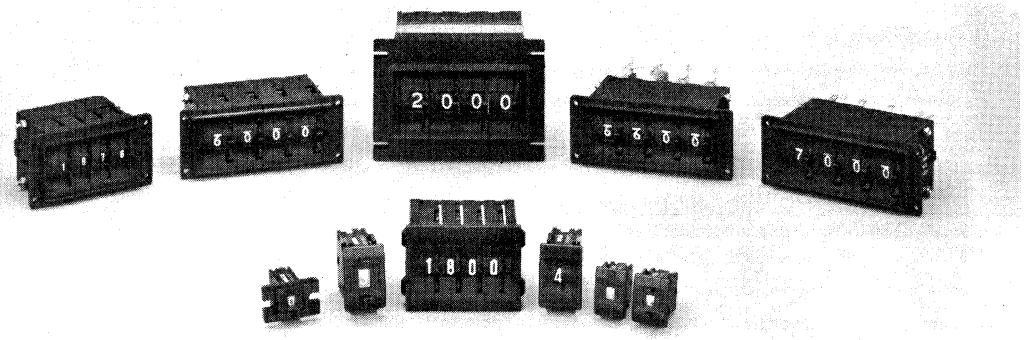
Telephone (714) 835-6000 • Telex 67-8420 • Facsimile (714) 953-3747

EECO® THUMBWHEEL SWITCHES



1100 Series Thumbwheel or Pushwheel Switch

With a narrow .236 width design and front mount configuration, the 1100 Series switch offers space saving dimensions in an attractive black matte finish.

Number of Positions	10
Life	300,000 Detents
Electrical Rating	
Non-Switching Load	0.500 Amp
Switching Load	0.100 Amp
Contact Resistance	0.200 Ohm
Dielectric Withstanding V	500 V rms
Seal	Dust
Panel Mount	Front
Dimensions, Module	
Height	0.708 (17.98)
Width	0.236 (5.99)
Depth, Behind Panel	0.905 (22.99)
Actuation Method	
Thumbwheel/Push/Pen/Lock-Set	Std.

1400 Series Thumbwheel or Pushwheel Switch

Thumbwheel, Push-Set or Lock-Set, the 1400 Series switch with its high reliability, easy snap-together assembly and variety of binary or decimal codes gives design flexibility to the user.

Number of Positions	10 and 16
Life	1,000,000 Detents
Electrical Rating	
Non-Switching Load	1.000 Amp
Switching Load	0.100 Amp
Contact Resistance	0.200 Ohm
Dielectric Withstanding V	500 VDC
Seal	Dust
Panel Mount	Front
Dimensions, Module	
Height	0.945 (24.00)
Width	0.315 (8.00)
Depth, Behind Panel	1.338 (33.99)
Actuation Method	
Thumbwheel/Push/Lock-Set	Std.

1776/1976 Series Thumbwheel Switch

Revolutionary in design, the 1776 Series .500 wide thumbwheel switch and the slimmer (.350) 1976 Series switch offer optional notched terminals for mounting directly to motherboards.

Number of Positions	8, 10, 12, and 16
Life	1,000,000 Detents
Electrical Rating	
Non-Switching Load	3.000 Amps
Switching Load	0.125 Amp
Contact Resistance	0.100 Ohm
Dielectric Withstanding V	1000 V rms
Seal	Dust
Panel Mount	Rear
Dimensions, Module	
Height	1.200 (30.48)
Width	0.500 (12.70), 0.350 (8.89)
Depth, Behind Panel	1.508 (38.30)
Actuation Method	Thumbwheel

Dimensions in inches (mm)

2000 Series Thumbwheel Switch

EECO's largest thumbwheel switch, the 2000 Series offers over 50 codes in 8-, 10-, and 16-positions. Available with a sealed option, plus extra large legend.

Number of Positions	8, 10, 12, and 16
Life	1,000,000 Detents
Electrical Rating	
Non-Switching Load	3.00 Amps
Switching Load	0.125 Amp
Contact Resistance	0.100 Ohm
Dielectric Withstanding V	1,000 V rms
Seal	Optional
Panel Mount	Rear
Dimensions, Module	
Height	2.100 (53.34)
Width	0.500 (12.70)
Depth, Behind Panel	2.030 (51.56)
Actuation Method	Thumbwheel

7000 Series Military Thumbwheel Switch

Qualified to the rigid standards of MIL-S-22710/15, this Military-grade switch offers a completely sealed contact area, impervious to dust, high humidity and salt spray. Can be used safely in explosive environments.

Number of Positions	8, 10, 12, and 16
Life	1,000,000 Detents
Electrical Rating	
Non-Switching Load	3.000 Amps
Switching Load	0.125 Amp
Contact Resistance	0.100 Ohm
Dielectric Withstanding V	1,000 V rms
Seal	Environmental
Panel Mount	Rear
Dimensions, Module	
Height	1.150 (29.21)
Width	0.500 (12.70)
Depth, Behind Panel	1.570 (39.88
Actuation Method	Thumbwheel

THUMBPOT® Digital Voltage Divider

This unit is available in .500 or .350 wide models and electrically divides the input voltage into precise, incremental voltage output values. The major feature of the unit is exacting repeatability.

Number of Positions	10
Life	1,000,000 Detents
Electrical Rating	
Std. Res. Range	1,000-100K Ohms
Std. Res. Tolerance	±1%
Dielectric Withstanding V	500 V rms
Ins. Res. (@ 500 VDC)	1,000 Megohms
Seal	Dust
Panel Mount	Rear
Dimensions, Module	
Height	1.200 (30.48)
Width	0.500 (12.70), 0.350 (8.89)
Depth, Behind Panel	1.250 (31.75)
Actuation Method	Thumbwheel

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electro-mech
LIGHTED PUSH-BUTTON SWITCHES

DISPLAY ASSEMBLIES/ INTERLOCK SWITCH ASSEMBLIES/ INDICATORS

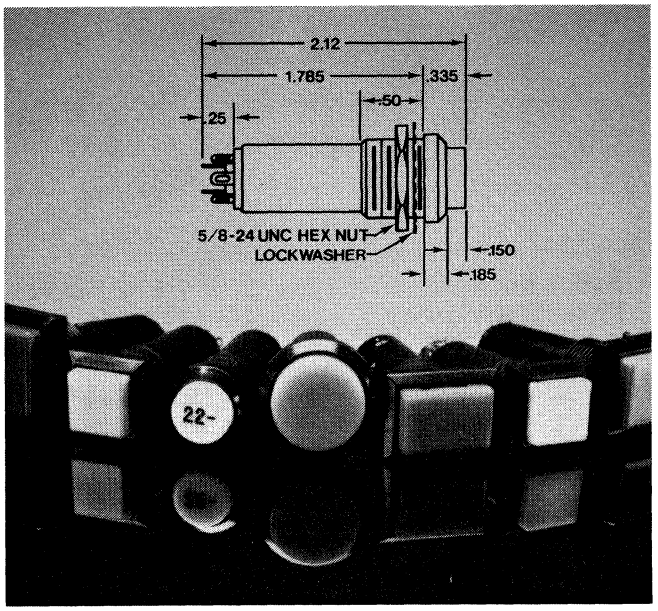
ELECTRO-MECH provides a perfect blend of quality standard products with in-depth experience in answering unique requirements. Proven engineering designs are illustrated by the excellent performance characteristics of each ELECTRO-MECH lighted push-button switch, indicator, and display assembly. Low-bounce, long-life contacts, new innovations in legends, displays, field-service, packaging—all standard features. Whatever your applications, ELECTRO-MECH is prepared to answer your specific needs. Choose from any of the most popular models.

Technical specifications apply to all ELECTRO-MECH Switch models unless otherwise specified:

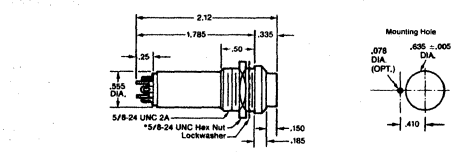
- **Ratings: 30 Volts DC or 115 Volts AC; 2 amps resistive, 1 amp inductive**
- **Weight: 0.8 oz. (approx.)**
- **Operating Pressure: 2 lbs. + 1 lb.**
- **Plunger Travel: 3/16" (approx.)**
- **Actuations: 100,000**
- **Accommodates all "switchlines" standard lenses. Uses one T1-3/4, AN3140-327, 328, 330 bulb or neon lamp, 3 actuation modes standard**
- **Lenses: Available in ½" to 1" round and square, plus various rectangular sizes.**

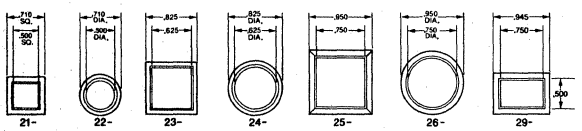
SERIES 20

A NEW CONCEPT OF FAST EASY SWITCH INSTALLATION AND DISPLAY DESIGN VERSATILITY



MOUNTING SPECIFICATIONS





SWITCH FUNCTIONS	SPST N.O.	SPST N.C.	DPST N.O.	DPST N.C.	DPST 1 N.O., 1 N.C.	SPDT	DPDT
MOMENTARY	2*-128	2*-129	2*-130	2*-131	2*-132	2*-149	2*-150
PUSH-ON PUSH-OFF	2*-228	2*-229	2*-230	2*-231	2*-232	2*-249	2*-250
PUSH-ON REMAIN-IN PUSH-OFF	2*-828	2*-829	2*-830	2*-831	2*-832	2*-849	2*-850
N.O. POS	2-5		1-2, 4-5		1-2	1-2	1-2, 4-5
N.C. POS		2-5		2-3, 5-6	5-6	2-3	2-3, 5-6
COMMON POS			2, 5	2, 5		2	2, 5

*—Indicate style of switch (21- through 26, and 29)

FEATURES:

- **Momentary or alternate action**
- **Mounts in a ⅝" dia. round hole**
- **High density mounting ability—less than ¾" centers**
- **Low profile appearance in one unitized housing**

ELECTRO-MECH's Series 20 Switches are provided in display configurations.

These low profile units are available in any switching mode with independent circuitry from SPST to DPDT including a separate indicator circuit. The all plastic, unitized housing assures ease in handling (no adapters, clamps or brackets). Just drop in round hole and secure with a nut from behind panel.

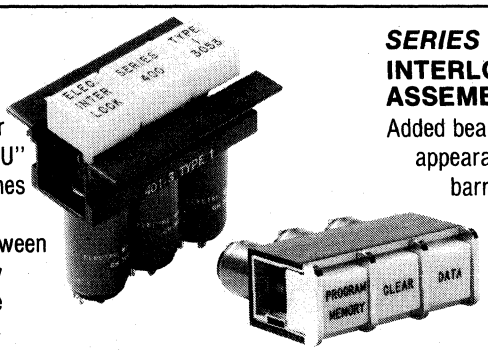
Series 20 Switches have the same internal parts as the all metal 6100 Series Switches including positive action, reliable circuitry and proven low bounce characteristics made possible by our unique design concept of silver slide bar action.

Available options include gold plating for dry circuit applications. Round slotted nuts for mounting switches on close centers.

SERIES 400

MULTI-STATION SUB-PANEL ASSEMBLIES

Multi-station switch assemblies designed for sub-panel mounting by means of a flanged "U" channel. All standard ELECTRO-MECH switches can be incorporated with several types of mechanical interlocking/lockout actions between stations. Up to 12 stations in one or two row configurations. The standard center distance between switches is ⅝", ¾", ⅞" and 1".



SERIES 500

INTERLOCKING SWITCH ASSEMBLIES

Added beauty and long-lasting appearance with handsome chrome barriers between each switch or indicator. Independent or interlocking action. Ten types of tracking action and switching sequences. Up to 12 switches in single or dual row, ⅞" or 1" centers.

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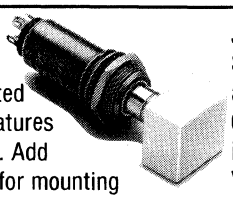
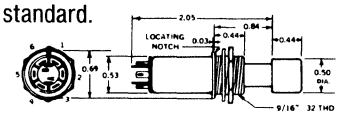
electro-mech
LIGHTED PUSH-BUTTON SWITCHES

COMMUNICATIONS/INDUSTRIAL CONTROLS/DISPLAYS
COMPUTER PERIPHERALS/INSTRUMENTATION

SERIES 2100

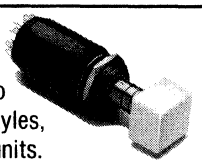


This version of our standard illuminated Pushbutton Switch features silver slide bar action. Add BR after part number for mounting on ⅝" centers. Utilizes AN3140-T 1¾"or Neon bulb. All other specifications same as standard.

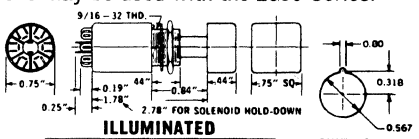


	1 PST		2 PST		1 N.O.		
	N.O.	N.C.	2 N.O.	2 N.C.	1 N.C.	1 PDT	2 PDT
Momentary Push-on/ Push-off	2128	2129	2130	2131	2132	2149	2150
	2228	2229	2230	2231	2232	2249	2250

SERIES 2600



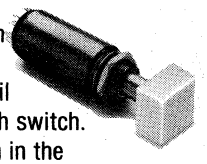
Standard models are available from 2PST to 6PDT in 116 different styles, including non-lighted units. Virtually any standard ELECTRO-MECH lens may be used with the 2600 Series.



ILLUMINATED

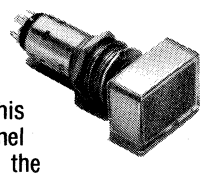
	Mom.	Push On Push Off	Push On Remain In Push Off	Snap Feel Mom.
2 PDT	2650	2750	2850	2550
3 PDT	2651	2751	2851	2551
4 PDT	2652	2752	2852	2552
5 PDT	2653	2753	2853	2553
6 PDT	2654	2754	2854	2554

SERIES 3000

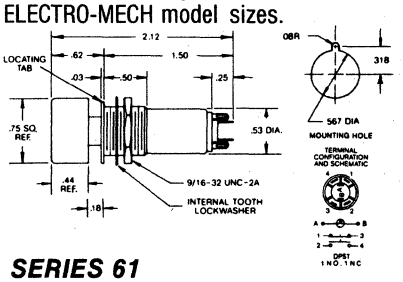


Illuminated Pushbutton switches with an integral hold-down coil which is activated with switch. Holds the push-button in the depressed position until coil is de-energized returning it to relaxed position. Available in all circuit configurations up to 6 PDT. Same specifications as standard model.

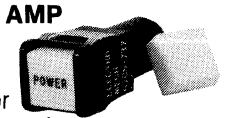
SERIES 6100



High-density packaging requirements are answered with this shorter, front panel mount, providing the same quality design as standard ELECTRO-MECH model sizes.

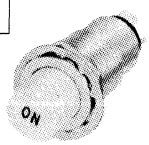


SERIES 4000 10 AMP



Low profile matches standard industry models. Momentary or Alternate Action design takes any standard lens size. 30 VDC or 115 VAC, 10 A Resistive, 5 A Inductive.

SERIES 5000



An exceptionally short momentary switch available in circuit configurations up to 2 PDT.

	1 PST		2 PST				
	N.O.	N.C.	2 N.O.	2 N.C.	1 N.O. 1 N.C.	1 PDT	2 PDT
MOMENTARY	5128	5129	5130	5131	5132	5149	5150

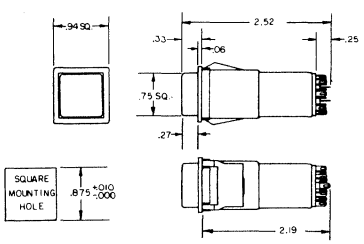
Designer Group Switches

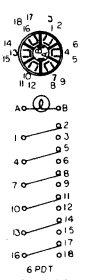
¾" sq., ¾" x 1½", ¾" x ⅞", ½" sq.

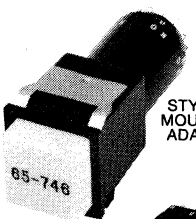
These ELECTRO-MECH Standards feature typical switch functions and mounting options for design flexibility. A choice of dual/quad display units are also available.

All Designer Group units feature:

- **1PST TO 6PDT**
- **Momentary; Alternate action; push-on remain-in; push-on, push-off and momentary snap-feel.**





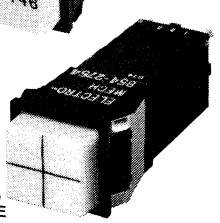


STYLE 65 MOUNTING ADAPTER

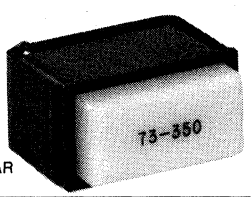
MODEL 65
NO BARRIER

MODEL 68
SINGLE BARRIER (L OR R)

MODEL 67
DOUBLE BARRIER

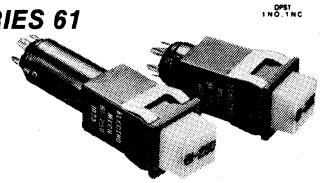


MODEL 600/800 DUAL/QUAD LITE SWITCH



MODEL 73
¾" x 1½"
RECTANGULAR

SERIES 61



ELECTRO-MECH's Series 61 switches are provided in ½-inch square, snap-in or hardmount configurations. Each low-profile unit is available in any function from SPST to 2PDT, each controlled with an independent circuit. The all plastic, unitized housing, helps insulate switch from other surrounding components. The 61 Series is also available in a standard PC Board mounting configuration.

SERIES 60
MOMENTARY SWITCH

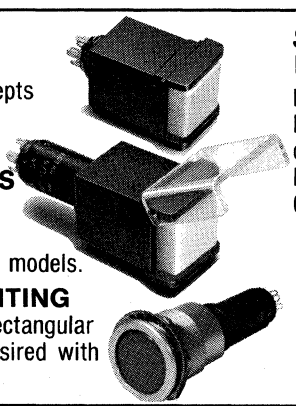
Rear mounted "U" bracket accepts switch installation from front of panel.

LG SERIES SAFETY LENS

Available on all 67-single-station, double-barrier lighted push-button bezel switch models.

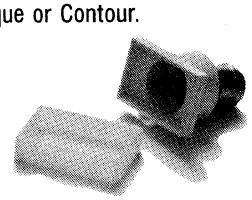
EL SERIES FLUSH MOUNTING

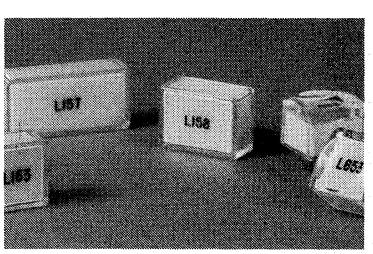
Available in round, square or rectangular styles. Specify switch model desired with "EL" suffix (i.e. 73 EL-2654).



SERIES 150
INTERCHANGABLE LENSES/FILTERS

Displays may be changed or buttons replaced. Non-wearing, clear-acrylic lens and filter buttons. Available in standard, Opaque or Contour.





ELECTRO-MECH COMPONENTS, INC. • 1826 N FLORADALE AVE. • SO. EL MONTE, CA 91733 • (818) 442-7180 • FAX: (818) 350-8070 • TWX: 510-601-8764

all types of switches, control devices...

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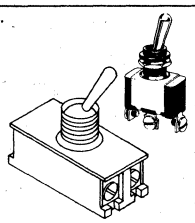
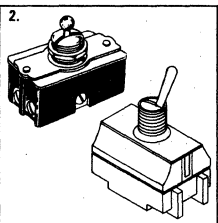
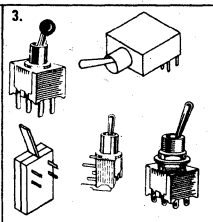
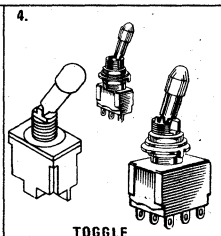
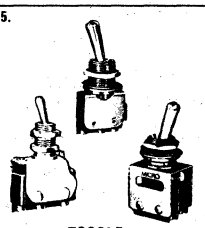
AEROSPACE – COMMERCIAL

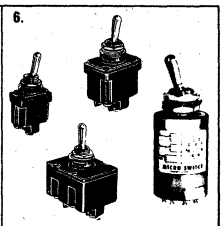
1. 
TOGGLE
General Purpose

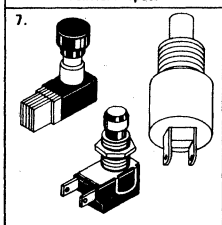
2. 
TOGGLE
High Capacity

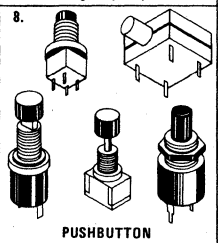
3. 
TOGGLE
Miniature & Ultra Miniature

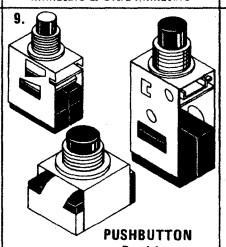
4. 
TOGGLE
Locking Lever

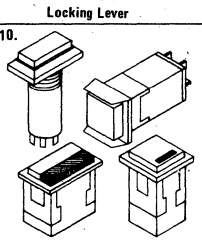
5. 
TOGGLE
Precision

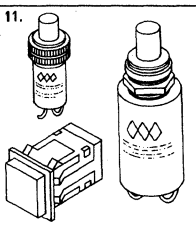
6. 
TOGGLE
Environmentally Sealed

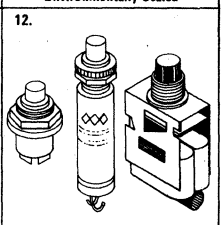
7. 
PUSHBUTTON
General Purpose

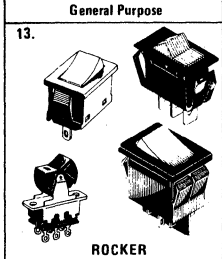
8. 
PUSHBUTTON
Miniature & Ultra Miniature

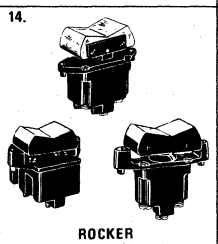
9. 
PUSHBUTTON
Precision

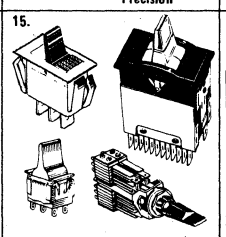
10. 
PUSHBUTTON
Lighted

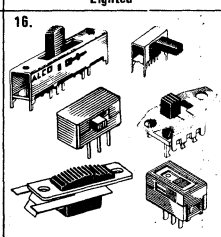
11. 
PUSHBUTTON
Reed & Solid State

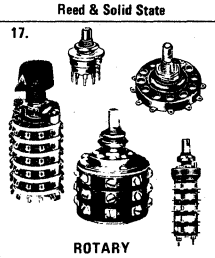
12. 
PUSHBUTTON
Enviromentally Sealed

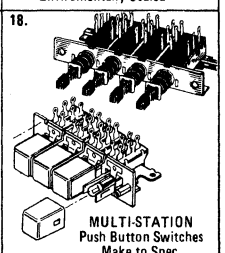
13. 
ROCKER
Lighted & Unlighted

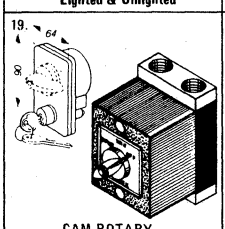
14. 
ROCKER
Heavy Duty / Sealed

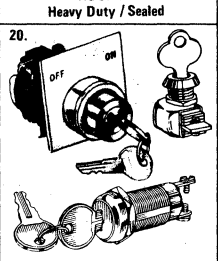
15. 
PADDLE

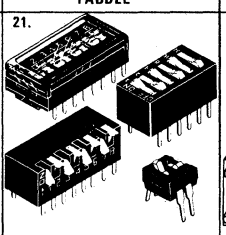
16. 
SLIDE

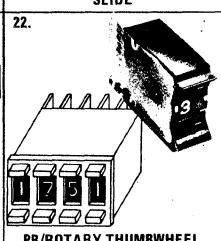
17. 
ROTARY
Electronic Duty

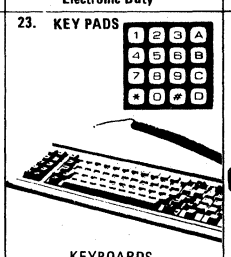
18. 
MULTI-STATION
Push Button Switches
Make to Spec.

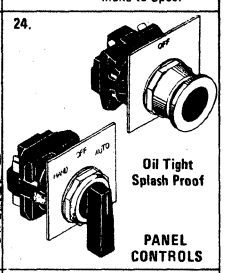
19. 
CAM-ROTARY
High Capacity HP Rated
Make to Spec.

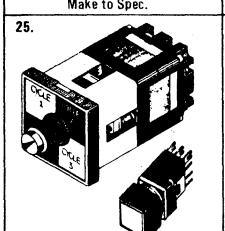
20. 
KEY LOCK

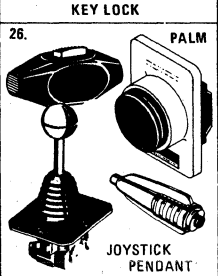
21. 
DIP SWITCH

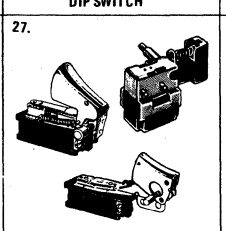
22. 
PB/ROTARY THUMBWHEEL
Programmable Code Switch

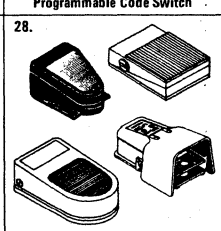
23. KEY PADS 
KEYBOARDS

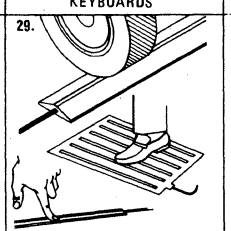
24. 
Oil Tight
Splash Proof
PANEL
CONTROLS

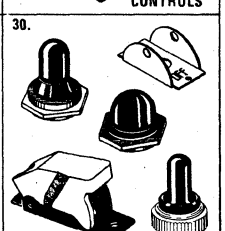
25. 
Lighted - Oil Tight
PANEL CONTROLS

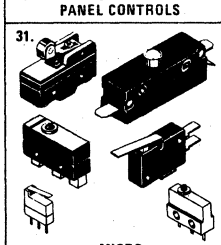
26. PALM 
JOYSTICK
PENDANT

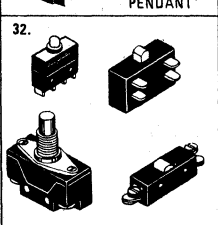
27. 
TOOL HANDLE

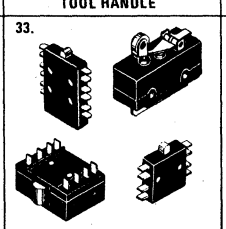
28. 
FOOT SWITCH

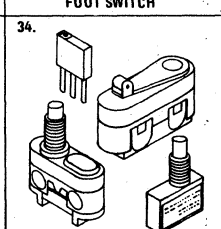
29. 
TAPE/AIR SWITCHES

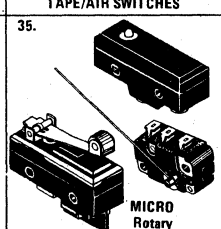
30. 
SWITCH GUARDS & SEALS

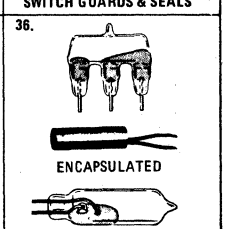
31. 
MICRO
Single Break

32. 
MICRO
Double Break

33. 
MICRO
2 & 3 Poles

34. 
MICRO
Sealed & Hi-Temperature

35. 
MICRO
Rotary
MICRO High DC Capacity
Magnetic Blow-Out Switches

36. 
ENCAPSULATED
MERCURY SWITCHES

ELECTRIC SWITCHES INCORPORATED (213) 660-1310
2478 Fletcher Dr, Los Angeles, California 90039
FAX: 213-660-5130
TWX: 910-321-2971

...motor controls & replacement parts

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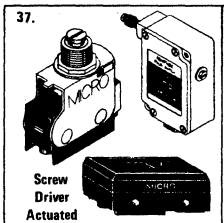
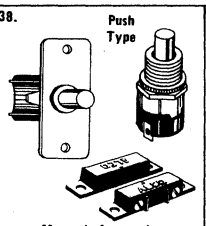
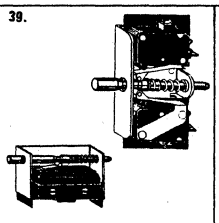
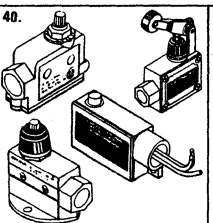
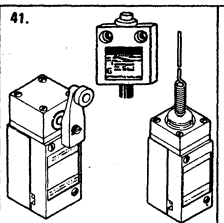
37. 

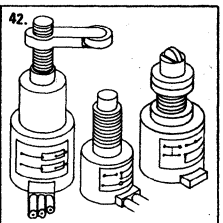
Screw Driver Actuated & PULSE SWITCHES

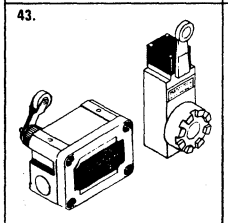
38. Push Type 
Magnetic Actuated DOOR SWITCHES

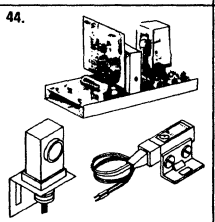
39. 
DOOR INTERLOCK

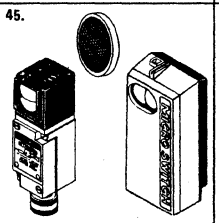
40. 
ENCLOSED SWITCHES

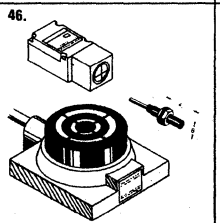
41. 
LIMIT SWITCHES

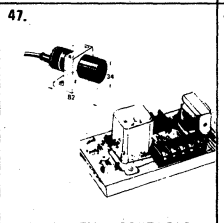
42. 
LIMIT SWITCHES
Sealed & Hi-Temperature

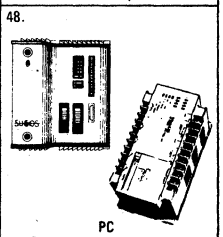
43. 
LIMIT SWITCHES
Explosion Proof

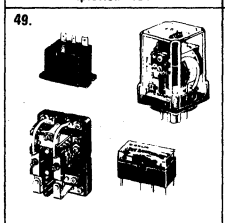
44. 
PHOTO–ELECTRIC CONTROLS
Fiber Optics-LED-Incandescent

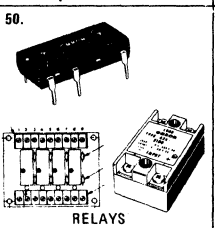
45. 
PHOTO-ELECTRIC CONTROLS
Self- Contained

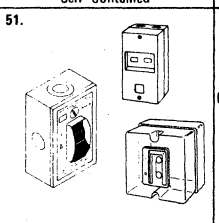
46. 
PROXIMITY CONTROLS

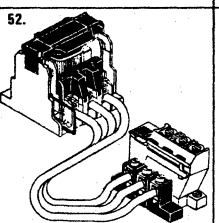
47. 
LIQUID LEVEL CONTROLS
Capacitance & Resistance Type

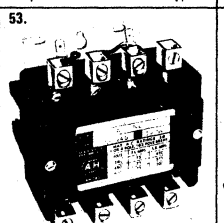
48. 
PC
Programmable Controllers

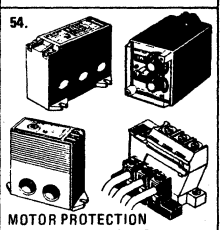
49. 
RELAYS
Electro-Mechanical

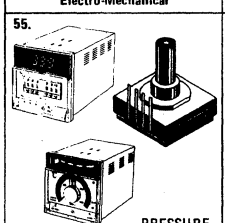
50. 
RELAYS
I/O Modules/Board
Reeds & Solid State

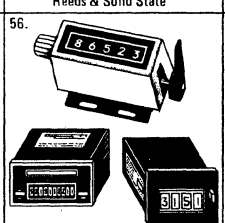
51. 
MANUAL MOTOR STARTERS

52. 
MAGNETIC MOTOR STARTERS

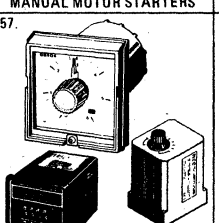
53. 
MAGNETIC CONTACTORS

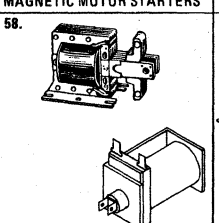
54. 
MOTOR PROTECTION
Thermal - OverCurrent
Open & Reverse Phase

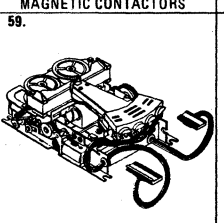
55. 
PRESSURE
TRANSDUCERS
TEMPERATURE CONTROLS

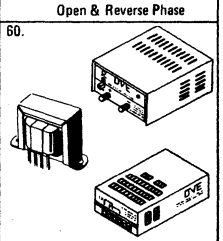
56. 

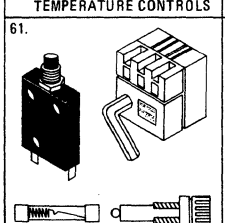
COUNTERS

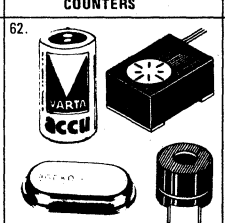
57. 
TIMERS

58. 
SOLENOIDS

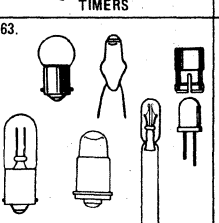
59. 
IMPACT PRINTERS

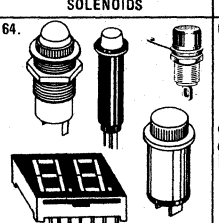
60. 
TRANSFORMERS
POWER CONDITIONERS

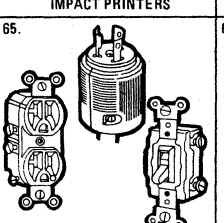
61. 
CIRCUIT PROTECTION
FUSES & FUSEHOLDERS

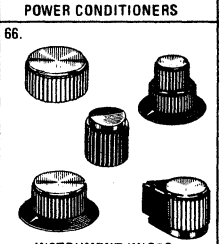
62. 

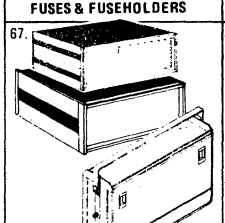
BATTERIES/BUZZERS
Audio Transducers

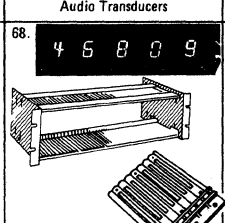
63. 
LEDS & NEON
Incandescents Mini-Lamps

64. 
INDICATOR LIGHTS
LED DISPLAYS

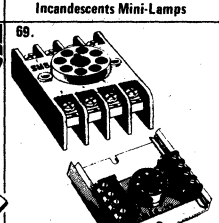
65. 
WIRING DEVICES

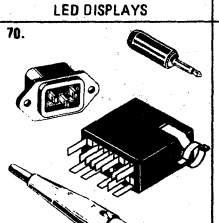
66. 
INSTRUMENT KNOBS
Commercial & Military

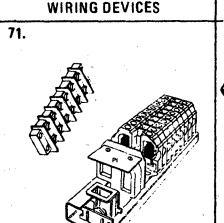
67. 
INSTRUMENT CASES
BAILS & HANDLES

68. 

DIGIBEZELS
PC RACKS & BOARDS

69. 
SOCKET SNAP–TRACKS

70. 
PLUGS JACKS & CONNECTORS

71. 
TERMINAL BLOCKS

72.

CUSTOM LEGENDING

CALL TOLL FREE

NATIONAL:
800–421–8855

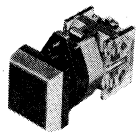
CALIFORNIA:
800–252–4640

THE PICTORIAL DISPLAY REPRESENTS PART OF THE WIDE VARIETY OF SWITCHES, CONTROLS AND ELECTRONICS HARDWARE STOCKED BY ELECTRIC SWITCHES, INC. FOR DETAILED INFORMATION, CALL OR WRITE US. CATALOGS WILL BE SENT UPON REQUEST.

E S I

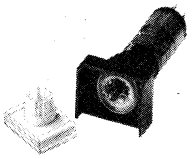
eao ■ THE WORLD'S FINEST SWITCHING PRODUCTS... DESIGNED WITH STYLE!

OIL AND WATERTIGHT SWITCHES — Mounting holes of 7/8", 5/8"

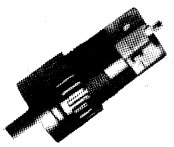


Series 04
Minature Oil and Watertight 7/8" Round hole mounting
Round or Square Face
10 AMP, 600 Volts, up to 8 Poles
Pushbutton, Lever, Keylock, Emergency Stop Actuators

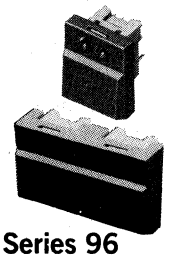
Series 14
Rugged 04 Front, Small back of Panel Depth.
5A 250 VAC, Low Level or Electronic Switching
Keylock, Lever, Round Pushbutton Actuators



Series 51
Highly Styled Round, Square, or Rectangular
Front 9 Lens Colors,
4 Switch Elements,
Sealed to IP 65

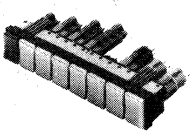


Series 52
Companion to Series 51 in a Lighted Rotary Switch with all the same Switch Elements



Series 96
Sealed to IP 67 standards, compatible terminals.
1 or 2 LED Illumination.
Wave Solderable and Washable. Series 98 also available

INTERLOCKS



Series 30
Mechanical Interlock
All Metal Construction,
1,000,000 Operations
2–20 Pushbutton Stations
5 Interlock Combinations
4 Switch Element Choices

P.C. BOARD MOUNTABLE —KEYBOARD SWITCHES

All Rated 100 mA 50 VAC, 72 VDC
All have Momentary and Maintained Action

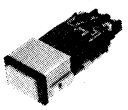
Series 97
Small Round or Square
LED Illuminated
Excellent where small size is essential
1 or 2 N. O. Contacts

Series 99
Lighted Keyboard Switch
1 or 2 Pole N.O. or N.C.
Single, Dual, or Triple Width

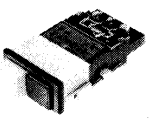
See Oil and Watertight for Series 96

POWER SWITCHES

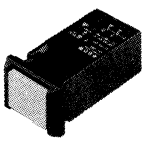
10 AMP, 380 VAC



Series 02
S.P.D.T. or D.P.D.T. Action
Maintained or Momentary
3 Bezel Shapes, 9 Lens Colors
Large Display Screen
Keylock Available



Series 03
Two Lamp Illumination
Two Button Interlock Available
Single or 2 Button Operation
S.P.D.T. or D.P.D.T.
Maintained or Momentary

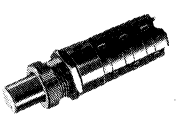


Series 22
Front panel mounting by one person
10Amp 380 Volts AC
Sealed to IP 65 standards
Mushroom cap available

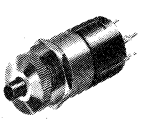
See Series 04 for Additional Power Switching

MINIATURE

Series 19
Mounts in 3/8" Round Hole
Round or Square Bezel
Low Level Switching 100 mA at 50 VAC or 72 VDC
Maintained or Momentary Action

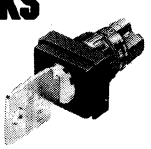


Series 11
Round Lens Mounts in 5/8" Round Hole from rear of Panel
1–3 Pole Switching
4 Elements
Lamps and LED's
Front Replaceable

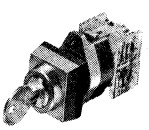


Series 21
Non-Illuminated
Small back of Panel Depth
5A, 250 VAC, Low Level or Electronic Switch Element
Momentary or Maintained Action

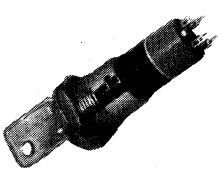
KEYLOCKS



Series 31
Two and Three Position Keylock Switches
4 Switching Elements 5A, 250 VAC, Low Level
2 Hall Effect Electronic Switches
2 Security Levels
Round, Square, Rectangular Bezel
Mounts in a 5/8" Round Hole



Series 04
Power Switching 10 AMP, 600 VAC
2 and 3 Position Switches
Round and Square Face
7/8" Round Hole Mount

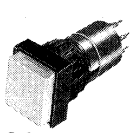


Series 15
Low cost 5 tumbler lock
Choice of many switch elements
Chrome finish,
Low profile bezel

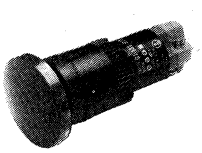
Additional Keylock Series 02, 03, 14, 22, 30, and 51

ALL PURPOSE PANEL SWITCHING PRODUCTS

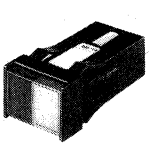
Lamps are Stationary on all EAO Switch Designs.



Series 31
Round, Square, Rectangular Front with 5/8" Round Hole Mounting
9 Lens Colors, Concave or Flat, Transparent, Translucent
4 Switch Elements, 5A, 250 VAC,
Low Level and Electronic
Indicators, Pushbuttons, Buzzers, Flashers, Fuse-Switch, Keylock, Read-out



Series 01
Round, Square, and Rectangular with Larger Bezel Design
9 Lens Colors
Momentary or Maintained, Position Indicating
Front Lens and Lamp Removable



Series 41
Dual Lamp Switch, Wired Independently
Full or Split Screen
Snap-in Mount
4 Switch Elements

Design in EAO & Save — you can feel the difference!

eao ■

EAO SWITCH CORPORATION
198 PEPE'S FARM RD. P.O. BOX 552, MILFORD, CT 06460.
203/877-4577 TELEX: EAOSWITCHMFRD 964347. FAX: 203/877-3694

Subsidiary of Stein Industries, Inc.

ELECTRONIC COMPONENTS GROUPE
26 North Fifth Street, Minneapolis, MN 55403
612-375-9639 FAX 612-375-1905 800-826-8719

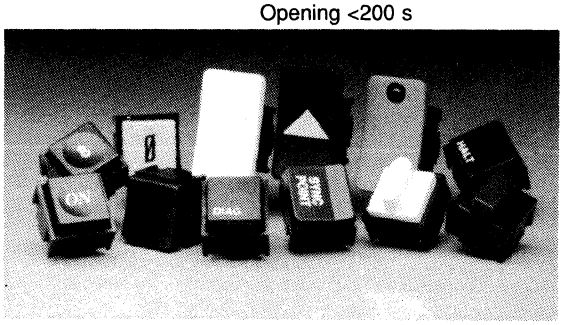
320 Series Push Button Switches

Our Most Dynamic Line

- Tactile feel pushbuttons...a distinctive difference
- Flexibility of layout...for single key or keyboard construction
- Choice of contact design for SPST, SPDT and SPST two output requirements
- .1" installation grid for standardization of layout

Mechanical Data

Travel	.7mm (.028")
Operating Force	120 grams
Snap Time	Closing <50 s Opening <200 s



Electrical Data

Type of Contact	Single pole single throw/ 1 input/1 or 2 outputs; Single pole double throw/ 1 input/1 output; Break before make (BBM)
Contact Rating	25 mA/50v (DC)
Initial Resistance	50 mΩ after 1 x 10^5 cycles at maximum
Switching Load	100 mΩ
Life @ maximum switching load	320 (E1-2) 10 switching cycles 320 (E1-1 & U1-1) 10 cycles
Climatic application class per DIN 40040	(HRF -25° to +75° C)

Materials Data

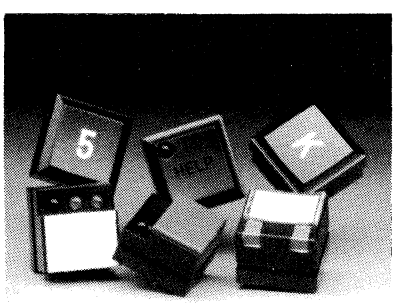
Housing	PC-GF
Knob	ABS or equivalent
Contacts (Fixed)	CuZn Ag
Switch Contact	CrNi Au

MiniTast Switches

Miniature Switches for Digital Electronics

Feather-Light Switching

- Reliability and long life
- Snap action contacts, tested to 10 million switching cycles at full load
- Self-cleaning contacts - maintenance free
- High quality basic materials, no functional fatigue
- Dust-proof by compact design
- Optional LEDs



	1100/1110 Series	1200 Series	1300 Series
Mechanical Data			
Contact	1 Form C (SPDT)	2 Form C (DPDT) 1 Form C (SPDT)	1 Form A (SPST)
Travel	1.5mm	2.5mm	1.5mm
Force	1.2Gr	1.5Gr	1Gr
Life	10 x 10^6 Opns @ full load	5 x 10^5	10 x 10^6 Opns @ full load
Temperature range	-25°C	-25°C	-25°C
To DIN 40040	+85°C	+75°	+85°C
Mechanical Function	Momentary	Momentary or alternate action	Momentary
Electrical Data			
Max Switching Voltage	60V	60V	60V
Max Switching Current	250mA	100mA	100mA
Max Switching Power	15W resistive load	6W resistive load	6W resistive load
Bounce Time	1ms	2ms	2ms
Contact Resistance	20 mΩ	50 mΩ	50 mΩ
Test Voltage	500 V AC	500 V AC	500 V AC
Materials Data			
Contacts	Silver 10 microns or Gold 3 microns	Silver 10 microns or Gold 3 microns	Silver 10 microns or Gold 3 microns
Body and Cap	Polycarbonate	Body - Polycarbonate black; Cap - Polycarbonate black or gray	Polycarbonate

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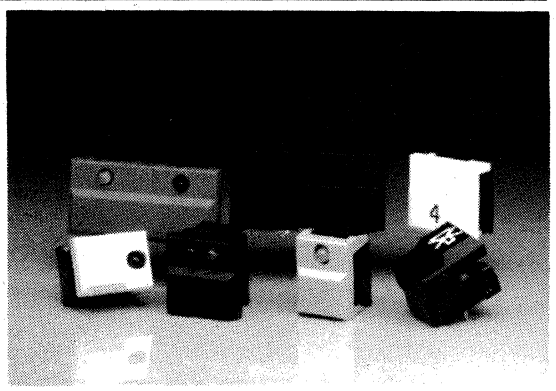
SigmaTast Input Switches

High Quality input switches for electronic devices

- With standoffs for PCB Mount
- Watertight body available
- Sealed terminals standard
- Gold contacts standard
- Micro-switch type coil spring over center contact system
- Short travel...2mm
- Tested to 5 million operations with momentary action



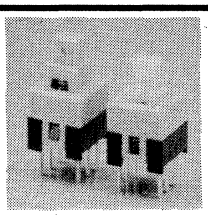
Mechanical Data

Housing/Cap Material	PC-ABS
Operating Stroke	2mm (.079")
Overtravel	1mm (.039")
Function	Momentary/Alternate Action
Contact Bounce	≤ 2ms
Mounting	PCB for flo-solder
Material	Polycarbonate
Contacts	Cu Sn gal./Ag/Au
Duration of Life	5 x 10^6 momentary, 5 x 10^5 alternate action
Operating Force	< 200 grams
Classification of Applications	HSF DIN 40040/IP 67 DIN 40050
Solder Specification	265° C (509 F) for 5 sec.

Electrical Data

Voltage Rating	24V
Test Voltage Cont-Cont	150V
Current Rating	12mA
Continuous Current	120mA
Power Rating	240mW
Insulation Resistance	>10°Ω
Contact Resistance	≤20mΩ
Capacitance Cont-Cont	≤1pF
Contact Configuration	SPDT

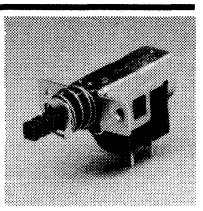
TL Series Tact Switches



Featuring TL2230 Switches

Contact Type	Mechanical
Circuit	DPDT
Contact Rating	12V DC 0.1A
Switching Volt Max	30V DC 0.3A
Operating Force	200 +/- 80 grams
Overall Travel	2mm
Initial Contact Resistance	<30m
Operating Life	≥1 x 10^4 cycles
Operating Temperature Range	-20° C to 70° C

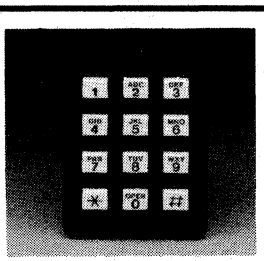
PS Series Power Switches



Featuring Model SSBS

Circuit	
Rating	15A 125V AC 10A 125V AC
Insulation Resistance	≥ 100mΩ
Contact Resistance	≤ 20mΩ
Dielectric Strength	1000V AC 1 min.
Overall Travel	3.5mm
Travel to Lock	2.5mm
Approvals	UL, CSA

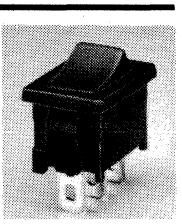
JP Series Keyboards/Keypads

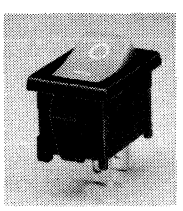


Featuring JP7202L

Contact	Conductive Rubber
Rating	DC 25V 5mA
Contact Resistance	500 Max
Bounce	≤ 10ms
Operating Force	75g +/-30g
Stroke	1.4 +/-0.3mm
Operating Life	≥1 x 10^4 cycles
Body Color	Black
Key Color	White
Ink Color	Black

RS Series Rocker Switches





Including RS 1066 Products

Circuit	RS 1066A SPST On-Off RS 1066C SPDT On-On RS 1066D SPDT On-Off-On RS 1066E SPST On-(Off) RS 1066F SPST (On)-Off RS 1066G SPDT On-(On)
Rating	AC 10A 125V, 6A 250V
Insulation Resistance	DC 500V, 100MΩ Min.
Contact Resistance	50mΩ Max.
Dielectric Strength	AC 1500V 1 min.
Approvals	UL (1066A & 1066C) CSA, VDE Pending
Note	All versions available in all black or black with "on-off" symbols as shown

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26 North Fifth Street, Minneapolis, MN 55403
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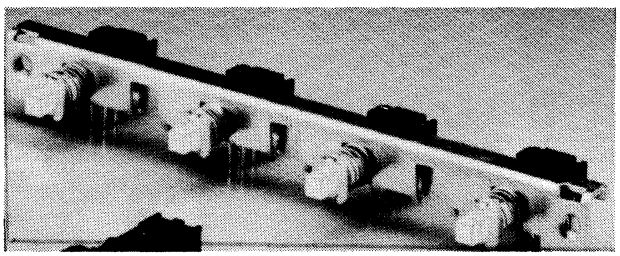
MTK Series Switches

Miniature Switches - use ganged or individually

Ultra light feel - Short Stroke

Available features include:

- Wiping "knife contacts" for smooth, silent actuation
- Up to six poles per module
- Mounting chassis
- Optional terminal length
- Snap-on buttons
- Interlocked assemblies



Mechanical Data

Functions Available	Momentary, Alternate Action Interlocked
Contact Configuration	2 pole, 4 pole, 6 pole
Switch Timing	Black body - non-shorting (BBM) Standard Gray body - shorting (MBB) Optional
Available Spacing	10, 12.5, 15, 17.5, and 20 mm center to center
Contacts	Moving - wiping "knife-type", Fixed - PC pins bottom only
Mounting	Individual or chassis mounting
Overall Travel	2.5mm
Travel to Lock	1.5mm
Maximum Soldering Time and Temperature	260 +/- 5 C +/-1 sec.
Operating Temp. Range	-10° C to +60° C

Electrical Data

Switching Voltage Max.	30V DC
Switching Current Max.	100mA
Withstand Voltage	500 V AC (50-60 Hz)
Operating Life	$\geq 1 \times 10^5$ cycles
Contact Resistance	20 mΩ max @ 1 Khz - initial 40 mΩ - after life - no load 100 mΩ - after life - under load
Insulation Resistance	100 MΩ @ 500 V DC

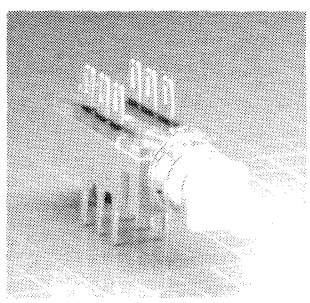
Material Data

Housing	PPHOX9 (NORYL) UL94HB
Plunger	Duracon UL94HB
Terminal Board	Laminate UL94HB
Moving Contacts	Phosphor bronze, 1 micron silver
Fixed Contacts	Brass - .5 micron silver
Alternate Action Pin	Stainless steel
Alternate Action Staple	Phosphor bronze
Plunger Return Spring	Baked zinc plated steel

TA Series Pushbutton Switches

Modular Construction

- Solder lugs on top for hand wiring
- PC at bottom for flo-soldering
- Ease of maintenance...switch plunger with sliding contacts is removable from the front without disturbing electrical connections
- Enclosed housing protects inner contact area from dust and foreign intrusions
- Fixed terminals are "staked" in position providing an extra seal to prevent wicking of solder or flux



Mechanical Data

Housing	Polycarbonate (UL 94HB)
Plunger	Duracon (UL 94HB)
Moving Contacts	Bimetal Brass/AgNi
Sliding Contacts	0.01 mm, Ag 90%, Ni 10%
Fixed Contacts	Brass 0.005 mm with silver plating
Moving Contact Return Spring	Stainless steel spring
Plunger Return Spring	Baked & Zinc plated steel
Alternate Action Staple	Highly resisted steel wire, chrome plated
Terminal Die Bone	High strength bonding red resin
Release Bar	Steel/Zinc plated
Chassis	Steel/Nickel plated or Steel/Zinc plated
Release Bar Spring	Stainless Steel
Specials	Valox (UL 94VO), gold plating, available on request

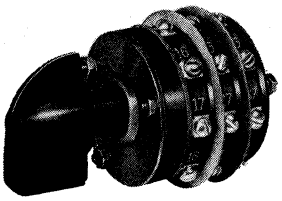
Electrical Data

Contact Resistance	Initial - 5 mΩ max; after 25,000 cycles, 20 mΩ max.
Current/Voltage Ratings	0.5A @ 100V AC, 0.2A @ 250V AC, 1A @ 25V DC
Dielectric Strength	Contact Gap - 1500 V RMS Min. (1 min.)
Insulation Resistance	Adjacent contacts - 2 x 10 ohms min. (Dry condition). 3 x 10 ohms min. (100% relative humidity after 96 hrs @ 70 F); Life Test - 100,000 cycles min.

ELECTROSWITCH
UNIT OF ELECTRO SWITCH CORP.

selection guide
rotary switches

Detent-Action Switches



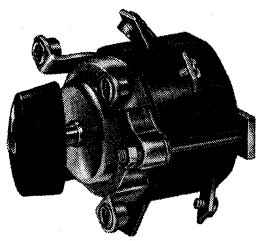
Heavy-duty, multi-pole rotary switches of modular design suitable for a wide variety of complex applications.

Double-side, double-wiping contacts are self-cleaning, shock-proof and virtually bounce-proof.

Variety of options available (spring-return, waterproof mount, key-lock, push-to-turn, etc.).

Continuous ratings from 5 to 30 amps at 600 volts. Up to 75 poles...to 16 positions.

Snap-Action Switches

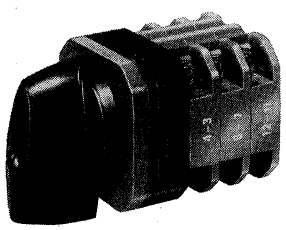


Best for direct current (DC) switching capability where high-speed transfer time is desirable. Transfer time is independent of the speed at which the handle shaft is turned (i.e. "tease-proof").

Available with non-shorting, shorting or "sweep" contacts for single to four-throw switching. Several options available.

Continuous rating from 20 to 200 amps at 600 volts. Up to 12 poles...to 4 positions.

Cam-Actuated Switches

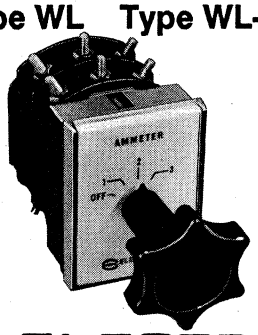


For use with direct motor control with compactness of design.

Wide choice of options include single or two-hole mount, base and door mount, key operation, tandem and gear driven, multi-rated combinations, etc.

Continuous ratings from 12 to 200 amps at 600 volts. Up to 24 poles...to 12 positions.

TYPE W Type W-2
Type WL Type WL-2



Instrument & Control Switches for power industry and heavy-duty industrial applications.

These respected, high quality rotary switches are now manufactured by Electroswitch, Weymouth, Mass., the recognized leader in power rotary switches. As always, you can rely on fast, dependable deliveries ... on engineering backup ... on design guidance ... on economical pricing.

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UNIT OF ELECTRO SWITCH CORP.
Weymouth, Massachusetts 02188
Telephone: 617/335/5200 • FAX: 617/335/4253

ELECTROSWITCH

SOUTHERN OPERATION

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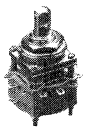
COMMERCIAL SWITCH REFERENCE GUIDE

- Low current military application switches (to Mil-S-3786) are also available. Request Bulletin # MIL-0001.
- Request Bulletin # Com-0001 for our full line commercial application catalog.
- Full custom switch capabilities.
- Keylock versions available.

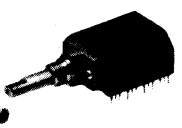
- Quality workmanship
- Dependable service
- Competitive prices



SERIES 38
1.2 in. diameter
enclosed contacts

SERIES 80
.81 in. square
environment-proof

SERIES 100
1.5 in. diameter
environment-proof



SERIES 400
PCB SWITCH
.82 in. wide (8-pin)
OR
1.2 in. wide (12-pin)

SERIES 600
1.6 in. diameter
environment-proof

SERIES 900A
.91 in. diameter
WATER RESISTANT
DESIGN

SPECIFICATIONS	SERIES 38	SERIES 80	SERIES 100	SERIES 400 12 PIN	SERIES 600		SERIES 900A
TYPE	**ENCLOSED**	**ENCLOSED**	**ENCLOSED**	**ENCLOSED**	**ENCLOSED**		**ENCLOSED**
Electrical Rating (Resistive) With Silver Plated Contacts	N/A	.10A @ 125 vac .25A @ 28 vdc	.3A @ 125 vac .5A @ 28 vdc	.1A @ 125 vac .25A @ 28 vdc	.5A @ 125 vac 1.0A @ 28 vdc		1A @ 125 vac 1A @ 28 vdc
With Silver Alloy Contacts	.5 @ 125 vac .5 @ 28 vdc	.20A @ 125 vac .25A @ 28 vdc	.5A @ 125 vac 1.0A @ 28 vdc	–	1.0A @ 125 vac 2.0A @ 28 vdc		–
Current Carrying Capacity	3A	6A	15A	6A	25A		5A
Maximum Temp. Rise	30°C	30°C	30°C	30°C	30°C		30°C
Voltage Breakdown (Sea Level)	1000 vac min.	600 vac min.	1000 vac min.	1000 vac min.	1000 vac min.		1000 vac min.
Contact Resistance (Initial)	N/A	.005 ohms max.	.003 ohms max.	.030 ohms max.	.003 ohms max.		.020 ohms max.
With Silver Alloy	.010 ohms max.	.004 ohms max.	.002 ohms max.	0.25 ohms max.	.002 ohms max.		–
Insulation Resistance Silver Plated Brass (Silver Alloy)	(1,000 megohms min.)	10,000 megohms min.	10,000 megohms min.	10,000 megohms min.	10,000 megohms min.		15,000 megohms min.
Rotational Torque	12 to 60 in. oz. variable	5 to 30 in. oz. variable	12 to 96 in. oz. variable	5 to 30 in. oz. variable	12 to 48 in. oz. variable		15 in. oz. nominal
Stop Strength Acetal Housing Material	N/A	5 in. lbs.	10 in. lbs.	N/A	10 in. lbs.		4.5 in. lbs.
Metal Housing Material	25 in. lbs.	8 in. lbs.	25 in. lbs.	8 in. lbs.	25 in. lbs.		N/A
MIL-S-3786 Requirements Explosion Proof	N/A	N/A	Yes	N/A	Yes		N/A
Low-Frequency Vibration	Yes	N/A	Yes	N/A	Yes		N/A
Shock (Type M)	Yes	N/A	Yes	N/A	Yes		N/A
Minimum Mechanical Life	25,000 cycles	25,000 cycles	25,000 cycles	25,000 cycles	25,000 cycles		25,000 cycles
Index Angles Available 15°	N/A	N/A	N/A	N/A	Yes		N/A
22½°	N/A	N/A	Yes	N/A	N/A		N/A
30°	Yes	Yes	Yes	Yes	Yes		Yes
36°	N/A	N/A	Yes	N/A	N/A		N/A
45°	N/A	N/A	Yes	N/A	N/A		N/A
60°	N/A	Yes	Yes	Yes	Yes		N/A
90°	N/A	Yes	Yes	Yes	Yes		N/A
180°	N/A	N/A	Yes	N/A	N/A		N/A
Poles Per Deck Available With 15° Index	N/A	N/A	N/A	N/A	12 max.		N/A
With 22½° Index	N/A	N/A	Consult Factory	N/A	N/A		N/A
With 30° Index	6 max.	6 max.	6 max.	6 max.	6 max.		4 max.
With 36° Index	N/A	N/A	5 max.	N/A	N/A		N/A
With 45° Index	N/A	N/A	Consult Factory	N/A	N/A		N/A
With 60° Index	N/A	3 max.	3 max.	3 max.	3 max.		N/A
With 90° Index	N/A	2 max.	2 max.	2 max.	2 max.		N/A
With 180° Index	N/A	N/A	1 max.	N/A	N/A		N/A
Material & Finishes Front Housing	Nickel Plated Brass	Acetal or Die-Cast Zinc	Acetal or Die-Cast Zinc	Die-Cast Zinc	Acetal	Zinc Plated Steel	Acetal
Bushing	Nickel Plated Brass	Brass or Die-Cast Zinc	Brass or Die-Cast Zinc	Brass or Die-Cast Zinc	Brass	Brass	Acetal
Detent Balls	Rollers Stainless Steel	2-Steel Alloy	2-Steel Alloy	2-Steel Alloy	2-Steel Alloy	1-Steel Alloy	N/A
Detent Spring	Music Wire Plated	Coil Piano Wire	Coil Piano Wire	Coil Piano Wire	Coil	Flat Steel	
Detent Mechanism	Nickel Plated Steel	Tin Plated Steel	Zinc Plated Steel	Tin Plated Steel	Zinc Plated Steel		Acetal
Shaft	Nickel Plated Brass	Brass	Brass	Brass	Brass		Acetal
Retaining Clip	N/A	Zinc Plated Steel	Zinc Plated Steel	Zinc Plated Steel	Zinc Plated Steel		N/A
Rivets	N/A	Aluminum	Aluminum	Aluminum	Aluminum		N/A
Screws	Brass	Zinc Plated Steel	Zinc Plated Steel	Zinc Plated Steel	Zinc Plated Steel		N/A
Fixed Contacts	Silver Alloy	Silver Plated Brass	Silver Plated Brass	Silver Plated Brass	Silver Plated Brass		Silver Plated Brass
Movable Contacts	Silver Alloy	Spring Silver Alloy	Spring Silver Alloy	Spring Silver Alloy	Spring Silver Alloy		Silver Overlay Brass
Movable Contact Rotor	Glass Alkyd	Acetal	Acetal	Acetal	Acetal		Acetal

All products featured are proudly made in the U.S.A.

Electroswitch Southern Operations, 2510 N. Boulevard, Raleigh, NC 27604 • (919) 833-0707, FAX (919) 833-8016

ELMA

ELMA Electronic Inc.

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High Quality Modular Rotary, Keylock and Coded Switches

A Member Of The Sulzer Group, 41440 Christy Street, Fremont, CA 94538 • (415) 656-3400

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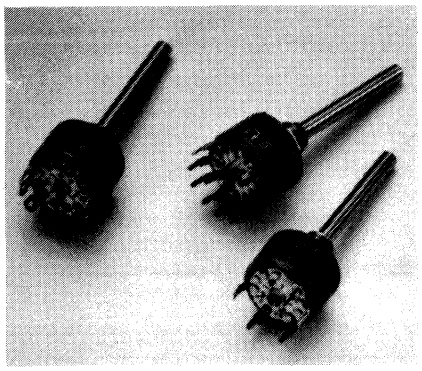
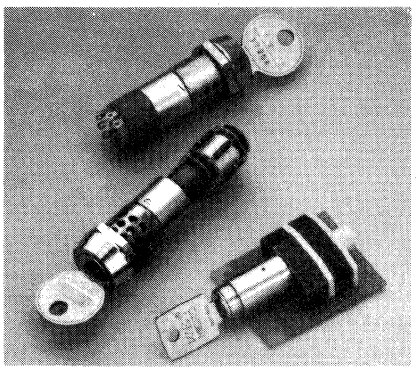
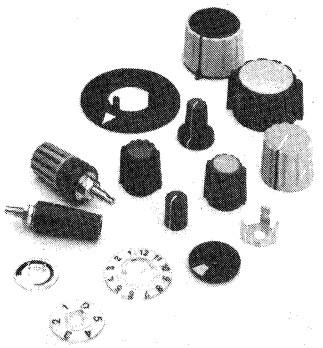
ELMA—Experience and precision for every High Quality switch application



TYPE 01



TYPE 01 AND 06 KEYLOCK



COLLET KNOBS

All **ELMA** switches are designed and manufactured to ensure high reliability and long life. They are in keeping with the strict standards required in medical technology and communications. Common areas of application include process and manufacturing control, measuring and monitoring equipment.

ELMA switches are available in the following forms:

—a broad standard range of rotary switches of different sizes with solder lug terminals or for PCB mounting

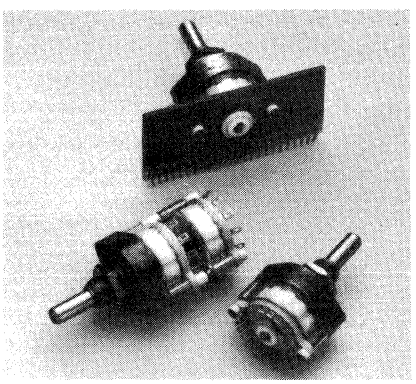
—Binary coded rotary switches for PCB mounting

—Binary coded rotary switches for PCB mounting with mounting dimensions according to IC 297/ DIN 41494 standards.

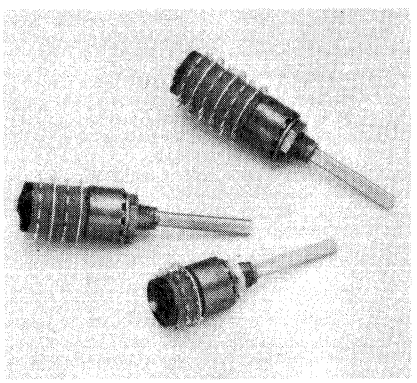
ELMA switches are mainly used in industrial electronics and are especially suitable for switching medium loads, logic levels and dry circuits.

Consequently they are offered with a choice of contact material—gold flashed silver and 3 or 5 μm hard gold. These materials plus the design of the contact ensure high and constant electrical conductivity and good resistance to corrosion and abrasion.

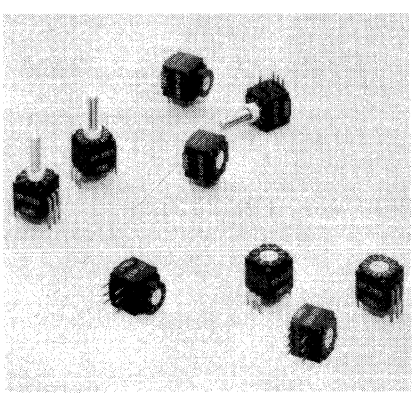
The **ELMA** rotary, PCB, code and key switches are guaranteed to be of the finest quality and to exhibit high reliability and repeatability over many years—this is what has earned us our world wide reputation for excellence.



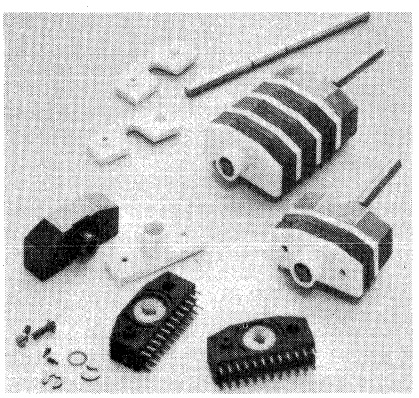
TYPE 04



TYPE 06



TYPE 07 — CODED DIP



TYPE 08

COLLET KNOBS:
For every switch ELMA manufactures the ideal collet knob. They are available ex stock in many different sizes and colors with numerous modular accessories such as pointers, stators, figure dials, etc.

MAXIMUM FLEXIBILITY FOR CUSTOM EXECUTIONS!

See section 1400 (Cabinets, Enclosures, Racks & Chassis), section 2025 (Computers-Mini/Micro) and section 2400 (Panel Hardware-Bezels, Dials, Knobs, etc.) for additional ELMA products!

ENTECH
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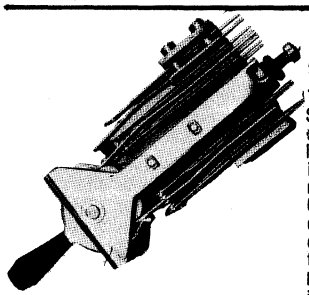
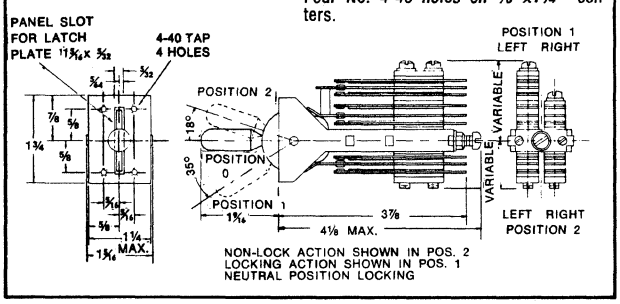
QUALITY FEATURES

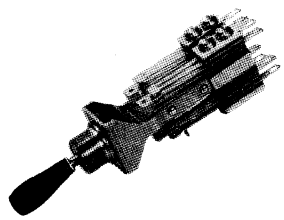
● Non-ferrous metals, amply protected against corrosion by heavy plating or protective finishing. ● Non-corrosive metals for parts that cannot be plated. ● Strong frame construction for longer life, more constant adjustment. ● Top grade phenolics (conforming to Army, Navy and Air Force specifications) with high break-down ratings. ● Contact spring assemblies tightened under pressure, securely anchored with high tensile strength screws. ● Higher contact pressures with self-cleaning wiping action. ● Tinned terminals for easy soldering.



SERIES 4100

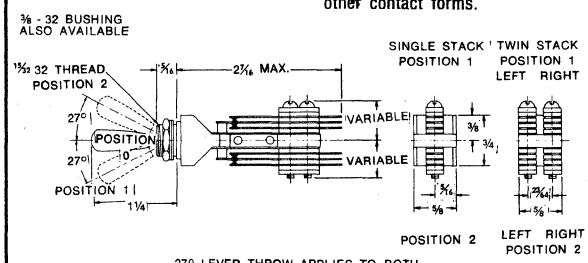
A heavy duty lever switch with positive locking mechanism. Applications include Transmitters, Power Plants, Fire Alarm Systems, Machine Tools, Test Equipment, etc. Series 4102 is a two position switch, locking only, without neutral. Series 4103 is three position, locking, non-locking or no-throw in Positions 1 and 2. Position 0, neutral, is locking only. Also available on special order in four and five position construction and with rotary action. Contacts 10 or 20 Ampere. Any contact combination may be used up to 15 contacts in each of the four stacks. Mounting-Four No. 4-40 holes on 5/8"x1 1/4" centers.

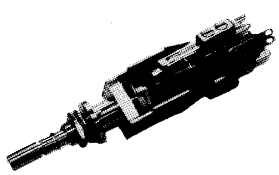




SERIES 4703

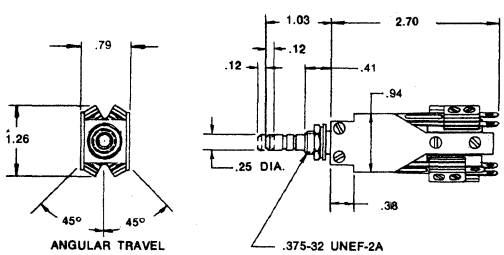
A simply constructed three position toggle type lever switch for switching multiple circuits in electronic and communication equipment. A unique feature permits easy operation of the lever in Positions 1 and 2. Position 0 is always locking. Contacts are 3 Amp Palladium Standard, 5 Amp available. Either one or two contact stacks may be mounted on both sides of the frame resulting in a contact capacity up to 20 Form A or equivalent number of blades of other contact forms.

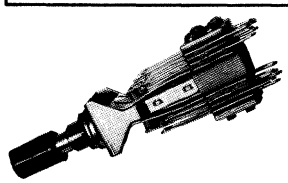




SERIES 4400

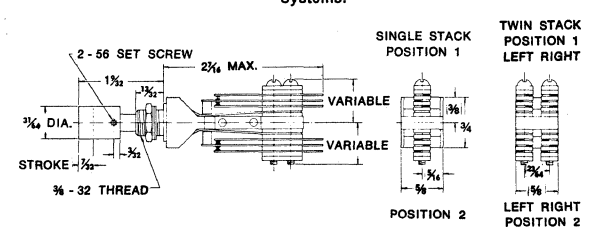
This recently developed rugged multi-function switch combines compact size with great flexibility. Available in Push-Pull, left turn and right turn with or without latching functions. Standard contacts are 3 Amp Palladium. Terminals can be solder or quick connect Taper Tab. Custom Knobs and an optional dust cover can be provided.

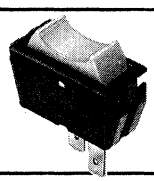




SERIES 5500

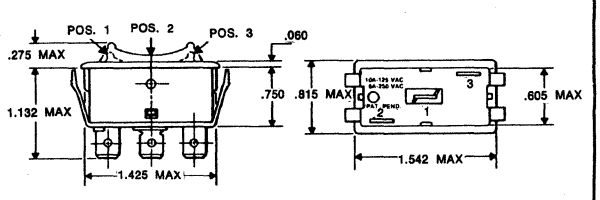
A compact momentary action Push Button Switch. Either single or double contact pile-ups may be mounted on both sides of the frame, resulting in a contact capacity up to 20 Form A or equivalent number of other contact forms. Contacts-3 or 5 Amp Palladium. Optional bifurcated Gold or Palladium contacts. Applications include Computer and Signal Systems.

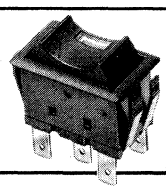




SERIES 790

Compact-"Snap Action" rocker with snap in mounting for panels .030" to .156" thick. Rated (resistive) 10A 125Vac, 5A 250Vac, 10A 12VDC. Available with momentary, maintained and progressive on circuits in single pole configuration. Recommended mounting hole is .625" X 1.437". Custom hot stamped rockers available. Terminals .250 quick connect.

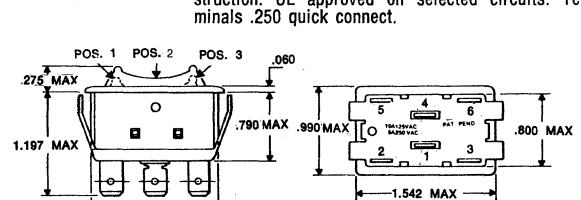




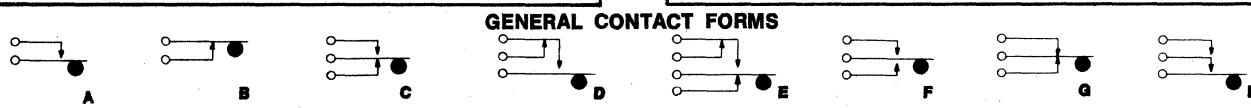
SERIES 791 and 792

A complete range of "Snap Action" maintained or momentary circuits in single or double pole. 791 Series is lighted with 6V, 14V or 28V incandescent bulbs or 120V, 240V neon bulbs.

792 Series is identical in size but is unlighted. Contact rating same as 790 series. Recommended mounting hole is .812" X 1.437" and panel thickness is .030" to .156". Highest quality polycarbonate construction. UL approved on selected circuits. Terminals .250 quick connect.



GENERAL CONTACT FORMS



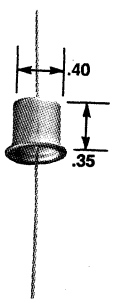
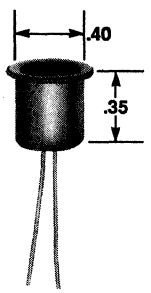
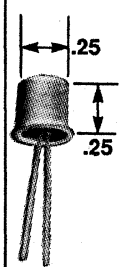
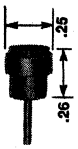
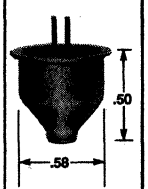
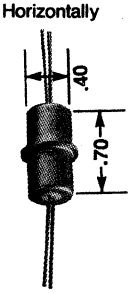
FIFTH DIMENSION INC.

Miniature Mercury Tilt Switches

- **Versatile** — Available to sense, tilt, vibration or impulses for commercial, industrial or military applications
- **Reliable** — Hermetically sealed, oxygen-free atmosphere provides typical life of 250,000 operations and more
- **Rugged** — Welded metal cases
- **Wide choice** — Omnidirectional or planar
- **Precise** — Operate to tight tolerances

Notes:

1. Response speed depends on the damping fluid used, and is related to jitter reduction. Rated on a scale of 0 to 5, with 5 being heavily damped (longest response time).
2. Switches with other dampening factors are available. Consult factory.
3. Jitter is tendency for switch to change state 3° from operational point. Ranked on a scale of 0 to 5, with 5 being very susceptible to vibrations.
4. Values shown are for switch viewed so that pins are side by side. For values with pins in line (one behind the other) ask for product data sheet.

	Omnidirectional (NO)			Omnidirectional (NC)		Miniature Omni-directional (NC)	Single Plane	Omni-directional (NC) Snap Action	Double Ended	
Dimensions							Mounts Horizontally 		Mounts Horizontally 	
Part Number	**TS7-0**	**TS7-0J**	**TS7-10**	**TS7B-0**	**TS7B-10**	**TS8**	**TS66**	**STS411**	**2TS7B-0**	**2TS7B-10**
Operating Angle (°) (to close from 0°)	16±8	18±8	6±5	25±12 (4)	25±12 (4)	7±5 (4)	+1.5±3	42±6 (4)	65±12 (4)	65±12 (4)
Operationg Angle (°) (to open from 0°)	12±8	12±8	4±5	35±12 (4)	35±12 (4)	13±10 (4)	−2±3	55±6 (4)	55±12 (4)	55±12 (4)
Uncontrolled angle (°) (total included)	0	20±20	0							
Switching Hysterysis (°)	4±4	6±4	2±3	10±6	10±6	6±5 (4)	3.5±2	13±5	10±6	10±6
Typical Repeatability (±°)	3	3	3	2	2	3	1	2	3	3
Load Current (resistive)										
@ 115 VAC (amps)	0.5	0.5	0.5	0.5	0.5	0.2	0.1	1.0	0.5	0.5
@ 12 VDC (amps)	1.0	0.5	1.0	1.0	1.0	0.5	0.2	2.0	1.0	1.0
Insulation Resistance @ 500 VDC (megohms)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Breakdown Voltage (VAC)	1000	1000	1000	750	750	600	1000	1000	750	750
Typical Contact Resistance @1 MA (ohms)	0.3	0.7	0.5	0.15	0.50	0.25	0.5	0.1	0.15	0.50
Maximum Operating Temperature (°C)	125	125	125	125	125	125	135	125	125	125
Minimum Operating Temperature (°C)	−35	−35	−20	−35	−20	−35	−35	−35	−35	−20
Speed of Response (relative) (1)	0	0	2	0	2	0	0	1	0	2
Contact Jitter (relative) (3)	4	5	2	3	2	3	4	0	3	2

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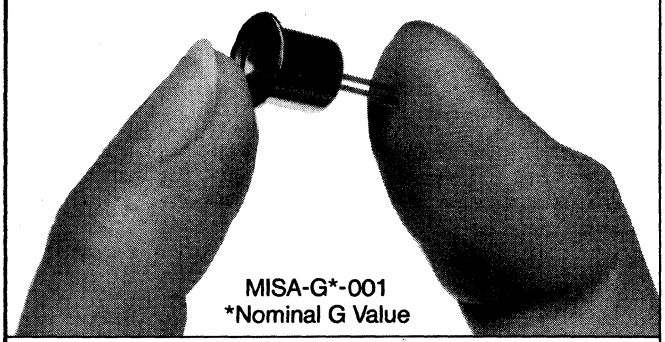
FIFTH DIMENSION INC.

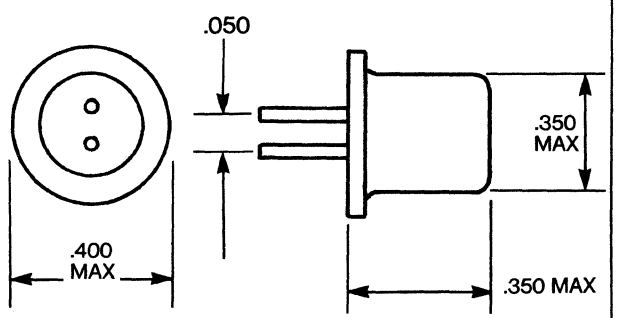
Mercury Impulse Switches

Patented under one or more of the following: 3,831,118, 3,976,960 and 4,683,355 (others pending)

Lo-G Impact Switches: 2 to 10 G



MISA-G*-001
*Nominal G Value



- High resistance to transverse loads
- Mountable in any position — responds to axial loads
- No contact bounce
- No mechanical springs — liquid-phase mercury design
- Hermetically-sealed welded metal case
- High repeatability

Specifications

Contact Type:
SPST, normally open, non-latching

Sensitivity: 2 to 10 G
(G is nominal centrifugal switching value)

Contact Resistance, max. (ohms): 10

Rated Load: 0.1 amp @ 10 VDC to 0.01 amp @ 200 VDC

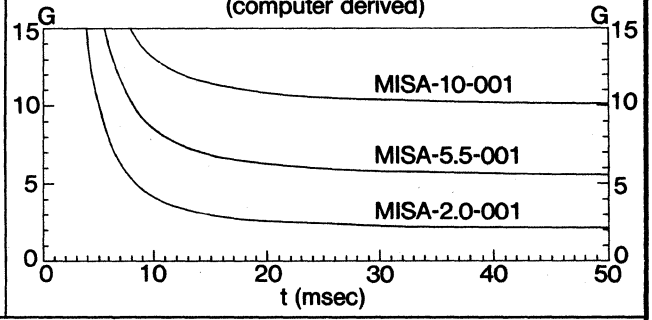
Insulation Resistance @ 500 VDC: 1,000 megohms

Breakdown Voltage (VDC): 750

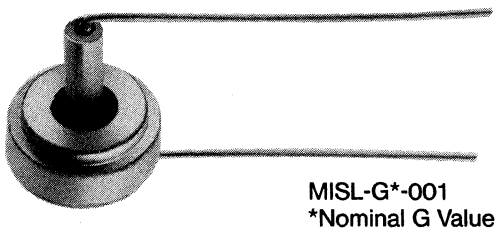
Operating Temperature Range (°C): −35 to +125

Storage Temperature Range (°C): −65 to +125

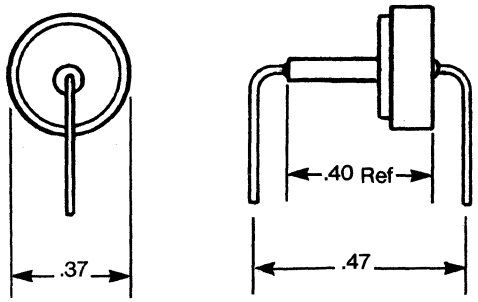
Impulse Magnitude—G vs. Operating Time
(computer derived)



Hi-G Impulse Switches: 200 to 2,000 G's



MISL-G*-001
*Nominal G Value



- Mercury wetted, bounce free
- Mountable in any position — responds to axial loads
- Hermetically-sealed welded steel case
- Used for ordnance fuzing applications
- Can be used for repetitive applications

Specifications

Contact Type: SPST, normally open, non-latching

Sensitivity (nominal): 200-2,000 G* (special designs to 20,000 G) (G is nominal centrifugal switching value)

Tolerance (standard): G max.: G min.=3:1

Operate Time (G level dependent):
0.1 milliseconds typical

Release Time (following G decay):
proportional to the integral of Gdt

Typical Contact Resistance (ohms): 0.15

Rated Load: 2.0 amp @ 5 VDC to 0.1 amp @ 200 VDC

Insulation Resistance @ 500 VDC: 1,000 megohms

Breakdown Voltage (VDC): 1,000

Operating Temperature Range (°C): −35 to +125

Storage Temperature Range (°C): −65 to +125

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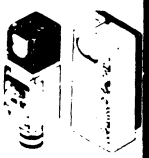
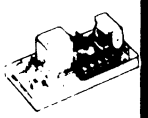
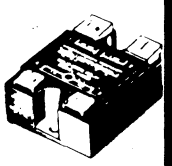
TOGGLE SWITCHES

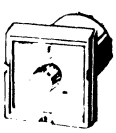

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS


TEMPERATURE CONTROLS

TIMERS

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COUNTERS
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MEC
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RBM
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Arrow Hart
Carlingswitch
Cherry Electric
C&K
EECO
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Omron
Oslo
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Saia
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Jeffers

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Dolan-Jenner
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Photoswitch/AB
Skan-A-Matic

PROXIMITY
Agastat
Electro
Omron

POTS & RESISTORS
Clarostat
Ohmite

SOLENOID
Dormeyer
Guardian
Line Electric

TIMERS
ATC
Agastat
Amperite
Antex
Crouzet
Eagle Signal
Guardian
Industrial Timer
Magnecraft
Master Electronics
Midtex
National Controls
Omron
Potter & Brumfield
SSAC
Struthers-Dunn
Syracuse Electronics

TERMINAL BLOCKS
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Buchanan
Curtis
Electrovert
Kulka
Magnum
Marco
RDI
Underwriters Safety
Vernitron-Beau
Weidmuller

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Sola
Stancor
Thordarson
Triad
U.T.C.

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Belden
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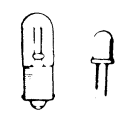
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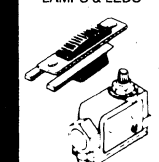
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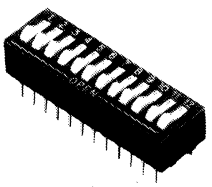
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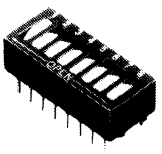
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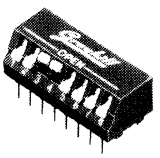
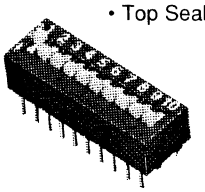

PIONO-DIP®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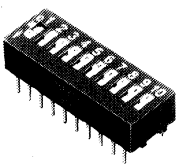
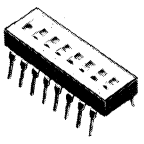

Recessed Slide


Machine Insertable

ROCKER DIP SWITCHES—SERIES 76
Raised and Recessed Rockers and PIANO-DIP®

Rated to make and break 1 mA, 5 Vdc: or 50 mA, 30 Vdc: or 150 mA, 30 Vdc for 10,000 operations per position. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate. Width is .380"; height is .315" for raised rocker style, .267" for recessed style, and .301 " for the PIANO-DIP® switch.

SLIDE DIP SWITCHES—SERIES 78
Raised and Recessed Slide Types

Rated to make and break 1 mA, 5 Vdc; or 50 mA, 30 Vdc; or 125 mA, 30 Vdc for 10,000 operations. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate. Width is .380"; height is .315" for raised slides and .265" for recessed slides.

MACHINE INSERTABLE, MIDIP® SWITCH–SERIES 90

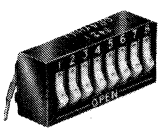
Compatible with leading TO-116 IC insertion equipment. Rated to make and break 100 mA, 30 Vdc; or 10 mA, 50 mVdc for 2,000 operations per position. Base contacts are brass, gold plated 10 microinches over nickel. Terminals are molded (sealed) into base. Top seal is thermoplastic. Width is .280"; height is .160".

MILITARY QUALIFIED DIP SWITCHES

All switch part numbers containing the letter M are qualified to MIL–S–883504 as follows:

Raised Rocker Type	MS83504/01-022 thru -030 and -032
Recessed Rocker Type	MS83504/02-022 thru -030 and -032
Raised Slide Type	MS83504/04-022 thru -030
PIANO-DIP® Type	MS83504/11-024 thru -030

For additional qualified DIP switches with double throw circuitry, see next page; for qualified switches with gold terminals, contact Grayhill.



RIGHT ANGLE STYLES

All standard 76 and 78 switches except the PIANO-DIP® switches are available with terminals for right angle mounting. Contact GRAYHILL for more information.

ORDERING INFORMATION

Type	No. Of Stations	Length	Part No.* Standard	Part No.* Military
Raised Rocker Type	2	0.28	76SB02	76MSB02
	3	0.38	76SB03	76MSB03
	4	0.48	76SB04	76MSB04
	5	0.58	78SB05	78MSB05
	6	0.68	76SB06	76MSB06
	7	0.78	76SB07	76MSB07
	8	0.88	76SB08	76MSB08
	9	0.98	76SB09	76MSB09
	10	1.08	76SB10	76MSB10
	12	1.28	78SB12	78MSB12
Recessed Rocker Type	2	0.28	76RSB02	76MRSB02
	3	0.38	76RSB03	76MRSB03
	4	0.48	76RSB04	76MRSB04
	5	0.58	76RSB05	76MRSB05
	6	0.68	76RSB06	76MRSB06
	7	0.78	76RSB07	76MRSB07
	8	0.88	78RSB08	78MRSB08
	9	0.98	76RSB09	76MRSB09
	10	1.08	76RSB10	76MRSB10
	12	1.28	76RSB12	76MRSB12
Raised Slide Type	2	0.28	78B02	78MB02
	3	0.38	78B03	78MB03
	4	0.48	78B04	78MB04
	5	0.58	78B05	78MB05
	6	0.68	78B06	78MB06
	7	0.78	78B07	78MB07
	8	0.88	78B08	78MB08
	9	0.98	78B09	78MB09
	10	1.08	78B10	78MB10

Type	No. Of Stations	Length	Part No.* Standard	Part No.* Military
Recessed Slide Type	2	0.28	78RB02	N/A
	3	0.38	78RB03	N/A
	4	0.48	78RB04	N/A
	5	0.58	78RB05	N/A
	6	0.68	78RB06	N/A
	7	0.78	78RB07	N/A
	8	0.88	78RB08	N/A
	9	0.98	78RB09	N/A
	10	1.08	78RB10	N/A
PIANO-DIP® Side Actuated Rocker Type	4	0.48	76PSB04	76MPSB04
	5	0.58	78PSB05	78MPSB05
	6	0.68	76PSB06	76MPSB06
	7	0.78	76PSB07	76MPSB07
	8	0.88	76PSB08	76MPSB08
	9	0.96	76PSB09	76MPSB09
	10	1.08	76PSB10	76MPSB10
Machine Insertable Slide Type	4	0.47	90B04	N/A
	5	0.57	90B05	N/A
	6	0.67	90B06	N/A
	7	0.77	90B07	N/A
	8	0.87	90B08	N/A
	9	0.97	90B09	N/A
	10	1.07	90B10	N/A

*To order top tape sealed, add suffix S to part number.

For prices and discounts, contact your local Sales Office, an authorized Distributor, or GRAYHILL.

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- SPDT & DPDT – Separate Circuits

SERIES 76 ROCKER AND TOGGLE SWITCHES

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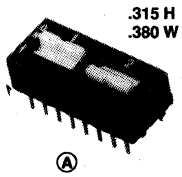

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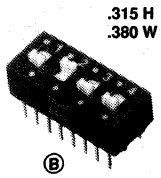

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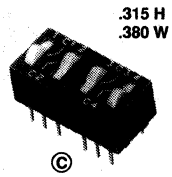

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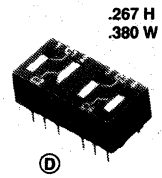

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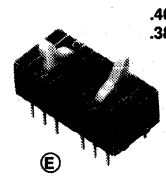

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2 POLE, 3 POLE, AND 4 POLE, SINGLE THROW SLIDE SWITCHES (FIG. A)

Rated for 10,000 operations to make and break the following loads: 1 mA, 5 Vdc; or 50 to 150 mA, 30 Vdc. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate.

Circuitry	No. of Positions	Length	Part Number
2PST	1	0.280	**78F01**
	2	0.480	**78F02**
	3	0.680	**78F03**
	4	0.880	**78F04**
	5	1.080	**78F05**
3PST	1	0.380	**78G01**
	2	0.680	**78G02**
	3	0.980	**78G03**
4PST	1	0.480	**78H0I**
	2	0.880	**78H02**

To order top sealed switches, add the suffix S to the part number in the chart.

SPDT AND DPDT SLIDE SWITCHES WITH SEPARATE CIRCUITS (FIG. B)

Rating and materials are the same as the switches in Figure A. In Single Pole/Double Throw switches, each slide operates two adjacent separate circuits, opening one of them, while closing the other. (In Double Pole/Double Throw switches, 1 slide switches 4 circuits at once, opening circuits 1 and 3, while closing 2 and 4, etc.). This circuitry, used in telephone switching systems, makes these switches form, fit, and function equivalents. For true SPDT (DPDT) circuitry, adjacent terminal pairs may be tied with a printed circuit. Dot on the cover indicates the closed position of individual terminal pairs.

Circuitry	No. of Positions	Length	Part Number
SPDT	1	0.280	**78J0I**
	2	0.480	**78J02**
	3	0.680	**78J03**
	4	0.880	**78J04**
	5	1.080	**78J05**
DPDT	1	0.480	**78K0I**
	2	0.880	**78K02**

To order top sealed switches, add the suffix S to the part number in the chart.

For prices and discounts of all products on this page, contact your local Sales Office, an authorized Distributor or Grayhill.

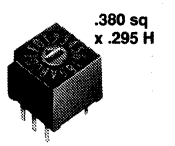
Available From Your Local GRAYHILL Distributor.

SPDT AND DPDT ROCKER AND TOGGLE SWITCHES WITH COMMON POLES (FIG. C, D, E)

Rated to make and break 50 mA 30 Vdc , and 125 mA 30 Vdc for 10,000 operations. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate. SPDT (DPDT) circuits are 3 (6) terminal circuits for true SPDT (DPDT) switching and compact spacing. Common pole terminals are marked with a C, and first and second throws are marked as 1 and 2. Military versions are qualified to MIL-S-83504.

Circuitry And Type	Positions	Length	Part No. Raised	Part No. Recessed	Part No. Toggle
SPDT, Standard	2	0.380	**76SC02**	**76RSC02**	**76STC02**
	3	0.580	**76SC03**	**76RSC03**	**76STC03**
	4	0.780	**76SC04**	**76RSC04**	**76STC04**
SPDT, Military	2	0.380	**76MSC02**	**76MRSC02**	**76MSTC02**
	3	0.580	**76MSC03**	**76MRSC03**	**76MSTC03**
	4	0.780	**76MSC04**	**76MRSC04**	**76MSTC04**
DPDT, Standard	1	0.380	**76SD01**	**76RSD01**	**76STD01**
	2	0.780	**76SD02**	**76RSD02**	**76STD02**
DPDT, Military	1	0.380	**76MSD01**	**76MRSD01**	**76MSTD01**
	2	0.780	**76MSD02**	**76MRSD02**	**76MSTD02**

To order top sealed switch (not available on TOGGLE-DIP), add the suffix S to the Grayhill part number.



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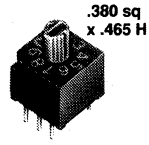

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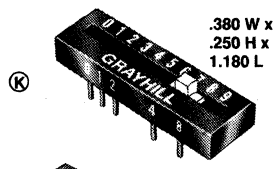

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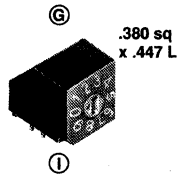

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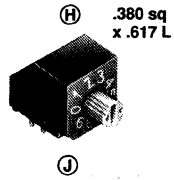

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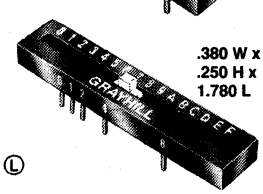

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BINARY AND HEXADECIMAL OUTPUT DIP SWITCHES

Series 74 sealed switches (FIG. G, H, I, J) are available in both BCD and Hexidecimal codes and their complements. Series 79 linear switches (FIG. K, L), in BDC and Hex, have true zero output. Series 74 switches are rated to make and break 10 mA 50 mVdc, or 125 mA, 30 Vdc for 2,000 cycles (10 positions) or 1000 cycles (16 positions); Series 79 are rated for 10 mA 50 Vdc, or 50 mA 30 Vdc, or 125 mA 6 Vdc for 2,000 cycles. A cycle is movement thru all positions and a return. See catalog for pin locations.

Circuitry and Actuator	No. Of Positions	Part No. Flush Actuator	Part No. Extended Actuator	Part No. Rt. Angle Flush	Part No. Rt. Angle Extended	Part No. Linear Action
BCD	10	**74AB10**	**74BB10**	**74AB10-RA**	**74BB10-RA**	**79B10**
BCD Comp	10	**74AC10**	**74BC10**	**74AC10-RA**	**74BC10-RA**	—
Hexadecimal	16	**74AB16**	**74BB16**	**74AB16-RA**	**74BB16-RA**	**79B16**
Hex Comp	16	**74AC16**	**74BC16**	**74AC16-RA**	**74BC16-RA**	—

For top tape seal on Series 79 switches, add the suffix "S" to the part number.

Grayhill INC. Pushbutton Switches

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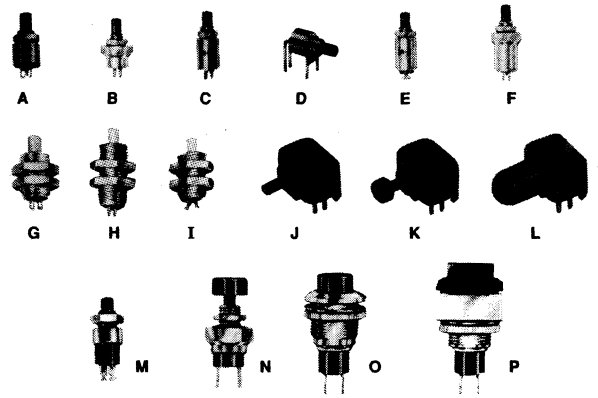
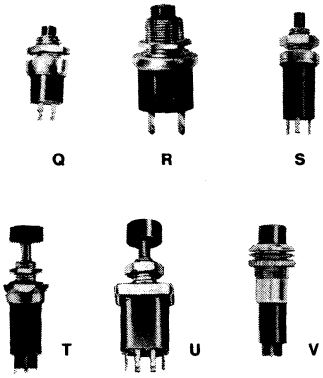
SMALL LOW CURRENT MOMENTARY SWITCHES



50% ACTUAL SIZE



BUTT CONTACTS

SPST = Single Pole/Single Throw, Momentary
SPDT = Single Pole/Double Throw, Momentary
DPDT = Double Pole/Double Throw, Non-shorting, Momentary
NO or NC = Normallly Open or Normally Closed

MINIATURE, BUTT CONTACT SWITCHES—FIG. A TO L

Gold contacts provide low level switching with maimum life in minimum space. PC, sealed, overtravel, right angle, and limit switch. SPST NO or NC, and SPDT types. Add -EW suffix for 6" wire leads.

1 AMP BUTT CONTACT SWITCHES—FIG. M TO P

Small, long wearing switches with silver contacts. SPST NO in standard, UL recognized, sealed, and bezel types; SPST NC in standard and UL types. Add -EW suffix for 6" wire leads.

WIPING CONTACTS

1/2 & 1 AMP WIPING CONTACT SWITCHES—FIG. Q, R

Self cleaning contacts for use in critical contact resistance circuits. SPST NO or NC, standard, UL, and 6" wire lead types (-EW).

1/4 AMP WIPING CONTACT SWITCHES—FIG. T, U, V

Long wipe, double throw switches for low level switching. SPDT or DPDT, standard, sealed, or bezel types.

10 AMP SNAP ACTION SWITCHES—FIG. W

Rapid make and break for higher current switching; audible click. SPST NO or NC, and SPDT types.

4-WAY SWITCH, JOYSTICK LIKE ACTION—FIG. X

Moves cursor or icon on a display; directional arrows on keycap. SP4T with center common.

ORDERING INFORMATION

Circuitry & Description	A Fig.	Part No., Red or Natural Button	Part No. Black Button	Wires Suffix	Make & Break Current*	Life Operations	Behind Panel	Max. Width
NO	A	39-1	39-3	-EW	500 mA	1,000,000	0.315	0.253
NO, PC	A	39-401 RED	39-401 BLK	—	150 mA***	1,000,000	0.215	0.253
NO, Sealed	B	39-351 RED	39-351 BLK	-EW	500 mA	250,000	0.350	0.361
NO, Overtravel	C	39-12	39-24	-EW	500 mA	100,000	0.455	0.253
NO, PC, Right Angle	D	39-501 RED	39-501 BLK	—	150 mA***	1,000,000	0.300	0.253
NC	E	39-2	39-6	-EW	250 mA	250,000	0.490	0.253
NC, Sealed	F	39-352 RED	39-352 BLK	-EW	250 mA	100,000	0.529	0.361
NO, Limit	G	39-101 (Natural)	—	—	500 mA	500,000	0.650	0.505
NO, Overtravel, Sealed	H	39-701 (Natural)	—	-EW	150 mA**	100,000	0.800	0.505
NC, Limit, Sealed	I	39-702 (Natural)	—	-EW	250 mA	100,000	0.560	0.505
SPDT PC, Right Angle	J	39-251 RED	39-251 BLK	—	250 mA	500,000	0.400	0.500
SPDT PC, RA, Sealed	J,L	39-250 RED	39-250 BLK	—	250 mA	500,000	0.400	0.500
SPDT, PC, RA, Wide Button	K	39-261 RED	39-261 BLK	—	250 mA	500,000	0.400	0.500
SPDT PC, RA, Wide, Sealed	K,L	39-260 RED	39-260 BLK	—	250 mA	500,000	0.400	0.500
NO	M	30-1	30-3	-EW	1 Amp	1,000,000	0.592	0.375
NO, UL Recognized	M	30-1UL	30-3UL	—	5 Amps	6,000	0.592	0.375
NO, Sealed	N	30-251 RED	30-251 BLK	-EW	1 Amp	100,000	0.632	0.505
NO, Overtravel	M	30-15	30-37	—	1 Amp	500,000	0.677	0.375
NO, Round Bezel	O	30-05-01-502-0303	30-05-01-502-0707	—	1 Amp	1,000,000	0.930	0.640
NO, Square Bezel	P	30-01-01-500-0303	30-01-01-500-0707	—	1 Amp	1,000,000	1.110	0.640
NC	M	30-2	30-6	-EW	1 Amp	1,000,000	0.605	0.375
NC, UL Recognized	M	30-2UL	30-6UL	—	5 Amps	6,000	0.605	0.375
NO	Q	23-1	23-4	—	250 mA	100,000	0.663	0.468
NO	R	4001	10-9	—	1 Amp	100,000	0.965	0.800
NO, UL Recognized	R	4001UL	10-9UL	—	3 Amps	6,000	0.965	0.800
NC	R	4002	10-10	—	1 Amp	100,000	0.965	0.800
NC, UL Recognized	R	4002UL	10-10UL	—	3 Amps	8,000	0.965	0.800
SPDT	S	46-101 RED	46-101 BLK	—	250 mA	250,000	0.890	0.437
SPDT, Sealed	T	46-150 RED	46-150 BLK	—	250 mA	100,000	0.957	0.437
SPDT, Round Bezel	V	46-05-05-502-0303	46-05-05-502-0707	—	250 mA	250,000	1.179	0.640
DPDT	U	46-200 RED	46-200 BLK	—	250 mA	250,000	0.921	0.625
DPDT, Sealed	U	46-270 RED	46-270 BLK	—	250 mA	100,000	0.957	0.650
NO	W	2201	7-7	—	10 Amps	25,000	1.239	0.880
NC	W	2202	7-8	—	10 Amps	25,000	1.239	0.880
SPDT	W	7-26 RED	7-26 BLK	—	10 Amps	25,000	1.239	0.880
4-Way, SP4T	W	—	04A-K01	—	250 mA	500,000	1.315	0.845

*At 115 Vac resistive except as noted. **at 5 Vdc. ***At 28 Vdc.

For prices and discounts, contact a local Sales Office, an authorized Distributor, or GRAYHILL
Available From Your Local GRAYHILL Distributor

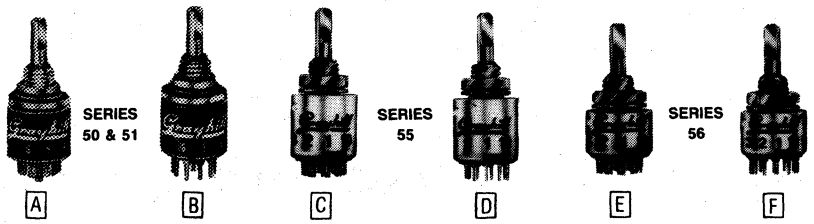
Grayhill INC. Rotary Switches

561 HILLGROVE • P.O. BOX 10373 • LA GRANGE, ILLINOIS 60525 • PHONE; (708) 354-1055

SINGLE DECK ROTARY SWITCHES

- 1/2 Inch Diameter, 200 mA Rating
- 1 to 2 Poles; 22½°, 30°, & 36° Throws
- PC, Military, and Adjustable Styles

2/3 ACTUAL SIZE



STANDARD AND MILITARY QUALIFIED SWITCHES SERIES 50 AND 51 SWITCHES — FIGS. A AND B

SERIES 50—36° (10 position), 0.5 inch diameter. Length behind panel for solder lug is 0.617. Height above board for PC mount is 0.667. Circle of terminal centers is 0.320. Rated to make and break 200 mA for 10,000 cycles (360° turn and return). Available in all listed styles except D, DP, SD, and SDP. Adjustable stops have removable stop pins. Military styles are qualified to MIL-S-3786/20.

SERIES 51 - 30° (12 position) and 22½° (16 position), 0.562 inch diameter. Circle of terminal centers is 0.382 in 30° and 0.500 in 22½°. All other dimensions and rating same as Series 50. Available in all listed styles except D, DP, SD, and SDP. Military styles are qualified to MIL-S-3786/35.

ECONOMICAL DESIGN ROTARY SWITCHES SERIES 55 — FIGS. C AND D, SERIES 56 — FIGS. E AND F

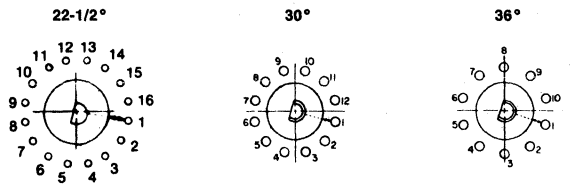
SERIES 55 — Economical version of Series 50 and 51. 36° (10 position) and 30° (12 position), 0.5 inch diameter. Length behind panel for solder lug is 0.635. Height above board for PC mount is 0.532. Circle of terminal centers are 0.340 (36°) and 0.366 (30°). Ratings same as Series 50. Available in all listed styles except military types.

SERIES 56 — Short behind panel. 36° (10 position) and 30° (12 position), 0.5 inch diameter. Length behind panel for solder lug is 0.480. Height above board for PC mount is 0.377. Circle of terminal centers same as Series 55. Ratings same as Series 50. Available in all listed styles except military types. Solder lug terminals (all styles without P).

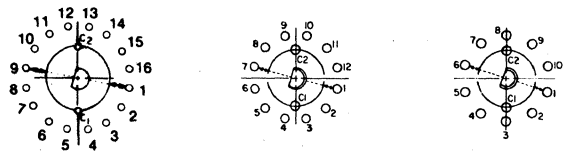
CIRCUIT DIAGRAM

Switch is viewed from shaft end and shown in position number one. For circle of terminal centers, see above. For center to center distance of common terminals, see the series and dimension below the 2-pole diagram.

ONE POLE



TWO POLE



51—.156 | 51—.156 | 50—.125
55/56—.190 | 55/56—.190

CHOICES

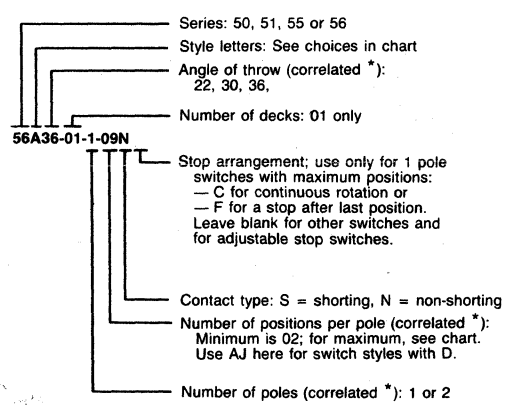
Series	Styles	Angle Of Throw	Number Of Poles	Positions Per Pole, Min.-Max.
51	A, S, P, & SP	22 1/2°	1	02 to 16
			2	02 to 08
	A, S, C, M, P, SP, CP, MP, CD, MD, CDP, & MDP	30°	1	02 to 12
			2	02 to 06
55/56	A, S, P, SP, D, SD, DP, & SDP	36°	1	02 to 12
			2	02 to 06
		30°	1	02 to 10
			2	02 to 05
50	A, S, C, M, P, SP, CP*, MP*, CD*, MD*, CDP*, & MDP*	36°	1	02 to 10
			2	02 to 05

*These styles in Series 50 (only) are not military qualified, but they are made like the military qualified switches.

STYLES

Solder Lug Terminals	PC Terminals
A = Basic Style	P = Basic Style
D = Plus Adjustable Stops	DP = Plus Adj. Stop
S = Shaft/Panel Seal	SP = Shaft/Panel Seal
SD = Seals, Adj. Stops	SDP = Seals, Adj. Stop
C = Basic Mil. Qual.	CP* = Basic Mil. Qual.
CD* = Mil. Qual., Adj. Stop	CDP* = Mil. Qual., Adj. Stop
M = Mil. Qual., Seals	MP* = Mil. Qual. Seals
MD* = Mil., Seal, Adj. Stop	MDP* = Mil., Seals, Adj. Stop

PART NUMBER FORMATION



*Parts of the number are correlated to others and must agree. For example, a 30°, 2 pole switch is limited to 06 positions per pole.

For prices and discounts, contact a local Sales Office, an authorized distributor, or GRAYHILL.

Available From Your Local GRAYHILL Distributor

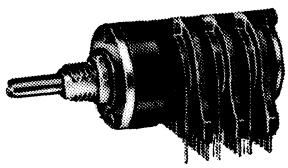
Grayhill INC.

Rotary Switches

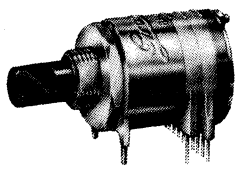
561 HILLGROVE • P.O. BOX 10373 • LA GRANGE, ILLINOIS 60525 • PHONE; (708) 354-1055

1/4 AMP ECONOMICAL ENCLOSED MULTIDECK SWITCHES – SERIES 71

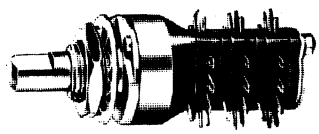
- 30° or 36° 1-3 Decks; 1 & 2 Poles
- Adjustable & MIL-S-3786 Styles
- 1/8" or 1/4" Shaft Diameter
- Solder Lug or PC Terminal
- Panel or Process Seal
- Other Types Also Available



Style AF

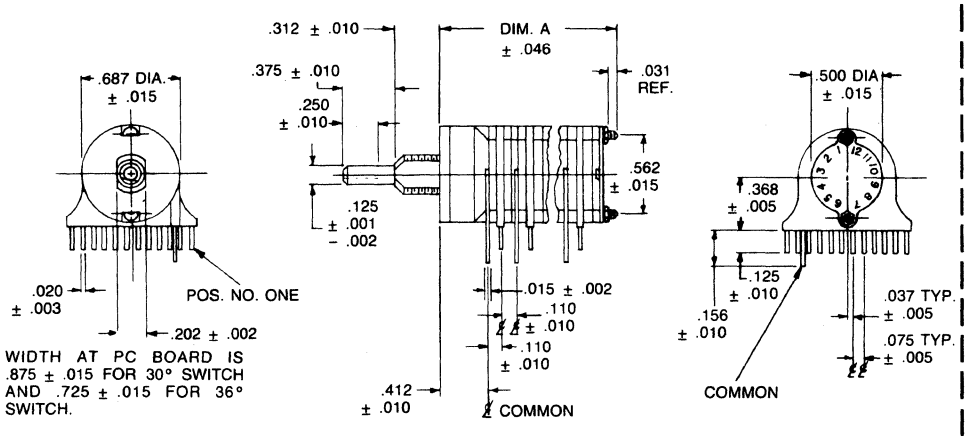


Style BT



Style B

DIMENSIONS – 71AF30 shown here; see also below.



No. Of Decks	Dim. A Standard	Dim. A Military	Dim. A Style BT
1	.761	.761	.795
2	.979	.979	1.040
3	1.197	1.415	1.285

STANDARD STYLES – STYLE LETERS A, B, F

Style A shaft is 1/8" in diameter, with a 1/4" diameter bushing; style B shaft is 1/4" in diameter with a 3/8" diameter bushing. Either style shaft may be ordered with either 30° or 36° angle of throw, with either solder lug (no style letter) or printed circuit terminals (style F).

SEALED STYLES – STYLE LETTERS S AND T

Style S is shaft and panel sealed. Shaft is sealed by an "O" ring inside the bushing; the panel, by a ring at the base of the bushing.Seals do not alter dimensions when switch is mounted.

Style T is process sealed to protect the entire switch against spray and immersion cleaning of PC boards. Style T is available only in the 1/4" shaft diameter, PC mount terminals, and fixed stops.

ADJUSTABLE STOP – STYLE LETTER D

Adjustable stop switches are standard switches with removable stop pins which the user can relocate as desired. They are available in either 30° or 36° angle of throw, with either shaft diameter, and with either solder lug or PC terminals.

MILITARY QUALIFIED STYLES – STYLE LETTER M

Style M switches are qualified to MIL-S-3786/39 and may be ordered by either the GRAYHILL part number or the M number. Military switches are available in 30° or 36° angle of throw, with either solder lug, or printed circuit terminals, in either shaft diameter. PC switches of 3 decks have a spacer deck after the second deck (see Dim. A in chart).

For prices and discounts, contact your local Sales Office, an authorized Distributor, or GRAYHILL.

Available From Your Local GRAYHILL Distributor

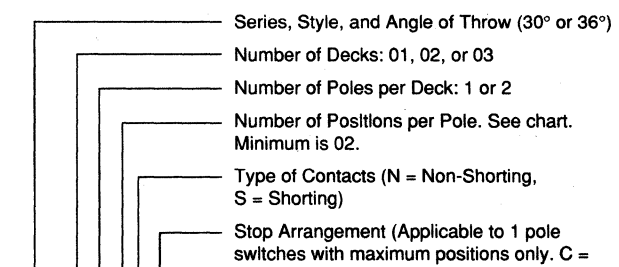
SPECIFICATIONS

RATING: Switches make and break 400 mA 30 Vdc (or 115 Vac), resistive, for 10,000 cycles (or 200 mA for 25,000 cycles); and 250 mA 30 Vdc, inductive (250 millihenries) for 10,000 cycles or 100 mA for 25,000 cycles. A cycle is a 360° rotation and a 360° return. For additional specifications, see the GRAYHILL catalog.

ORDERING INFORMATION

Style Choices By Shaft Size 1/8 Dia.	Style Choices By Shaft Size 1/4 Dia.	No. Of Decks	No. Of Poles/ Deck	Positions Per Pole, Min.-Max. 30°	Positions Per Pole, Min.-Max. 36°
A, AF, AS, ASF, AD, ADF, MA, MF, MAS, MASF	B, BF, BS, ASF, BD, BDF, BT, MB, MBF, MBS, MBSF	01	1	02 - 12	02 - 10
			2	02 - 06	02 - 05
		02	1	02 - 12	02 - 10
			2	02 - 06	02 - 05
		03	1	02 - 12	02 - 10
			2	02 - 06	02 - 05

PART NUMBER FORMATION



Grayhill INC.
561 HILLGROVE • P.O. BOX 10373 • LA GRANGE, ILLINOIS 60525 • PHONE; (708) 354-1055

Rotary Switches

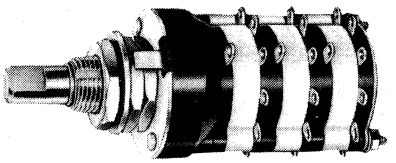
1 AMP MULTIDECK ROTARY SWITCHES — SERIES 42 AND 44

SHOWN HERE

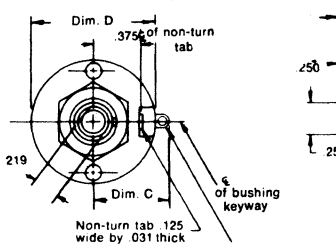
- 30° or 36° Throws
- 1-3 Decks; 1 & 2 Poles
- Solder Lug Style, Fixed Or Adjustable Stops

ALSO AVAILABLE *

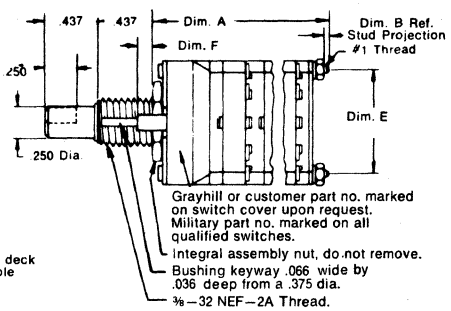
- 45°, 60°, and 90° Throws
- To 12 Decks; to 6 Poles
- PC Mount, Military, Sealed, Concentric Shaft, Add-A-Pot, and UL Recognized Styles



DIMENSIONS

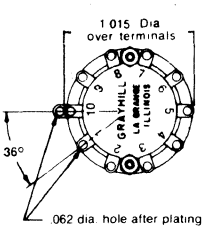


Common locations for a single pole per deck switch. For common location on multipole switches see circuit diagram.



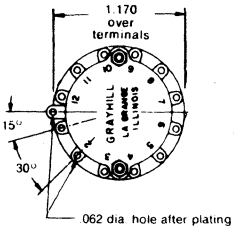
Two mounting nuts are included. Dimension A is 1.025 for 1 deck, 1.371 for 2 decks, and 1.717 for 3 decks. Dimension B is .062 for 1 to 5 decks.

36° ANGLE OF THROW



SERIES 42

30° ANGLE OF THROW



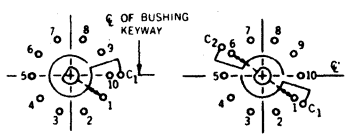
SERIES 44

Dimensions	C	D	E	F
SERIES 42	.562	1,000	.830	.093
SERIES 44	.642	1,162	1.000	.121

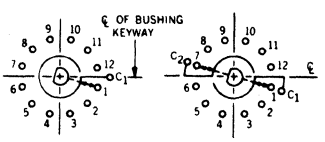
CIRCUIT DIAGRAMS

Shaft flat is opposite contact for first pole.

36° ANGLE OF THROW

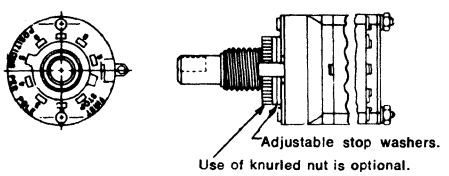


30° ANGLE OF THROW



ADJUSTABLE STOPS

Adjustable stop switches permit the user to externally set the switch stops which limit the rotation, by removing and relocating the stop washers. The panel or a knurled nut holds the washers in place. All other parts are the same as shown above.



Available From Your Local GRAYHILL Distributor

SPECIFICATION

Switches are rated to carry 10A, and to make and break the designated loads for 25,000 cycles (360° cw and 360° ccw) of operation. Resistive loads are 1A, 115 Vac: 1A, 6-28 Vdc; and 100 mA, 115 Vdc. Inductive loads are 250 mA, 115 Vac; 100 mA, 6-28 Vdc, and 20 mA, 115 Vdc.

Contact resistance is 200 milliohms maximum after life. Insulation resistance is 50,000 megohms minimum initially. Voltage breakdown is 2,000 Vac, initially and 500 Vac minimum after environmental tests. Stop-strength is 15 pound-inches minimum for fixed stop switches; 12 pound-inches for adjustable stop. Shorting or non-shorting, wiping contacts have over 150 grams of contact force.

ALSO AVAILABLE

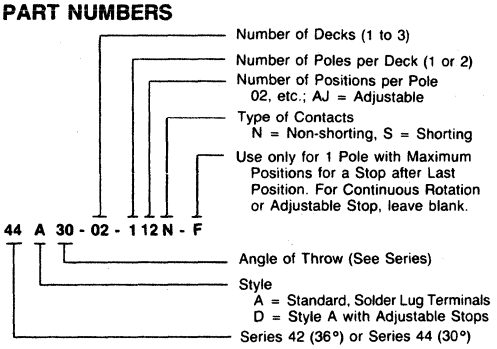
For other angles of throw; 3 to 6 poles per deck; concentric shaft or PC styles, consult GRAYHILL catalog for complete engineering information and drawings, or contact your local sales office.

SELECTION AND ORDERING INFORMATION

Series Angle Of Throw	Styles	No. Of Decks	Poles Per Deck	No. Of Positions Per Pole
42 36°	A = Standard S = Standard, Shaft/Panel Seal H = Military Qualified 125°C HS = Military Qualified, S/P Seal M = Military Qualified 85° UA = UL Recognized US = UL Recognized, S/P Seal D = Adjustable Stops UD = Adj. Stops, UL Recognized	01-12	1	02-10
			2	02-05
44 30°			1	02-12
			2	02-06

Adjustable stop switches and some fixed stop switches are available from your local GRAYHILL Distributor.

PART NUMBERS



For prices and discounts, contact your local Sales Office, an authorized Distributor, or GRAYHILL.

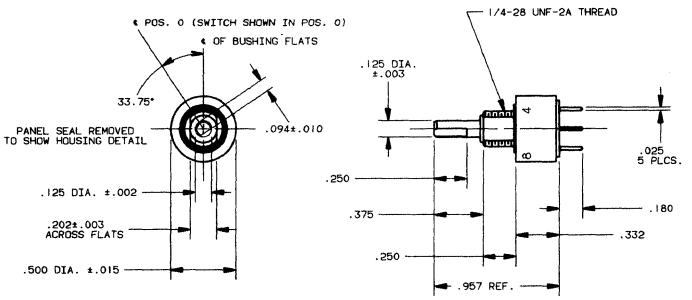
Coded Rotary Switches

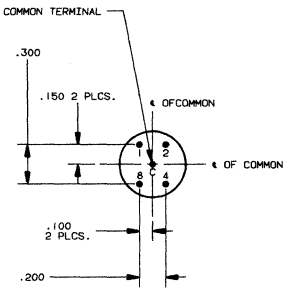
Grayhill INC. 561 HILLGROVE • P.O. BOX 10373 • LA GRANGE, ILLINOIS 60525 • PHONE; (708) 354-1055

1/2" BINARY CODED (HEXADECIMAL) SWITCH–SERIES 26

• Shaft and Panel Seal • 1 Pole, 2-16 Positions, Adjustable

Part Number
26ASD22-01-1-AJN





UNLESS OTHERWISE SPECIFIED TOLERANCES ARE ±.015

GENERAL SPECIFICATIONS

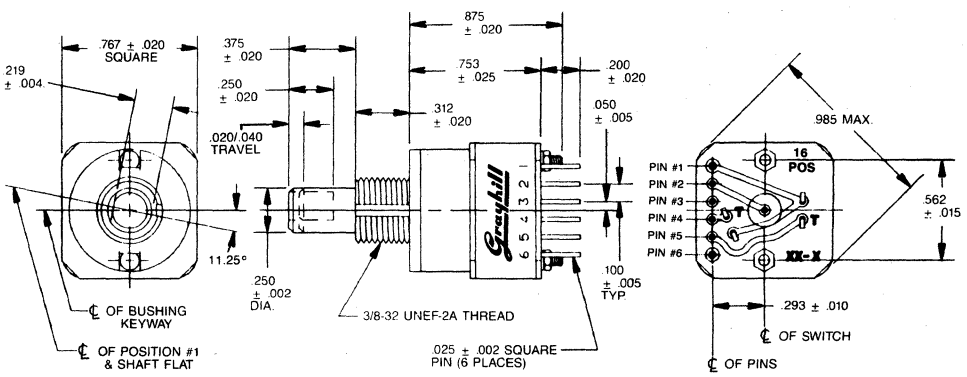
Rated to make and break logic compatible loads for 25,000 operations; a cycle is 360° cw and 360° ccw. Terminals are marked on the switch. All switches have all terminals, regardless of the number of active positions. Shaft flat faces active position.

ADJUSTABLE STOPS

The switch may have continuous rotation, or be adjusted to limit the rotation. The panel seal ring can be removed to expose the stop pin holes on the front of the switch. Two stop pins are supplied with the switch. One or both may be used to limit the rotation as desired.

OPTICALLY COUPLED ROTARY ENCODER SWITCH–SERIES 61

• Economical Touchscreen Alternative • 1-Hand Control of Cursor and Entry



GENERAL SPECIFICATIONS

Available in Quadrature 2 Bit Code (Q2B) or 2 Bit Counting Code (2BC) with (W) or without (WO) optional pushbutton entry switch. Pushbutton is actuated by pushing in on the shaft. Encoder is rated at 4-6 VDC, 30 mA maximum for more than 1 million cycles (cycle = 360° cw and 360° ccw). Logic low is .5 V maximum; logic high is 3.8 V minimum. Terminal locations are as follows:

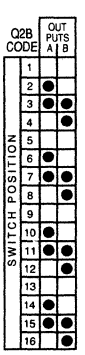
1=Ground 4=Output B
5= Output A 6-5V Supply
2 & 3=Optional Pushbutton Switch

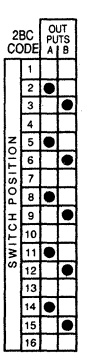
TRUTH TABLES

Output as related to pin locations is shown at right. For additional wiring diagrams, see Grayhill catalog.

ORDERING INFORMATION

Positions	Push-button	Code	Part No.
16	WO	Q2B	**61B22-01-01**
16	W	Q2B	**61B22-01-02**
24	WO	Q2B	**61B15-01-01**
24	W	Q2B	**61B15-01-02**
24	WO	Q2B	**61B15-01-01**
24	WO	Q2B	**61B15-01-01**





For additional variations, contact Grayhill.

For prices and discounts of the items on this page, contact a local Sales Office, an authorized local Distributor, or Grayhill.

Available through your local Grayhill Distributor

GRIMES MAKES GENUINE AMERICAN-MADE SWITCHES FOR JUST ~~95¢~~ 19¢* no matter how many you buy... NO ONE ELSE DOES.

Grimes makes low-profile keyboard switches with just 5 moving parts for greater reliability. And Grimes gives you features like our unique bottom bearing to reduce binding and our built-in jumper to eliminate the need and expense of jumper wires or double-sided circuit boards.

*Some comparable switches are sold for up to 95¢ each in small quantities, reducing in price to 25¢ each on orders of 100,000 or more. Our switches are 19¢ regardless of quantity.

SPECIFICATIONS SPST LOW PROFILE SWITCH WITH TACTILE FEEL.

Switch Contacts

Contact Arrangement	Single pole, single position, non-lock release with built in jumpers. Closed Contact Resistance Less than 4 ohms measured at 1 mA, 5VDC.
Contact Material	Gold plated at contact points.
Open Contact Resistance	Greater than 50M ohms measured at less than 5VDC.
Contact Bounce Time	Less than 5mSEC, make or break with normal finger activation (1mSEC typical.)
Dielectric Strength	Will withstand 110 VAC for 1 minute. without breakdown or other defects.
Total Switch Travel	Greater than .115 inch, less than .130 inch.
Contact Terminals	Four (4) solder pin terminals per switch contact form internal jumpers. Terminals are of phosphor bronze alloy solder plated. Terminals will withstand two completely reversed 90 degree bends before breakage.
Switch Mounting	Switch is self retaining by snap action of two of the four contact posts in a .062 thick PCB, before soldering. Switch withstands flow soldering at 500 degrees F without masking. Locating posts provide positive rotational positioning when soldering the four terminals to the PC board.
Maximum Switched Voltage	50 VDC.
Maximum Switched Current	10 mA
Maximum Switched Power	50 mW resistive

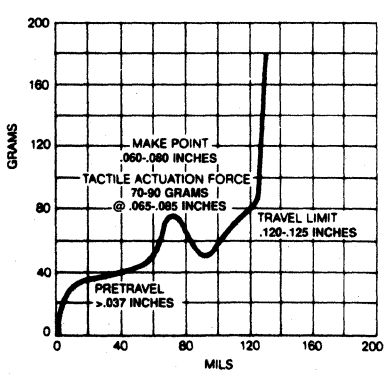
Mechanical Specifications

Actuation/Travel Force	See graph below.
Preload	Greater than 22 grams, less than 42 grams.
Pretravel	Greater than .055 inch.
Actuation Force	Greater than 70 grams, less than 90 grams.
Actuation Travel	Greater than .060 inch, less than .080 inch.
Contact Closure	Contact closure will be effected after no more than .095 inch stem travel.
Switch Life	The switch will perform satisfactorily per this electrical specification after 10×10^6 actuations while switching 1 mA.

Environmental Specifications

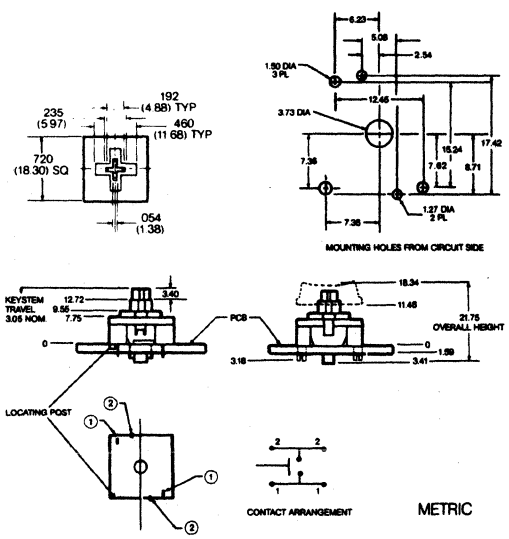
Operating Temperature Range	Greater than 0 degree C (32 degree F) less than 55 degrees C (131 degrees F).
Storage Temperature Range	Greater than −40 degrees C (−40 degrees F) less than 70 degrees C (158 degrees F)
Specification Verification Temperature Range	Greater than 15 degrees C (59 degrees F), less than 30 degrees (89 degrees F)
Humidity	Greater than 20% RH, less than 90% RH (non-condensing)
Shock	No defects in appearance or performance following a 30g shock per Mil-STD-202E, method 213 B. Test condition K (30g. 11ms 1/2 sine, 3 axis).
Vibration	No defects in appearance or performance following a random vibration test conducted per Mil-STD-202E method 214 test condition A (5.23g, 15 min, 3 axis).
Thermal Cycle	No defects in appearance following 8 thermal cycles between −40 degrees C and 65 degrees C per attached cycle graph.
Ozone	No defects in appearance or performance following a 250 hour exposure to 2.5 PPM ozone at 95% RH.
Hydrogen Sulfide	No defects in appearance or performance following 250 hour exposure to 25 PPM H_2S. The first two hundred hours at 95% RH and the final 50 at not greater than 50% HR.

Force vs. switch stem travel curve



FREE SAMPLES AVAILABLE.

General layout and dimensions.



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REED SWITCHES

HAMLIN

HAMLIN INC.
612 East Lake Street
Lake Mills, WI 53551
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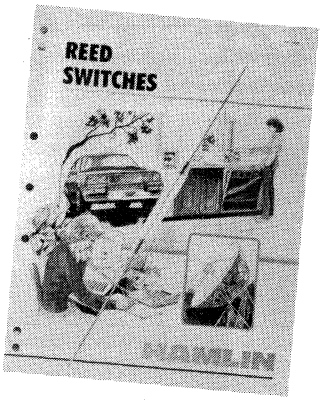
Dry and mercury wetted magnetic reed switches are precision created for reliable operation under the most critical conditions. These switches are hermetically sealed for safe dependable use in any atmosphere and are unaffected by high or low temperatures or pressure.

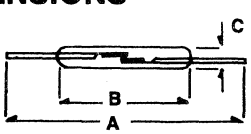
For detailed product information send for the Hamlin Reed Switch Catalog. The catalog provides complete information regarding specifications, dimensions, theory of operation, magnetic actuators, and reed switch application data.



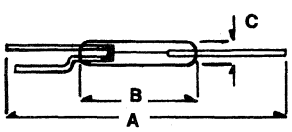
SWITCH MODEL NUMBER	FORM	DIM.* CODE	MAX. DC RATING	MAX. SWITCH AMPS.	MAX. DC VOLTS	A.T. PULL-IN RANGE	SPECIAL FEATURES	SWITCH LIST PRICE		ACTUATOR MAGNET	MAGNET LIST PRICE
MINIATURE MAGNETIC REED SWITCHES											
MINI-2S-115	A	1	3W	0.250	150	7-22	Miniature Size	1.39		H-31	.80
MDRR-6-185	A	2	10W	0.500	300	12-42	High Voltage Hold-off	1.01		H-33	1.24
MDRR-4-185	A	2	10W	0.500	200	12-37	Small Size	.95		H-33	1.24
MDSR-4-185	A	3	10W	0.500	200	12-37	.090" Dia.	.95		H-33	1.24
MLSR-4-185	A	2	20W	1.000	200	17-47	High Inrush	1.32		H-33	1.24
MLRR-2-185	A	4	20W	1.000	200	17-47	High Inrush	1.32		H-33	1.24
MARR-2-185	A	4	10W	0.750	200	12-52	Hi-Rel	.95		H-33	1.24
MARR-8-185	A	4	10W	0.500	300	22-62	High Voltage	1.07		H-33	1.24
MARR-5-196	A	4	10W	0.500	1000	22-52	Breakdown 1500 Volts	3.60		H-33	1.24
MRT-2-276	A	5	50W	1.500	180	37-62	High Current	2.14		H-33	1.24
MRG-DT-175	C	9	3W	0.250	175	15-40	Mod. Current & Voltage	3.47		H-33	1.24
MDRR-DT-175	C	8	3W	0.250	175	15-40	Small Size	3.15		H-33	1.24
STANDARD SIZE MAGNETIC REED SWITCHES											
DRR-DTH-445	C	10	30W	0.500	250	40-100	High Breakdown	5.74		H-32	2.76
DRT-DTH-445	C	10	50W	1.5	500	40-100	Inductive Loads	7.34		H-34	3.48
HIGH CURRENT MAGNETIC REED SWITCHES											
DRR-129-425	A	11	100W	3	400	52-102	High Current	3.59		H-34	3.48
MERCURY WETTED MAGNETIC REED SWITCHES											
MDC-1-387	A	6	50W	2	500	35-65	Mercury Wet	5.36		H-33	1.24
MDC-3-328	A	7	50W	2	500	35-65	Mercury Wet	6.93		H-33	1.24

SWITCH DIMENSIONS

FORM A



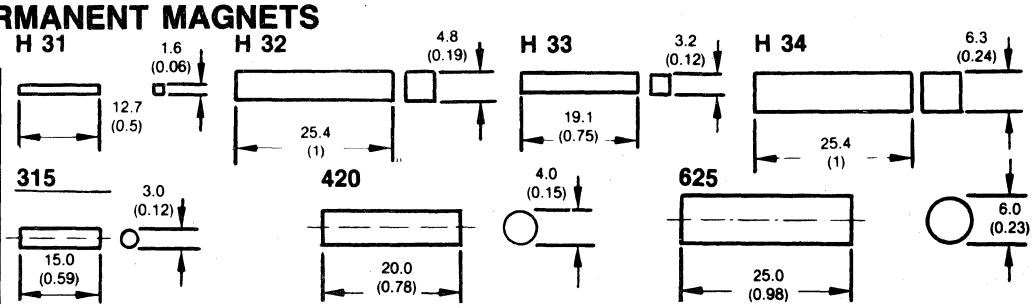
FORM C



* DIMENSION CODE		1	2	3	4	5	6	7	8	9	10	11
A OVERALL LENGTH NOMINAL	INCH	1.235	1.590	1.590	2.230	2.230	2.250	1.580	2.066	2.125	3.375	3.250
	MM	31.36	40.38	40.38	56.64	56.64	57.15	40.13	52.47	53.97	85.72	82.55
B GLASS LENGTH MAX.	INCH	0.500	0.600	0.600	0.800	0.800	0.610	0.550	0.580	0.610	1.562	2.000
	MM	12.70	15.24	15.24	20.32	20.32	15.49	13.97	14.73	15.49	39.67	50.80
C GLASS DIAMETER MAX.	INCH	0.070	0.105	0.090	0.105	0.130	0.130	0.100	0.105	0.130	0.218	0.207
	MM	1.78	2.660	2.280	2.660	3.300	3.300	2.540	2.660	3.300	5.54	5.250

ALNICO V PERMANENT MAGNETS

MAGNET TYPE	PRICE 1-24
H-31	.80
H-32	2.76
H-33	1.24
H-34	3.48
315	.92
420	1.33
625	1.90



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OKI electric industry company, ltd.

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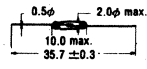
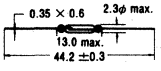
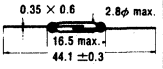
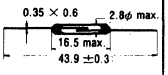
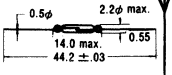
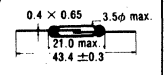
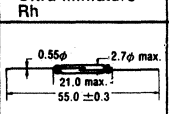
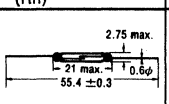
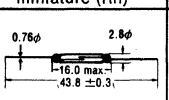
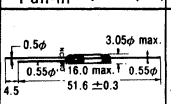
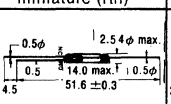
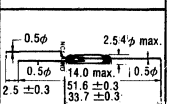
Specifications

POLYMER FREE CONTACTS

							
		ORD-211	**ORD-221**	**ORD-225**	**ORD-226**	**ORD-228**	**ORD-234**
Electrical Characteristics	Contact	1A	1A (offset)	1A	1A RLS/OP >0.8	1A	1A
	Contact resist. (Initial) [mΩ]	150 max.	150 max.	150 max.	150 max.	150 max.	150 max.
	Breakdown voltage [DCV]	150 min.	200 min.	250 min.	150 min.	200 min.	300 min.
	Insulation resistance [Ω]	10^9 min.	10^9 min.	10^{10} min.	10^9 min.	10^9 min.	10^{10} min.
	Electrostatic cap. [PF]	0.2 max.	0.3 max.	0.3 max.	0.3 max.	0.3 max.	0.5 max.
	Contact capacity [VA]	1.0	10	10	10	10	10
	Max. conductive curr. [A]	0.3	1.0	1.0	0.5	1.0	2.0
	Max. voltage [V]	24	100	100	100	100	200
Oper. Characteristics	Operate time [ms]	0.3 max.	0.3 max.	0.4 max.	0.3 max.	0.3 max.	0.5 max.
	Bounce time [ms]	0.3 max.	0.3 max.	0.4 max.	1.0 max.	0.3 max.	0.5 max.
	Release time [ms]	0.05 max.	0.05 max.	0.05 max.	0.1 max.	0.05 max.	0.05 max.
	Resonant frequency [Hz]	8600 ±500	2750 ±250	3700 ±300	4200 ±200	5300 ±300	2200 ±300
	Max operating freq. [Hz]	500	500	500	500	500	500
Standard Coil	Coil resistance [Ω]	600	450	450	450	450	500
	No. of turns [T]	5000	5000	5000	5000	5000	5000
	Dimensions [mm]	2.0 x 10	2.9 x 15	2.9 x 15	2.9 x 15	2.9 x 15	3.6 x 20
	Type No.	8	6	6	6	6	3
Features (Contact material)		Ultra-miniature Rh	Miniature offset (Rh)	General purpose miniature (Rh)	Drop-out >0.8 (Rh) Pull-in	General purpose miniature (Rh)	Long life (Rh)
							
		ORD-229	**ORD-2210**	**ORD-2211**	**ORT-233**	**ORT-551**	**ORT-551-1**
Electrical Characteristics	Contact	1A	1A	1A	1C	1C	1C
	Contact resist. (Initial) [mΩ]	150 max.	150 max.	100 max.	150 max.	150 max.	150 max.
	Breakdown voltage [DCV]	700 min.	300 min.	200 min.	200 min.	200 min.	200 min.
	Insulation resistance [Ω]	10^{10} min.	10^{10} min.	10^9	10^9 min.	10^9 min.	10^9 min.
	Electrostatic cap. [PF]	0.2 max.	0.5 max.	0.3 max.	1.5 max.		
	Contact capacity [VA]	20	70	30W max.	3	3	3
	Max. conductive curr. [A]	2.0	2.5	0.5; in-rush 3	0.5	0.5	0.5
	Max. voltage [V]	250	100	100	30	30	30
Operating Characteristics	Operate time [ms]	0.5 max.	0.5 max.	0.6 max.	1.0 max.	1.0 max.	1.0 max.
	Bounce time [ms]	0.5 max.	0.5 max.	0.4 max.	(NC) 1.0 max. (NO) 1.5 max.	(NC) 1.5 max. (NO) 1.0 max.	(NC) 1.5 max. (NO) 1.0 max.
	Release time [ms]	0.1 max.	0.1 max.	0.05 max.	0.5 max.	0.5 max.	0.5 max.
	Resonant frequency [Hz]	2200 ±300	2350 ±250	4600 ±500	6000 ±4000		
	Max. operating freq. [Hz]	500	500	500	200		
Standard Coil	Coil resistance [Ω]	500	500	450	570		
	No. of turns [T]	5000	5000	5000	5000		
	Dimensions [mm]	2.8 x 18	3.6 x 20	2.9 x 15	3.6 x 10		
	Type No.	7	3	6	10		
Features (Contact material)		High breakdown voltage (Rh)	High power (Rh)	High inrush	Miniature transfer (Rh)	Ultra Miniature transfer (Rh)	Ultra Miniature transfer (Rh)

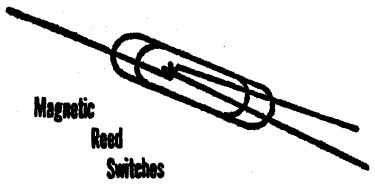
For a comprehensive engineering Reed Switch Catalog, contact factory. **(Also Available in Ruthenium.)**

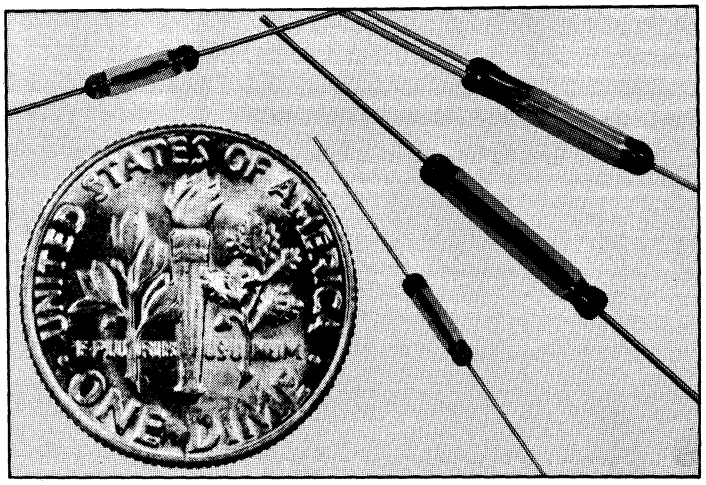
High Reliability Supported by Unique Technology.

Flux Scanning Method:

In spite of severe control of the sealing process, there is a slight probability that foreign matter such as magnetic particles may enter the glass. After extensive study in the detection of micro impurities, OKI has adopted the highly reliable flux scanning method. In flux scanning, external magnetism is moved so that foreign matter near the reed is forced to jump to the contact part. The contact resistance then measured is used as the standard for the selection of characteristics. We have thus succeeded in remarkably improving the reliability of reed switches by replacing conventional visual checking with the latest flux scanning method.

HERMETIC SWITCH





REED SWITCHES

FROM THE WORLD'S SMALLEST THROUGH THE INDUSTRY'S MOST POWERFUL

Model	Form	Max D C. Watts	Max D C. Amps	Max D C. Volts	Stock Amp-Turn Pull-In Range	Overall Length Inches	Max Glass Dia. Inches	Max Glass Length Inches	Special Features
MICRO-MINIATURE									
HSR-003	A	.01	.01	10	5-25	1.050	.055	.210	AVAILABLE IN HI-REL AND COMMERCIAL GRADES
HSR-042	A	0.3	.01	100	10-35	1.850	.090	.370	
HSR-370	C	3	.10	28	15-35	1.490	.072	.485	
MINIATURE									
HSR-1015RF	A	10	.5	200	40	2.090	.101	.800	STANDARD OR RADIO FREQUENCY CONTACT PREPARATION
HSR-1017	A	12	.5	200	15-40	2.190	.115	.850	
HSR-520	C	3	.25	100	15-40	2.000	.125	.600	
STANDARD									
HSR-190	A	15	1.0	250	40-80	3.230	.210	2.100	FULL SIZE — ECONOMICAL
HSR-780	A	25	1.5	1500	60-100	3.200	.215	2.000	
HSR-630	C	25	1.0	200	40-80	3.390	.210	1.300	
HIGH POWER									
HSR-134	A	100	3.0	100	60-100	3.390	.210	1.300	POWER SWITCHING IN 100 TO 200 WATT RANGE
HSR-V205	A	200	3.0	2500	100-150	3.230	.210	2.100	
HSR-834	C	100	3.0	500	60-100	3.390	.210	1.300	
HIGH VOLTAGE									
HSR-790	A	50	2.5	1000	60-100	3.230	.215	2.000	UP TO 10,000 VDC DIELECTRIC
HSR-V7K	A	50	3.0	5000	60-125	3.230	.210	2.100	
HSR-V10K	A	50	3.0	7500	100-150	3.230	.210	2.100	

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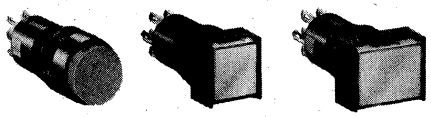
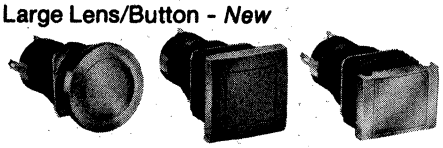
A SERIES PUSHBUTTONS

Standard Lens/Button



Round Square Rectangular

Large Lens/Button - *New*



Round Square Rectangular

FEATURES

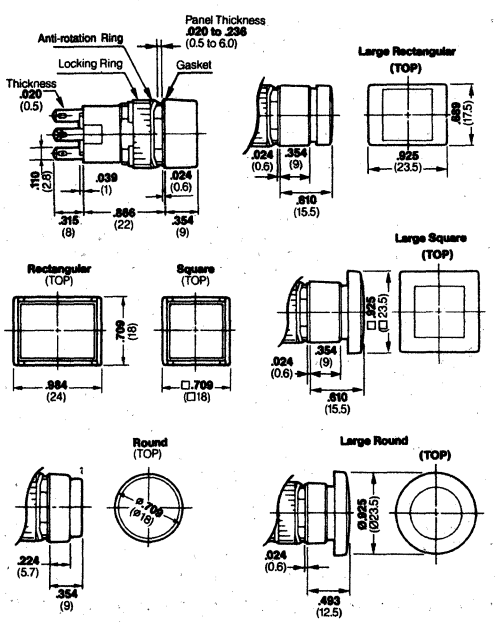
- Compact size—Ø.630 inch (Ø16 mm)
- Super bright LED or incandescent illumination
- Switching from 3 amps maximum down to 1mA AC/DC, 5V
- Enclosed 1P40 or oiltight IP65 construction
- SPDT and DPDT form C contact configuration
- Momentary switch action (alternate action available)

SPECIFICATIONS & CONTACT RATINGS

Contact Resistance: 50mΩ maximum (initial value)
Insulation Resistance: 100MΩ minimum (500V DC megger)
Dielectric Strength: 2,000V AC, 1 minute
Service Life (Mechanical): Momentary action type: 1,000,000 operations min.
Degrees of Protection: IP40: Enclosed type
IP65: Waterproof/Oiltight type
Contact Configuration: SPDT, DPDT
Contact Ratings: 3 amp, 250V AC/DC maximum
1mA, AC/DC 5V, minimum
Contact Material: Gold-clad silver

DIMENSIONS

Dimensions in **inches** (mm)



ILLUMINATED—LED TYPE (MOMENTARY ACTION)

Shape	Operating Voltage	Contact	Type No. Enclosed Type (IP40) Standard Lens	Type No. Enclosed Type (IP40) Large Lens	Type No. Oiltight Type (IP65) Standard Lens	Type No. Oiltight Type (IP65) Large Lens
Round	6V DC ±5%	SPDT	AL6M-M12·*	AL6M-M12M·*	AL6M-M12P·*	AL6M-M12PM·*
		DPDT	AL6M-M22·*	AL6M-M22M·*	AL6M-M22P·*	AL6M-M22PM·*
	12V DC ±10%	SPDT	AL6M-M13·*	AL6M-M13M·*	AL6M-M13P·*	AL6M-M13PM·*
		DPDT	AL6M-M23·*	AL6M-M23M·*	AL6M-M23P·*	AL6M-M23PM·*
	24V DC ±10%	SPDT	AL6M-M14·*	AL6M-M14M·*	AL6M-M14P·*	AL6M-M14PM·*
		DPDT	AL6M-M24·*	AL6M-M24M·*	AL6M-M24P·*	AL6M-M24PM·*
Square	6V DC ±5%	SPDT	AL6Q-M12·*	AL6Q-M12Q·*	AL6Q-M12P·*	AL6Q-M12PQ·*
		DPDT	AL6Q-M22·*	AL6Q-M22Q·*	AL6Q-M22P·*	AL6Q-M22PQ·*
	12V DC ±10%	SPDT	AL6Q-M13·*	AL6Q-M13Q·*	AL6Q-M13P·*	AL6Q-M13PQ·*
		DPDT	AL6Q-M23·*	AL6Q-M23Q·*	AL6Q-M23P·*	AL6Q-M23PQ·*
	24V DC ±10%	SPDT	AL6Q-M14·*	AL6Q-M14Q·*	AL6Q-M14P·*	AL6Q-M14PQ·*
		DPDT	AL6Q-M24·*	AL6Q-M24Q·*	AL6Q-M24P·*	AL6Q-M24PQ·*
Rectangular	6V DC ±5%	SPDT	AL6H-M12·*	AL6H-M12H·*	AL6H-M12P·*	AL6H-M12PH·*
		DPDT	AL6H-M22·*	AL6H-M22H·*	AL6H-M22P·*	AL6H-M22PH·*
	12V DC ±10%	SPDT	AL6H-M13·*	AL6H-M13H·*	AL6H-M13P·*	AL6H-M13PH·*
		DPDT	AL6H-M23·*	AL6H-M23H·*	AL6H-M23P·*	AL6H-M23PH·*
	24V DC ±10%	SPDT	AL6H-M14·*	AL6H-M14H·*	AL6H-M14P·*	AL6H-M14PH·*
		DPDT	AL6H-M24·*	AL6H-M24H·*	AL6H-M24P·*	AL6H-M24PH·*

Voltage/Current Ratings: 6VDC: 6VDC/20mA
LED Lamp 12VDC: 12VDC/13mA
24VDC: 24VDC/10mA

Ordering Notes: *Specify lens color codes:
R—Red A—Amber
G—Green Y—Yellow
W—White

ILLUMINATED—INCANDESCENT TYPE (MOMENTARY ACTION)

Shape	Operating Voltage	Contact	Type No. Enclosed Type (IP40) Standard Lens	Type No. Enclosed Type (IP40) Large Lens	Type No. Oiltight Type (IP65) Standard Lens	Type No. Oiltight Type (IP65) Large Lens
Round	5V AC/DC ± 5%	SPDT	AL6M-M15·*	AL6M-M15M·*	AL6M-M15P·*	AL6M-M15PM·*
		DPDT	AL6M-M25·*	AL6M-M25M·*	AL6M-M25P·*	AL6M-M25PM·*
	12V AC/DC ± 10%	SPDT	AL6M-M16·*	AL6M-M16M·*	AL6M-M16P·*	AL6M-M16PM·*
		DPDT	AL6M-M26·*	AL6M-M26M·*	AL6M-M26P·*	AL6M-M26PM·*
	24V AC/DC ± 10%	SPDT	AL6M-M17·*	AL6M-M17M·*	AL6M-M17P·*	AL6M-M17PM·*
		DPDT	AL6M-M27·*	AL6M-M27M·*	AL6M-M27P·*	AL6M-M27PM·*
Square	5V AC/DC ± 5%	SPDT	AL6Q-M15·*	AL6Q-M15Q·*	AL6Q-M15P·*	AL6Q-M15PQ·*
		DPDT	AL6Q-M25·*	AL6Q-M25Q·*	AL6Q-M25P·*	AL6Q-M25PQ·*
	12V AC/DC ± 10%	SPDT	AL6Q-M16·*	AL6Q-M16Q·*	AL6Q-M16P·*	AL6Q-M16PQ·*
		DPDT	AL6Q-M26·*	AL6Q-M26Q·*	AL6Q-M26P·*	AL6Q-M26PQ·*
	24V AC/DC ± 10%	SPDT	AL6Q-M17·*	AL6Q-M17Q·*	AL6Q-M17P·*	AL6Q-M17PQ·*
		DPDT	AL6Q-M27·*	AL6Q-M27Q·*	AL6Q-M27P·*	AL6Q-M27PQ·*
Rectangular	5V AC/DC ± 5%	SPDT	AL6H-M15·*	AL6Q-M15H·*	AL6H-M15P·*	AL6Q-M15PH·*
		DPDT	AL6H-M25·*	AL6Q-M25H·*	AL6H-M25P·*	AL6Q-M25PH·*
	12V AC/DC ± 10%	SPDT	AL6H-M16·*	AL6Q-M16H·*	AL6H-M16P·*	AL6Q-M16PH·*
		DPDT	AL6H-M26·*	AL6Q-M26H·*	AL6H-M26P·*	AL6Q-M26PH·*
	24V AC/DC ± 10%	SPDT	AL6H-M17·*	AL6Q-M17H·*	AL6H-M17P·*	AL6Q-M17PH·*
		DPDT	AL6H-M27·*	AL6Q-M27H·*	AL6H-M27P·*	AL6Q-M27PH·*

Voltage/Current Ratings: 5V AC/DC: 6V(AC/DC)/70mA
Incandescent Lamp 12V AC/DC: 12V(AC/DC)/37mA
24V AC/DC: 24V(AC/DC)/24mA

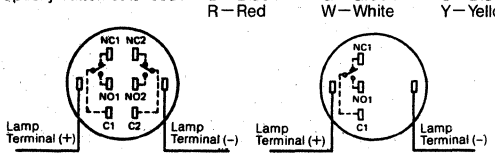
Ordering Notes: *Specify lens color code:
R—Red A—Amber
G—Green S—Blue
W—White

NON-ILLUMINATED (MOMENTARY ACTION)

Shape	Contact	Type No. Enclosed Type (IP40) Standard Button	Type No. Enclosed Type (IP40) Large Button	Type No. Oiltight Type (IP65) Standard Button	Type No. Oiltight Type (IP65) Large Button
Round	SPDT	AB6M-M1·*	AB6M-M1M·*	AB6M-M1P·*	AB6M-M1PM·*
	DPDT	AB6M-M2·*	AB6M-M2M·*	AB6M-M2P·*	AB6M-M2PM·*
Square	SPDT	AB6Q-M1·*	AB6Q-M1Q·*	AB6Q-M1P·*	AB6Q-M1PQ·*
	DPDT	AB6Q-M2·*	AB6Q-M2Q·*	AB6Q-M2P·*	AB6Q-M2PQ·*
Rectangular	SPDT	AB6H-M1·*	AB6H-M1H·*	AB6H-M1P·*	AB6H-M1PH·*
	DPDT	AB6H-M2·*	AB6H-M2H·*	AB6H-M2P·*	AB6H-M2PH·*

Ordering Notes: *Specify button color code: B—Black G—Green S—Blue
R—Red W—White Y—Yellow

TERMINAL ARRANGEMENT



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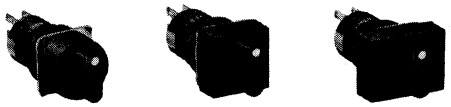
A SERIES SELECTOR SWITCHES

Knob Type Selector Switches - *New*



Round Square Rectangular

Key Lock Selector Switches - *New*

Round Square Rectangular

FEATURES

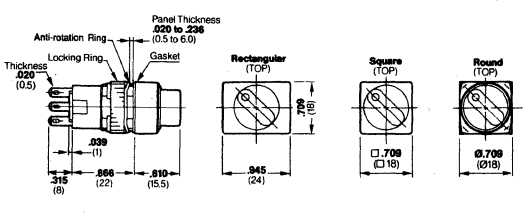
- Compact size—Ø.630 inch (Ø16mm)
- Knob and Key lock type selector switches available in 2 and 3-position
- Switching from 3 amps maximum down to 1mA AC/DC, 5V
- Enclosed IP40 or oiltight IP65 construction
- SPDT and DPDT form C contact configuration

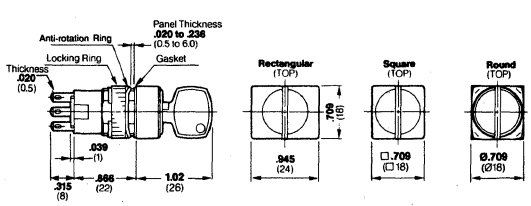
SPECIFICATIONS & CONTACT RATINGS

Contact Resistance: 50mΩ maximum (initial value)
Insulation Resistance: 100MΩ minimum (500V DC megger)
Dielectric Strength: 2,000V AC, 1 minute
Service Life (Mechanical): 250,000 operations min.
Degrees of Protection: IP40: Enclosed type
IP65: Waterproof/Oiltight type
Contact Configuration: SPDT, DPDT
Contact Ratings: 3 amp, 250V AC/DC maximum
1mA, AC/DC 5V, minimum
Contact Material: Gold-clad silver

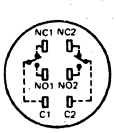
DIMENSIONS

Dimensions in **inches** (mm)





TERMINAL ARRANGEMENT



2- & 3-POSITION SELECTOR SWITCHES

Shape	Position	Contact Position (TOP) Left	Center	Right	Contact	Type No. Enclosed Type (IP44)	Oiltight Type (IP65)
Round	L R 2-Position Maintained	NO NC		NO NC	SPDT	AS6M-2Y1	AS6M-2Y1P
		Left Contact NO NC		Right Contact NO NC	DPDT	AS6M-2Y2	AS6M-2Y2P
	L C R 3-Position Maintained	Left Contact NO NC	Left Contact NO NC / Right Contact NO NC	Right Contact NO NC	DPDT	AS6M-3Y2	AS6M-3Y2P
Square	L R 2-Position Maintained	NO NC		NO NC	SPDT	AS6Q-2Y1	AS6Q-2Y1P
		Left Contact NO NC		Right Contact NO NC	DPDT	AS6Q-2Y2	AS6Q-2Y2P
	L C R 3-Position Maintained	Left Contact NO NC	Left Contact NO NC / Right Contact NO NC	Right Contact NO NC	DPDT	AS6Q-3Y2	AS6Q-3Y2P
Rectangular	L R 2-Position Maintained	NO NC		NO NC	SPDT	AS6H-2Y1	AS6H-2Y1P
		Left Contact NO NC		Right Contact NO NC	DPDT	AS6H-2Y2	AS6H-2Y2P
	L R C 3-Position Maintained	Left Contact NO NC	Left Contact NO NC / Right Contact NO NC	Right Contact NO NC	DPDT	AS6H-3Y2	AS6H-3Y2P

2- & 3-POSITION KEY LOCK SELECTOR SWITCHES

Shape	Position	Contact Position (TOP) Left	Center	Right	Contact	Type No. Enclosed Type (IP40)	Oiltight Type (IP65)
Round	L R 2-Position Maintained	NO NC		NO NC	SPDT	AS6M-2K1(*)	AS6M-2K1P(*)
		Left Contact NO NC		Right Contact NO NC	DPDT	AS6M-2K2(*)	AS6M-2K2P(*)
	L C R 3-Position Maintained	Left Contact NO NC	Left Contact NO NC / Right Contact NO NC	Right Contact NO NC	DPDT	AS6M-3K2(*)	AS6M-3K2P(*)
Square	L R 2-Position Maintained	NO NC		NO NC	SPDT	AS6Q-2K1(*)	AS6Q-2K1P(*)
		Left Contact NO NC		Right Contact NO NC	DPDT	AS6Q-2K2(*)	AS6Q-2K2P(*)
	L C R 3-Position Maintained	Left Contact NO NC	Left Contact NO NC / Right Contact NO NC	Right Contact NO NC	DPDT	AS6Q-3K2(*)	AS6Q-3K2P(*)
Rectangular	L R 2-Position Maintained	NO NC		NO NC	SPDT	AS6H-2K1(*)	AS6H-2K1P(*)
		Left Contact NO NC		Right Contact NO NC	DPDT	AS6H-2K2(*)	AS6H-2K2P(*)
	L C R 3-Position Maintained	Left Contact NO NC	Left Contact NO NC / Right Contact NO NC	Right Contact NO NC	DPDT	AS6H-3K2(*)	AS6H-3K2P(*)

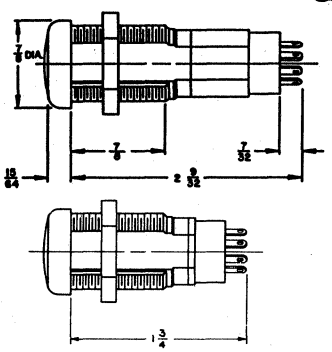
Ordering Notes: (*) Indicate Key Removeable Position Code: A—All Positions
B—Removeable Left
C—Removeable Right
D—Removeable Center

SWITCHLOCKS

Illinois Lock Company *A Division of The Eastern Co.*

LQ7

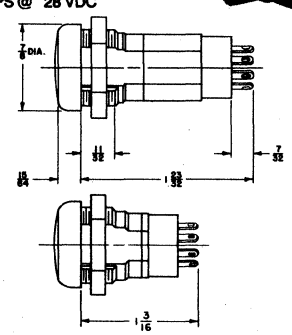
ELECTRICAL RATINGS
4 AMPS @ 125 VAC
2 AMPS @ 250 VAC
4 AMPS @ 28 VDC



STANDARD & 20KVDC ANTI-STATIC
PROTECTION ROTARY SLIDE SWITCHES

LQ9

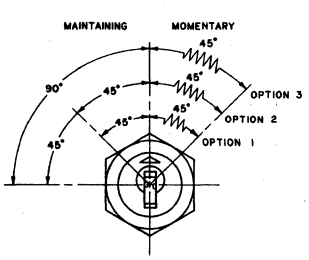
ELECTRICAL RATINGS
4 AMPS @ 125 VAC
2 AMPS @ 250 VAC
4 AMPS @ 28 VDC



STANDARD & 20KVDC ANTI-STATIC
PROTECTION ROTARY SLIDE SWITCHES

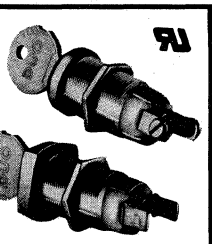
LQ14

ELECTRICAL RATINGS
4 AMPS @ 125 VAC
2 AMPS @ 250 VAC
4 AMPS @ 28 VDC

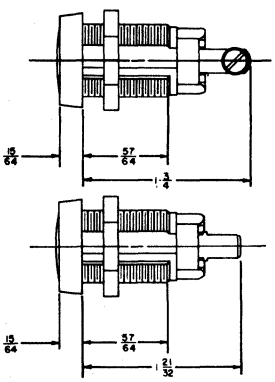


FOR LOCK DIM'S, REFER TO LQ7.

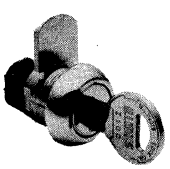
LQ1



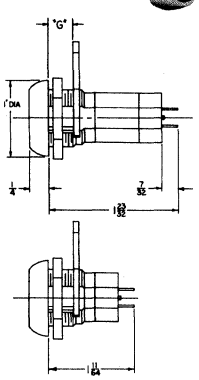
ELECTRICAL RATINGS
5 AMPS @ 115 VAC
5 AMPS @ 24 VAC



LQ20

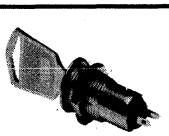


ELECTRICAL RATINGS
4 AMPS @ 125 VAC
2 AMPS @ 250 VAC
4 AMPS @ 28 VDC

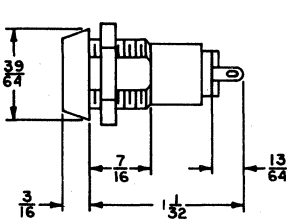


STANDARD & 20KVDC ANTI-STATIC
PROTECTION ROTARY SLIDE SWITCHES

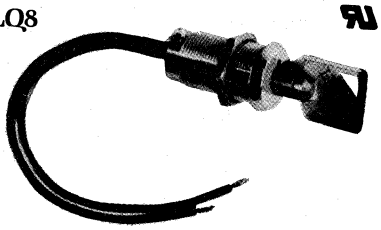
S109



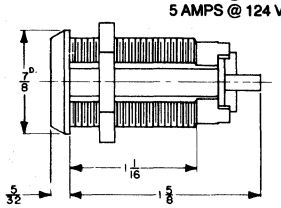
ELECTRICAL RATINGS
0.50 AMP @ 110 VAC
0.50 AMP @ 110 VDC



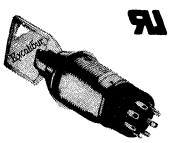
LQ8



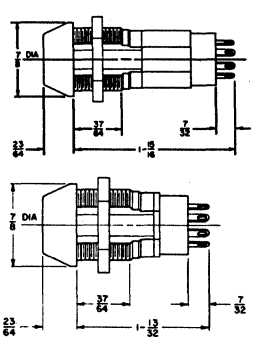
ELECTRICAL RATINGS
5 AMPS @ 120 VAC
5 AMPS @ 124 VDC



LQ13

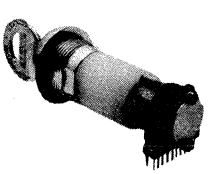


ELECTRICAL RATINGS
4 AMPS @ 125 VAC
2 AMPS @ 250 VAC
4 AMPS @ 28 VDC

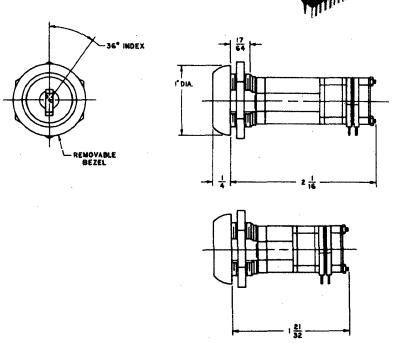


STANDARD & 20KVDC ANTI-STATIC
PROTECTION ROTARY SLIDE SWITCHES

LQ22



150 MA. @
28 VDC RESISTIVE
100 MA. @
115 VAC RESISTIVE



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SWITCHLOCKS

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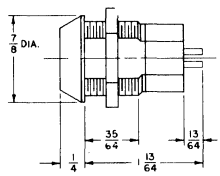
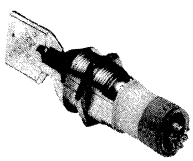
S204

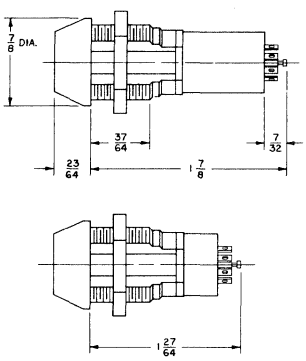
ELECTRICAL RATINGS
4 AMPS @ 125 VAC
2 AMPS @ 250 VAC
4 AMPS @ 28 VDC



LQ13CC

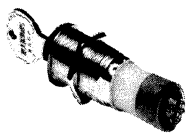


ELECTRICAL RATINGS
200 M.A. @ 28 VDC
150 M.A. @ 115 VAC

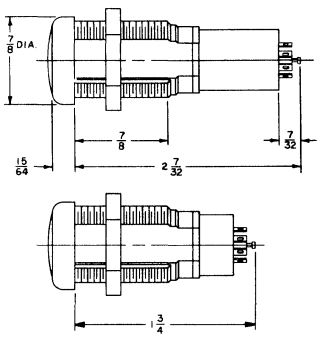


STANDARD & 20KVDC ANTI-STATIC
PROTECTION CENTER COMMON SWITCHES

LQ7CC



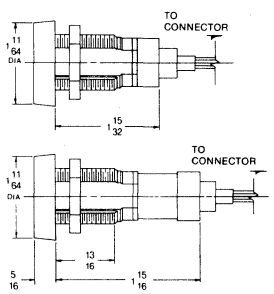
ELECTRICAL RATINGS
200 M.A. @ 28 VDC
150 M.A. @ 115 VAC



STANDARD & 20KVDC ANTI-STATIC
PROTECTION CENTER COMMON SWITCHES

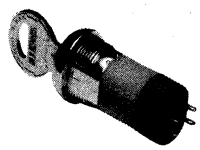
LQ21

ELECTRICAL RATINGS
200 M.A. @ 28 VDC
150 M.A. @ 115 VAC
OR
ELECTRICAL RATINGS
4 AMPS @ 125 VAC
2 AMPS @ 250 VAC
4 AMPS @ 28 VDC

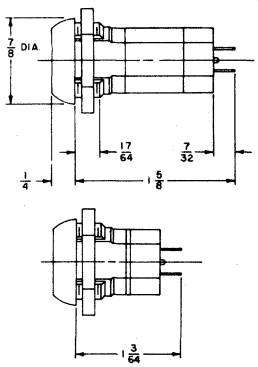


STANDARD & 20KVDC ANTI-STATIC
PROTECTION CENTER COMMON SWITCHES

LQ17ZZ



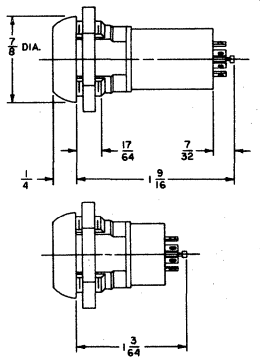
ELECTRICAL RATINGS
4 AMPS @ 125 VAC
2 AMPS @ 250 VAC
4 AMPS @ 28 VDC



STANDARD & 20KVDC ANTI-STATIC
PROTECTION ROTARY SLIDE SWITCHES

LQ17CC

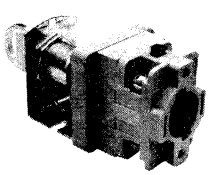
ELECTRICAL RATINGS
200 M.A. @ 28 VDC
150 M.A. @ 115 VAC

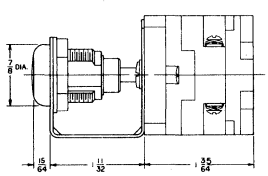


STANDARD & 20KVDC ANTI-STATIC
PROTECTION CENTER COMMON SWITCHES

LQ18

ELECTRICAL RATINGS
20 AMPS @ 600 VAC

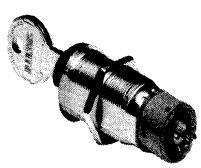


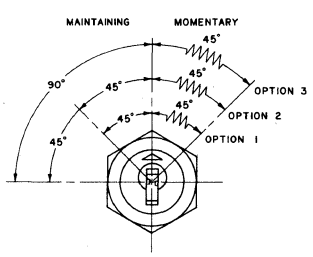


UL & CSA LISTED CAM SWITCH

LQ14CC

ELECTRICAL RATINGS
200 M.A. @ 28 VDC
150 M.A. @ 115 VAC





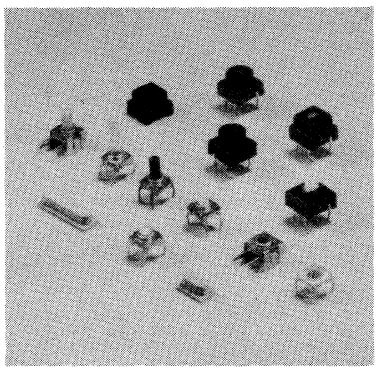
FOR LOCK DIM'S, REFER TO LQ7CC

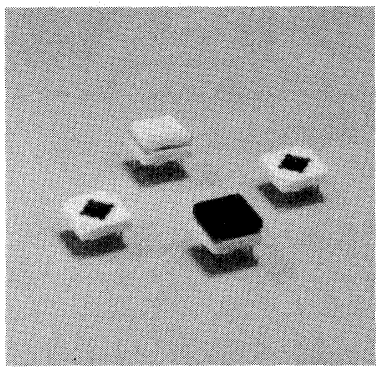
World's largest selection **of switchlocks for standard and OEM applications. Varying levels of security. Maintaining and momentary indexing, lengths starting at less than 1", milliamps to 20 AMPS, single and multiple poles, shorting and nonshorting contacts, static protection to 20 KVDC, quick connect, solderlug and PC terminals, L.E.D. indicator lights, custom wire harnessing, combination cam/switch lock.**

303 WEST HINTZ ROAD WHEELING, IL 60090 PHONE (312) 537-1800 TWX 910-651-0221 FACSIMILIE (312) 537-1881

Keyswitches

ITT Schadow





Description

Especially designed for keyboards, ITT keyswitches present a large choice of dimensions, travel, buttons, colours etc.

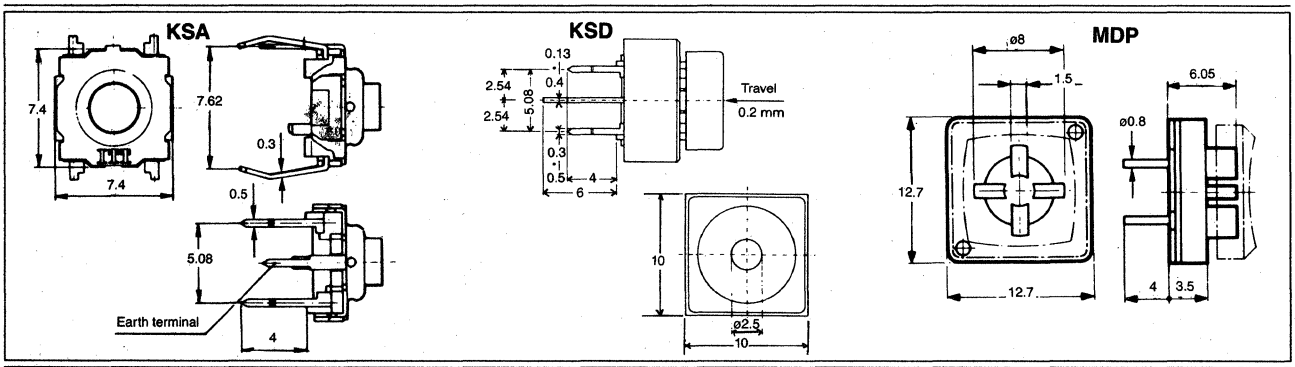
KSA/KSD

KSA miniature keyswitch with low travel, washable, automatic insertable good tactile feed back. KSD same family as KSA but with red, green or yellow led 2 light pipe form : round or rectangular, 2 button form : round or square.

MD/MDP

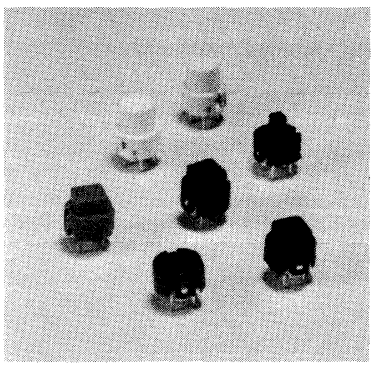
MD module is an inpulse keyswitch with rubber dome, MDP with additional button can be used directly in a keyboard with low travel and good tactile feed back.

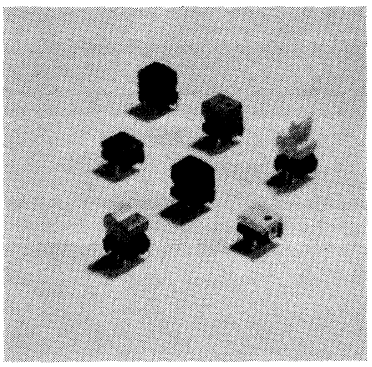
Mechanical data	KSA	KSD	MD		MDP
Operating force	1.3 N ± 25% standard	1.6 N ± 25% standard	2.6 N		2.4 N
Nominal travel	$0.3mm^{-0.4}_{-0}$	$0.2mm^{-0.1}_{-0}$	0.6 mm		0.3mm
Maxi travel	0.8 mm	0.3 mm	1.5 mm		0.5 mm
Electrical data					
Contact type	NO	NO	NO		NO
Contact material	S (G or request)	S	S	G	S
Voltage max/min	50 V/20 mV	50 V/5 V	100 V	100 V	100 V
Switching power	1 VA	1 VA	6 VA	3 VA	6 VA
Switching current max/min	50 mA/1 mA	50 mA/10 mA	100 mA	50 mA	100 mA
Contact resistance	50 mΩ	50 mΩ	< 10 mΩ	< 15 mΩ	< 10 mΩ
Insulation resistance	$> 10^5$ MΩ	$> 10^5$ MΩ	$> 10^5$ MΩ	$> 10^5$ MΩ	$> 10^5$ MΩ
Bounce	≤ 1 ms	≤ 5 ms	< 100 µs	< 100 µs	< 100 µs
Operating life	10^5	10^5	10^6	5.10^6	2.10^5
Climatic data					
Operating temperature	−40°C + 90°C	−20°C + 125°C	−25°C + 70°C		
Soldering	250°C ± 5°C/2 sec	260°C/2 sec	235°C/5 sec		
Washing	Sealed for solvent Immersion		Cleaning by immersion at normal temperature in alcohol or freon TF or TE		
Note : N.O.: Normally Open S: Silver plated G: Gold plated	Options • KSB: W/O actuator • KSL: long actuator (6.6 mm) • KSA: standard version • KSAV: vertical version • Different buttons available • Special: 3N operating force Note: illuminated button KSD are compatible with non illuminated KSA		Options MD 40 for −40 + 70°C		

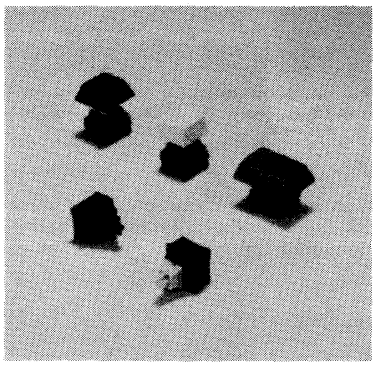


Keyswitches

ITT Schadow







D6

Keyswitch with impulse contact, D6 is suitable for keyboard with XY matrix. 4 versions of integrated button, good tactile feed-back.

MSL

Momentary keyswitch sealed too EIA-448-2. Multiple kecap options and one or two LED's available. Gold or Silver contacts.

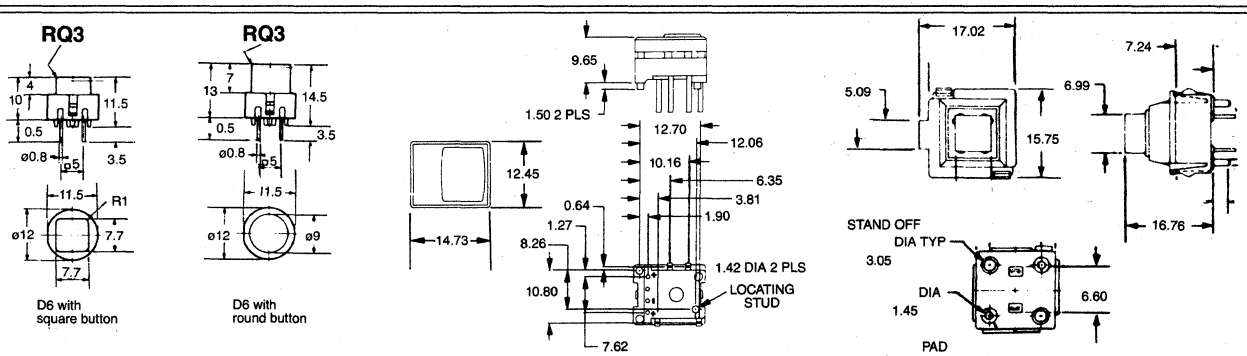
DC 60

Momentary keyswitch for alphanumerical keyboards. Low profile (16.7 mm).
Push-push option and spacebar available.

1.3 N ± 30%	2.2 N		0.7N
0.8	1.5 mm		1.5 mm
0.8 mm	1.8 mm		3.2 mm
NO	Single Pole Throw NO		Single Pole Single Throw NO
S	Ag	Au	Au
100 V	12 V	12 V	30 V
6 VA	360 mW	180 mW	1.5W
100 mA	30 mA	15 mA	50 mA
< 100 mΩ	⩽ 50 mΩ	⩽ 75 mΩ	⩽ 150 mΩ
10^5 MΩ	⩾ $9.^{10}$ MΩ	⩾ $9.^{10}$ MΩ	⩾ 100 MΩ
< 3 ms	< 15 ms	< 5 ms	0.5 ms Nom. 5.0 ms Max.
$2{,}5.10^5$	⩾ 250,000 (at Max. Power)		10,000,000 (at 250 mV amp Power)
−20°C + 85°C	−25°C + 70°C		0°C to 50°C
235°C/5 sec	Flow soldering 250°C 2 to 4 sec		Hand solder 260°C 2 sec. Flow solderable
Board side only	Washable		Hand clean freon TF

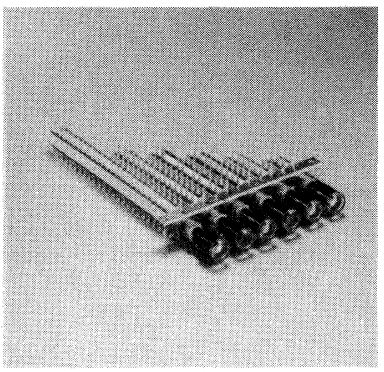
Options
- D6 with shaft 3.3 × 3.3
- D6 with flat surface
- D6 with square button □ 7.7 × 7.7
- D6 with round button ∅ 9
- Snap-on button □ 12.4

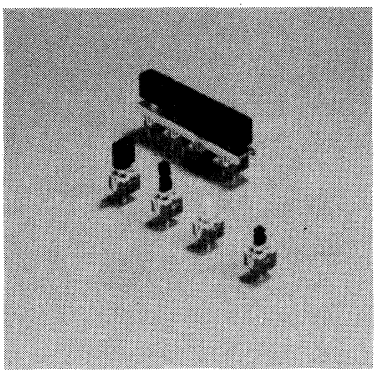
*Prevent flux from top side of PCB.
Restrict top surface of board to 83°C Max



Push button switches

ITT Schadow





Description

Push button switches family ITT offering large possibilities due to
- button style
- assembly system
- contact type
- travel et..

F Series

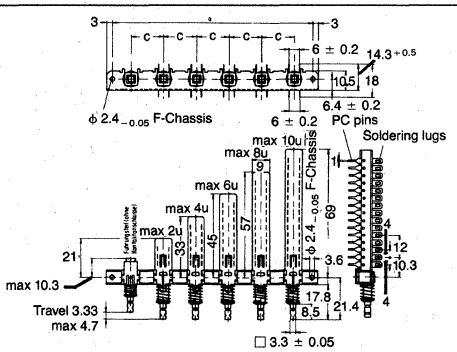
These switches offer wide possibilities:
- up to 10 change overs per module
- frame up to 23 positions with 5 different pitches
- patented mechanical indicator buttons.

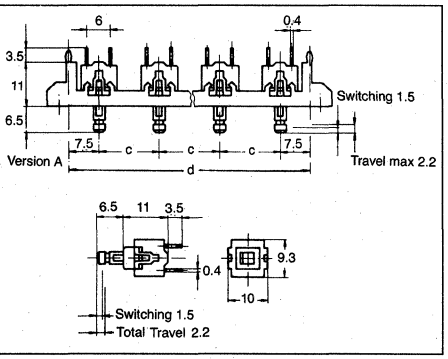
PVA

Rear terminated modular push buttons for PCB mounting parallel to the front panel.
PVA presents low operating force, short travel and small sizes.

Mechanical data			
Number of modules	1 to 23		1 to 16
Pitch between modules	10 - 12.5 - 15 - 17.5 - 20 mm		10 - 12.5 - 15 mm
Maxi travel	4.7 mm		2.2 mm
Operating force	6 N for C/O, 11 N 10 C/O		PVA1 : 120 cN PVA2 : 170 cN
Mechanical function	Interlocking, interdependent Release key, push-push		PVA1 : Momentary - PVA2 : Push-push PVA1, PVA2 : Interlocking, release
Electrical data			
Number of change over	2 to 10		2
Contact material	Ag	Au	Ag
Max voltage	30 V ~	30 V ~	50 V ~
Switching current	0.5 A	0.04 A	0.1 A
Switching power	15 W	300 mW	3 W
Contact resistance	⩽ 10 mΩ	⩽ 20 mΩ	< 50 mΩ
Voltage stability between contacts and contacts and earth	1500 V 1500 V		250 V ~ 500 V ~
Insulation resistance between	⩾ 10^3 MΩ		> 100 MΩ
Operating life	10^5		50,000
Climatic data			
Operating temperature	−20°C + 70°C		−25°C +85°C
Soldering	260°C/5 sec max.		260°C/5 sec.
Washing	Sealed contacts		Sealed contacts

Note: Changer-Over : C/O
Silver plated : Ag
Gold plated : Au

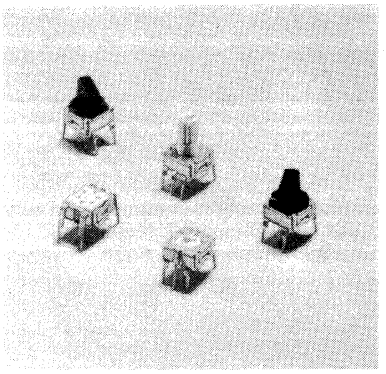


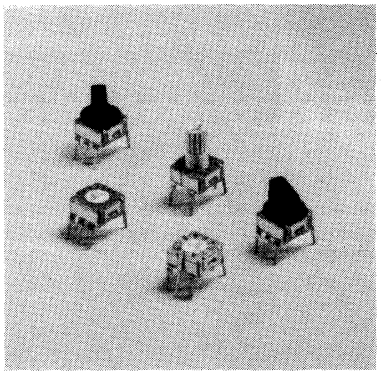


ITT Schadow Inc., 8081 Wallace Road, Eden Prairie, MN 55344 • 612/934-4400

Rotary switches

ITT Schadow





Description

ITT, one of the world of products leaders in rotary switches present a wide range, easy to use and adapt to customer specific requirements.

RTE 02/03

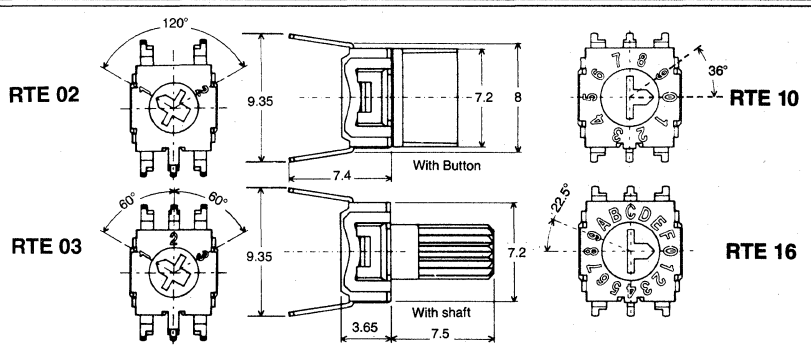
Micro-miniature rotary switch with 2 or 3 positions:
- operation by screw slot or by shaft, or by button
- Main applications in telephone set, computer or electronic controls.

RTE 10/16

Microminiature rotary switch for PS board with coding function 10 to 16 position operating by slot, shaft or button.

Mechanical data	RTE 02	RTE 03		RTE 10	RTE 16
Number of wafer	1	1		1	1
Number of pole/wafer	1	1		1	1
Number of positions	2	3		10	16
Coding	—	—		BCD	HEX
Angle between position	120°	60°		36°	22.5°
Shaft diameter	∅ 4 mm (in shaft version)			∅ 4 mm (in shaft version)	
End stop	Yes	Yes		W/O	W/O
Wafer material	Thermoplast.	Thermoplast.		Thermoplast.	Thermoplast.
Electrical data					
Contact type	—	—		—	—
Contact material	S	S	G	G	G
Max switching power	0.5 W	0.5 W	0.3 W	0.3 W	0.3 W
Switching current max/min	100/1 mA	100/1 mA		100/1 mA	100/1 mA
Carrying current	—	—		—	—
Voltage max/min	50/2 V	50/2 V	30/0.05 V	30/2 V	30/2 V
Contact resistance	50 mΩ	50 mΩ		100 mΩ	100 mΩ
Voltage stability between contacts and contacts and earth	500 V RMS	500 V RMS		300 V RMS	300 V RMS
Insulation resistance between contacts and between contacts to earth (500 V CC)	10^4 MΩ	10^4 MΩ		10^4 MΩ	10^4 MΩ
Number of operations max.	1500 index.	1500 index.		20,000 index.	20,000 index.
Climatic data					
Climatical category	25/85/21			25/85/21	
Operating temperature	−40°C + 85°C		−40°C + 85°C		
Soldering	Wave			Wave	
Washing	W/O thermal shock			W/O thermal shock	

*MBB shorting - BBM : non shorting. Note : S = Silver - G = Gold



ITW Switches — The line with the "3-Year" Warranty

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01-9	Pushbutton caps	B•1763
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05-6	One-light snap-in pushbutton	B•1768
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APPROVALS Many of ITW switches are available with international approvals and these are indicated with the following symbols:

MIL Spec CEE24

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LIMITED WARRANTY: Seller's products are warranted for a period of three (3) years from date of shipment to be free from defects in material and workmanship, provided Buyer, within this warranty period, gives Seller written notice of any claim under this warranty and promptly returns the product prepaid in accordance with Seller's written authorization. Seller will, at its sole election thereafter, refund the purchase price or repair or replace such product found, under the terms of this warranty, to be defective or not within Buyer's specifications. This warranty does not include, nor does Seller assume responsibility for, defects or damage caused by misuse, abuse, alterations, service or repair by others, or failure to properly maintain this product.

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In no event, shall seller be responsible under this warranty for product failures relating to electrical conductivity, where such failure is for reasons outside seller's control, including failures resulting from improper storage or use.

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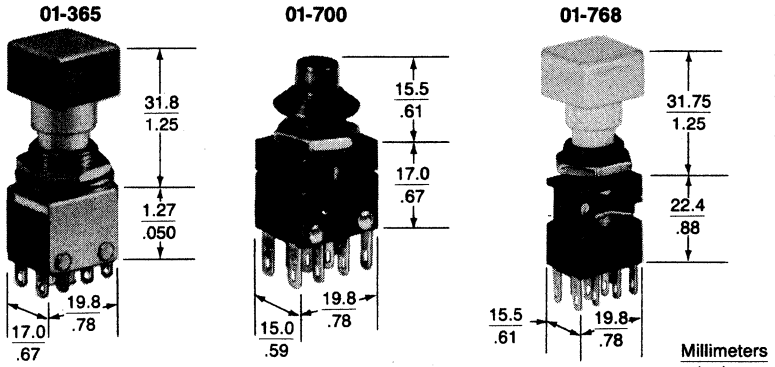
TW PUSHBUTTON SWITCHES

SERIES 01



FEATURES

- Momentary or Maintained
- 1 or 2 poles
- Form C or Form Z
- Gold or Silver contacts
- .110 quick connect terminals
- Illumination: LED, T-1¾ flange or screw base incandescent lamp
- Bushing size: 15/32″ or 5/8″
- Ratings: UL–10.1 amps at 125/250 VAC CSA–10.0 amps at 125 VAC
- Series 01-3: Metal bushing and bracket assembly
- Series 01-7: One-piece plastic housing
- Assortment of lens cap styles and colors
- Bezel adapter and dress nuts available
- Versions available to meet the requirements of MIL-S-22885/27

BUTTONS/BEZELS/LAMPS

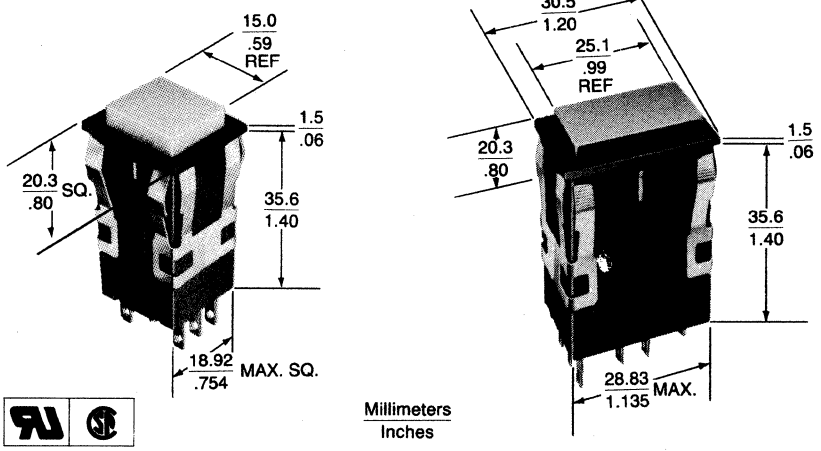
Part Number	Description
01-921411	3/4″ sq/white button
01-921412	3/4″ sq/red button
01-921413	3/4″ sq/green button
01-941411	3/4″ rd/white button
01-951911	7/8 × 1 1/8/white button
01-951912	7/8 × 1 1/8/red button
01-951913	7/8 × 1 1/8/green button
70-2150	Bezel adapter
80-010768	White cylindrical momentary plunger
80-011364	Wedge base lamp
80-701319	Flat black bezel
80-701320	Silver bezel

SWITCHES

Part Number	Bushing	Lamp Type	Contacts	Ckty/Action
01-365630	5/8	Flange	Silver	2P Form/Z Mom.
01-700152	15/32	Red/LED	Silver	1P Form Z/Mom.
01-768230	5/8	Flange	Silver	2P Form Z/Main.

MIL Spec

SERIES 50



FEATURES

- Electromechanical and solid state
- Square, rectangular and indicator only versions
- LED or T-1¾ wedge base incandescent lamp
- Circuitry options: SPDT or DPDT
- Gold or silver contacts
- Momentary or maintained action
- Terminals: .110 quick connect or .025 × .025 PC board
- Panel cutouts: Square–.750″; Rectangular–.750″ × 1.141″
- Ratings: UL Recognized File No. E27957 CSA Certified File No. LR42096
- Three button heights available–.19″, .32″, & .43″ high (above front panel)
- Variety of button caps: transmitted color, insertable legend, dead front, projected color and two-color rectangular buttons are available.
- Variety of button cap colors
- Two-light rectangular switch available
- Optional center and end barriers

BUTTONS

Part No.	Switch Type	Color
50-51C10G	Square	Green
50-51C10W	Square	White
50-51F10G	Rectangular	Green
50-51F10R	Rectangular	Red

SWITCHES

Part No.	Lamp Type	Style	Terminal	Circuitry/Action
50-21BBA2AA	None	Square	.110 QC	SPDT Silver/Momentary
50-21CBA2AD	Incandescent	Square	.110 QC	DPDT Silver/Maintained
50-21CBA2BA	Incandescent	Square	.110 QC	SPDT Gold/Momentary
50-21CBA3BA	Incandescent	Square	PC	SPDT Gold/Momentary

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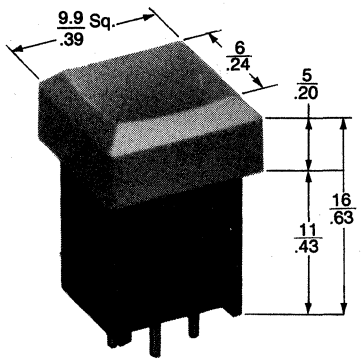
ITW PUSHBUTTON SWITCHES

SERIES 60 DATASWITCH



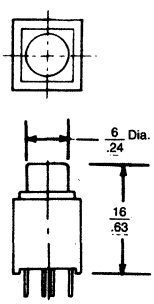
FEATURES:

- Circuitry: SPST-NO momentary
- PCB terminals
- Switch is .39" square
- Square and rectangular buttons; variety of colors
- Designed for flow soldering and automatic cleaning. Solvents must be compatible with 'ABS' and glass-loaded 'Noryl'.
- Legends can be engraved or printed onto switch tops
- Contact Rating: 20 ma-35 VDC

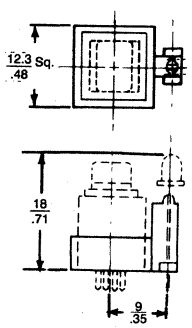
SWITCHES/LED SUPPORT/BUTTONS

Part No.	Description	Color
60-1000	Switch/rectangular button	—
60-3000	LED support only	—
60-4001	Button/square*	Black
60-4002	Button/square*	Red
60-4003	Button/square*	Green
60-4004	Button/square*	Light Grey

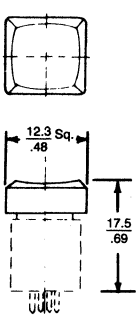
*Button caps fit on 60-1000 switch



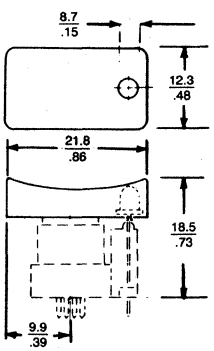
SWITCH WITH ROUND BUTTON



LED SUPPORT



SQUARE CAP



RECTANGULAR CAP

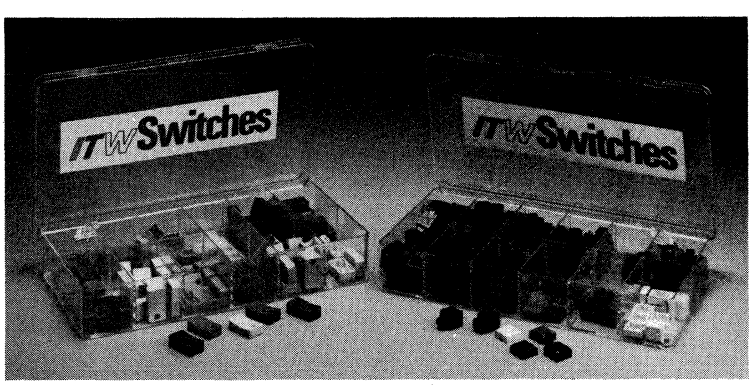
Millimeters
Inches

SERIES 60 PUSHBUTTON KIT

The ITW Switches Series 60 Pushbutton Kit is now available. This kit includes 66 switches (2 styles), 144 caps (all colors and sizes) and 60 LED supports which lets you build all possible Series 60 combinations.

No tools needed—all parts snap together quickly!

To order: 60-KIT



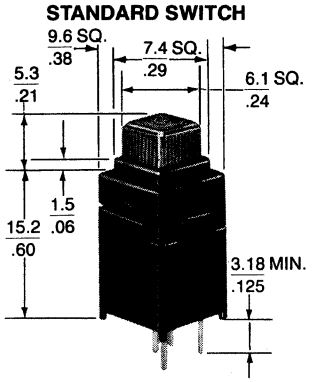
ITW Switches 6615 W. IRVING PARK ROAD • CHICAGO, IL 60634

Other versions are available. Call (312) 282-4040

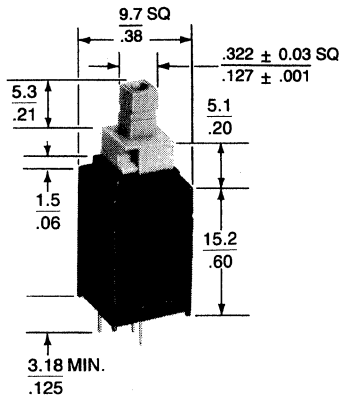
ITW PUSHBUTTON SWITCHES

SERIES 39 LED MINIATURE

STANDARD SWITCH



KEYCAP SWITCH



Millimeters / Inches

FEATURES:

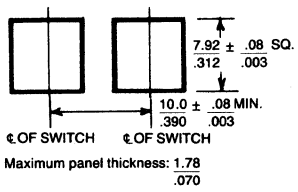
- Circuitry: SPST-NO-DB
- Momentary or maintained
- Bifurcated silver plated contacts
- Available in LED, lighted, non-lighted and inciator only versions
- Button styles: Standard–lighted & non-lighted; Keycap: Square–lighted and non-lighted; Rectangular–non-lighted
- Variety of colored lens and keycaps
- Standard or Hi-brite LED's
- Electrical Rating: .25 amp @ 30 VDC max. RES
- CONNECTOR MOUNTING OPTIONS: 39-800001–In-line mount connector 39-800002–Right-angle mount connector

KEYCAP STYLE BUTTONS

Part No.	Lighted	Color
80-390101	Yes*	White
80-390102	Yes*	Light Grey
80-390103	Yes*	Dark Grey
80-390104	Yes*	Black
80-390105	No	White
80-390106	No	Light Grey
80-390107	No	Dark Grey
80-390108	No	Black

*Requires light pipe–P/N 80-390100

PANEL CUTOUT RECOMMENDATIONS

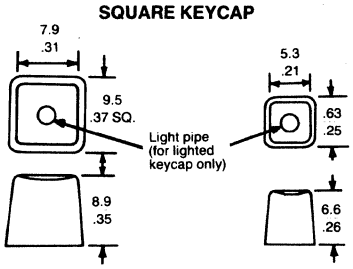


SWITCHES

Part No.	Lighted	Button Color	Button Style	Switch Action
39-12101	Yes*	Clear	Standard	Momentary
39-12111	Yes*	Red	Standard	Momentary
39-12113	Yes*	Green	Standard	Momentary
39-12201	Yes	Clear	Standard	Momentary
39-12211	Yes	Red	Standard	Momentary
39-12312	Yes	Green	Standard	Momentary
39-12413	Yes	Yellow	Standard	Momentary
39-12502	No	White	Standard	Momentary
39-12503	No	Red	Standard	Momentary
39-12509	No	Black	Standard	Momentary
39-13113	Yes*	Yellow	Standard	Maintained
39-13211	Yes	Red	Standard	Maintained
39-22100	Yes	—	Keycap	Momentary
39-22500	No	—	Keycap	Momentary
39-23100	Yes	—	Keycap	Maintained

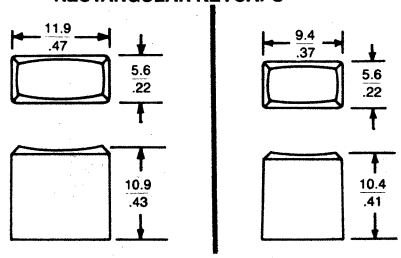
*LED not included–LED support P/N–80-390003 supplied in bulk

SQUARE KEYCAP



Millimeters / Inches

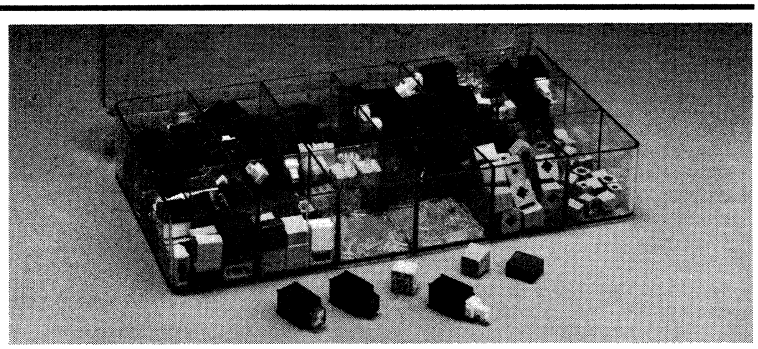
RECTANGULAR KEYCAPS



SERIES 39 PUSHBUTTON KIT

Now available is the ITW Switches SERIES 39 PUSHBUTTON KIT. This kit is filled with over 300 Series 39 switches, buttons, keycaps, light pipes, connectors to build hundreds of Series 39 switch combinations. With this kit, you can build the switch you need immediately.

To order: 39-KIT

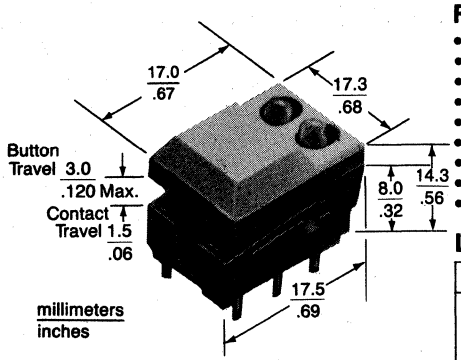


ITW Switches *6615 W. IRVING PARK ROAD • CHICAGO, IL 60634*

Other versions are available. Call (312) 282-4040

ITW PUSHBUTTON SWITCHES

SERIES 61 MINIATURE PC MOUNT DATA SWITCH



The above dimensions are for 1½ station keycaps.
For single station keycap substitute 12.3 (.48) for 17.3 (.68)

FEATURES

- Infinite flexibility of keytop styles
- 11 colors as standard
- Unique light pipe design
- Tactile feel
- Short travel
- Momentary or alternate
- Anti-static windows (up to 15KV protection)
- Gold or silver contacts
- Gamma style button cap also available

TECHNICAL DATA

CONTACT ARRANGEMENT	SPDT
Travel	≤3 mm/.12 in.
Housing and key top material	ABS or Polyester
Contact Material	Brass + Ni + Ag or Au
Operating Life — momentary	3,000,000 cycles
Operating Life — Alternate	500,000 cycles
Temperature range	−25 + 85°C/−13° + 185°F

LED SPECIFICATIONS

	ALPHA		
Color	Red	Green	Yellow
Typical Ratings			
Forward Voltage (v) @ 20 mA	1.7	2.2	2.2
Intensity (mcd) @ 10mA	0.8	5.5	2.5
Forward Current (mA)	40	30	20
Reverse Voltage (v)	5	5	5

	Momentary		Alternate	
	Gold	Silver	Gold	Silver
	61-101XX00	61-301XX00	61-201XX00	61-401XX00
	61-102XX00	61-302XX00	61-202XX00	61-402XX00
	61-1A1XX0Y²	61-3A1XX0Y²	61-2A1XX0Y²	61-4A1XX0Y²

	Momentary		Alternate	
	Gold	Silver	Gold	Silver
	61-1A2XX0Y²	61-3A2XX0Y²	61-2A2XX0Y²	61-4A2XX0Y²
	61-105XXY¹Y²	61-305XXY¹Y²	61-205XXY¹Y²	61-405XXY¹Y²
	61-106XXY¹Y²	61-306XXY¹Y²	61-206XXY¹Y²	61-406XXY¹Y²

ORDERING INFORMATION

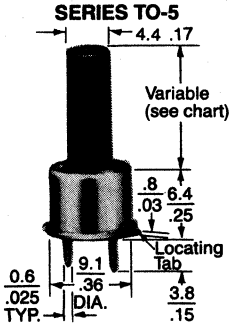
KEYCAP COLORS
Where XX
00 — Red
01 — Orange
02 — Green
03 — Blue
04 — Black
05 — Yellow
06 — Light Grey
07 — Dark Grey
08 — White
09 — Brown
10 — Beige

LEDS
(Left Position)
Where Y¹
0 — No LED
1 — Red
2 — Green
3 — Yellow

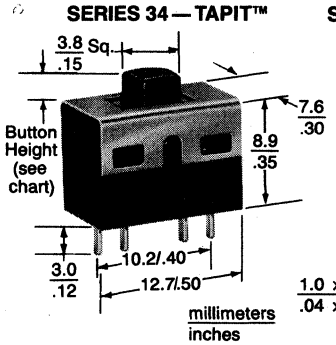
(Right or center position)
Where Y²
0 — No LED
1 — Red
2 — Green
3 — Yellow

SERIES TO-5 MINIATURE, SERIES 34 TAPIT™ SERIES 44 ECONOMITE®

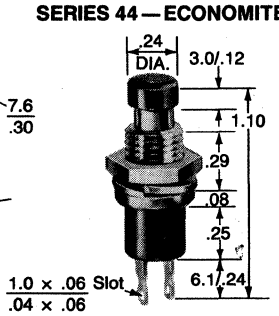
SERIES TO-5



SERIES 34 — TAPIT™



SERIES 44 — ECONOMITE®



Part No.	Switch Type	Mounting	Button Height	Button Color
034-500-002	Tapit	PC	.09″	Black
034-550-001	TO-5	PC	.06″	Black
034-550-002	TO-5	PC	.50″	Black
034-550-005	TO-5	PC	.15″	Black
034-550-006	TO-5	PC	.25″	Black
034-550-010	TO-5	PC	.38″	Black
034-550-015	TO-5	PC	.19″	Black
044-111-011	Economite	Panel	—	Black
044-111-021	Economite	Panel	—	Red

FEATURES:

SERIES TO-5 MINIATURE PCB MOUNT
- Circuit: SPST-NO momentary
- Gold contacts • PCB mount
- Life expectancy: in excess of 1,000,000 actuations
- Optional panel mounted version with threaded bushing available
- Wide range of actuator lengths and colors
- Optional vinyl protective boot
- Temperature range: −30°C to +65°C
- Contact Rating: 100 ma 125 VAC

SERIES 34 MINIATURE TAPIT™ PCB
- Circuit: SPST-NO & SPST-NC Form "Z" alternate circuits
- Gold contacts • PCB mount
- Life expectancy: 5,000,000 actuations
- Other button colors and lengths available
- Temperature range: −40°C to +100°C
- Contact Rating: 100 ma 125 VAC

SERIES 44 MINIATURE ECONOMITE®
- Contact combinations: SPST-NO & SPST-NC
- Silver or gold contacts
- Life expectancy: 50,000 actuations
- Button colors — black, red, green
- Mounts: 9/32″ diameter panel hole
- Temperature range: −30°C to +68°C
- Contact Rating: Silver — 1 amp @ 125 VAC
  Gold — 500 ma @ 125 VAC

ITW Switches 6615 W. IRVING PARK ROAD • CHICAGO, IL 60634

Other versions are available. Call (312) 282-4040

Any 61 switch on this chart is available overnight from these ITW Switches distributors:

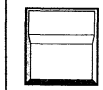
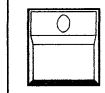
Cal Switch
13717 S. Normandie
Gardena, CA 90249
(213) 538-9830

Hawk Electronics
661 Glenn Avenue
Wheeling, IL 60090
(312) 459-4030

Powell Electronics
18 W. Forest Avenue
Englewood, NJ 07631
(201) 894-0800

Powell Electronics
Island & Enterprise Avenue
Philadelphia, PA 19101
(215) 365-1900

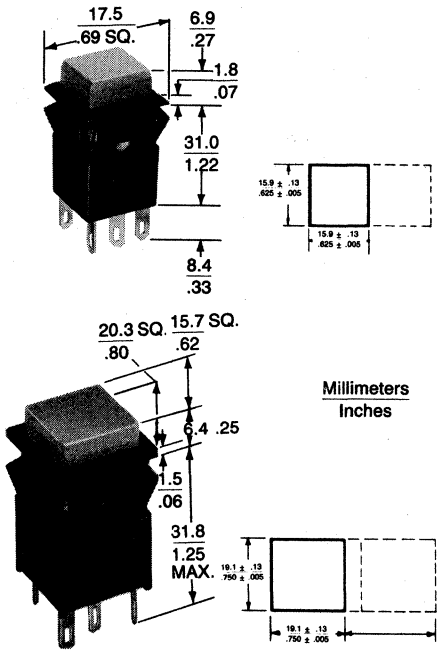
SERIES 61 PUSHBUTTONS

Button Colors	Momentary Action						Alternate Action					
	Non-Lighted		Lighted:Red LED				Non-Lighted		Lighted:Red LED			
												
Black	61-1010400	61-102040	61-1A10401	61-1A20401	61-1050411	61-1060411	61-2010400	61-2020400	61-2A10401	61-2A20401	61-2050411	61-2060411
White	61-1010800	61-1020800	61-1A10801	61-1A20801	61-1050811	61-1060811	61-2010800	61-2020800	61-2A10801	61-2A20801	61-2050811	61-2060811
Light Gray	61-1010600	61-1020600	61-1A10601	61-1A20601	61-1050611	61-1060611	61-2010600	61-2020600	61-2A10601	61-2A20601	61-2050611	61-2060611
Dark Gray	61-1010700	61-1020700	61-1A10701	61-1A20701	61-1050711	61-1060711	61-2010700	61-2020700	61-2A10701	61-2A20701	61-2050711	61-2060711
Yellow	61-1010500	61-1020500	61-1A10501	61-1A20501	61-1050511	61-1060511	61-2010500	61-2020500	61-2A10501	61-2A20501	61-2050511	61-2060511
Red	61-1010000	61-1020000	61-1A10001	61-1A20001	61-1050011	61-1060011	61-2010000	61-2020000	61-2A10001	61-2A20001	61-2050011	61-2060011
Orange	61-1010100	61-1020100	61-1A10101	61-1A20101	61-1050111	61-1060111	61-2010100	61-2020100	61-2A10101	61-2A20101	61-2050111	61-2060111
Green	61-1010200	61-1020200	61-1A10201	61-1A20201	61-1050211	61-1060211	61-2010200	61-2020200	61-2A10201	61-2A20201	61-2050211	61-2060211
Blue	61-1010300	61-1020300	61-1A10301	61-1A20301	61-1050311	61-1060311	61-2010300	61-2020300	61-2A10301	61-2A20301	61-2050311	61-2060311

For manufacturers' sales offices, see yellow pages

TW PUSHBUTTON SWITCHES

SERIES 05, 05-6



FEATURES

- Single and double pole
- Momentary and maintained action
- Contacts are silver plated
- 05 & 05-6: Lighted, non-lighted & indicator only versions. LED or T-1¾ wedge base incandescent lamp
  05-7: T-1¾ flange base incandescent, non-lighted and neon versions
- 05 & 05-6: .110 quick disconnect or PC board terminals
  05-7: .187 quick disconnect/solder terminals
- Circuitry options:
  05 — SPST-NO, SPDT, DPST-NO
  05-6 — SPST-NO, DPST-NO, DPDT
  05-7 — DPST-NO, SPST-NO
- Options include: variety of colored lens caps, insertable legend buttons, hot stamping and pad printing, lens barriers
- Ratings:
  05 — 1 amp RES, 125 VAC, UL Recognized and CSA Certified 10 MA @ 5VDC
  05-6 — 1 or 3 amps @ 125 VAC max., UL Recognized
  06-7 — 10 amps @ 125/250 VAC, UL Recognized File No. E27957 and CSA Certified LR16388-27

SWITCHES

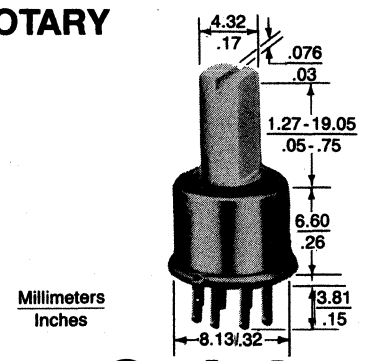
Part No.	Lamp Type	Terminal	Circuitry/Action
05-115	Incandescent	.110 QC	SPST-NO/Mom.
05-125	Incandescent	.110 QC	DPST-NO/Mom.
05-135	Incandescent	.110 QC	SPDT/Mom.
05-145	Incandescent	.110 QC	SPDT/Maint.
05-165	Incandescent	PCB	SPST-NO/Mom.
05-215	None	.110 QC	SPST-NO/Mom.
05-235	None	.110 QC	SPDT/Mom.
05-265	None	PCB	SPST-NO/Mom.
05-62115	None	.110 QC	SPST-NO/Mom.
05-62125	Incandescent	.110 QC	SPST-NO/Mom.
05-65125	Incandescent	PCB	SPST-NO/Mom.

BUTTONS

Part No.	Lamp Type	Color	Part No.	Lamp Type	Color
80-050007	Incandescent	White	80-050603	Incandescent	Red
80-050008	Incandescent	Red	80-050604	Incandescent	Green
80-050009	Incandescent	Green	80-050605	Incandescent	Blue
80-050011	Incandescent	Yellow	80-050606	Incandescent	Yellow
80-050011	LED	White			
80-050012	Incandescent	Amber			
80-050014	Incandescent	Clear	80-050111	N/A	White insert
80-050602	Incandescent	White	80-050113	N/A	Green insert
80-050603	Incandescent	Red			
80-050604	Incandescent	Green			
86-050011	LED	White			

TW ROTARY SWITCHES

SERIES TO-5 SPASAVER ROTARY



FEATURES

- Subminiature package size (.36″ diameter)
- Up to 8 positions at 45° indexing, 1 pole
- Low energy switch contacts (gold over nickel plating)
- Glass to metal sealed header
- 0.025″ PC terminals on 0.200″ bolt circle
- Shaft diameter 0.170″ with flat and slot
- Shaft length 0.31″ or 0.44″ from PC board
- Contact rating: 500 ma @ 125 VAC
- Life expectancy: in excess of 10,000 operations
- Options available: Vinyl protective boot and plastic knob

Part No.	Positions	Shaft Length*	Part No.	Positions	Shaft Length*
030-222-005	2	.05″	030-505-005	5	.05″
030-303-018	3	.18″	030-808-005	8	.05″
030-404-005	4	.05″			

*Shaft length measures with no bushing. With busning .30″ actuator is flush with top of bushing.

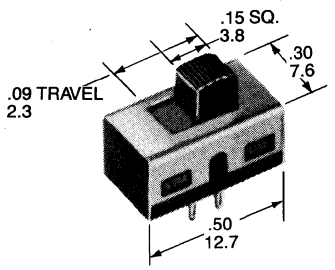
TW Switches 6615 W. IRVING PARK ROAD • CHICAGO, IL 60634

Other versions are available. Call (312) 282-4040

TW SLIDE SWITCHES

MINI MIKE™

Miniature Snap-Action Slide



Inches
Millimeters

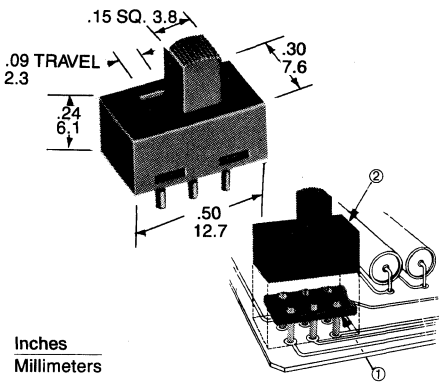
FEATURES

- Available in SPST, SPDT, DPDT, Form Z circuits
- Contacts are hard gold over barrier
- Terminal types — straight, "T", right-angle, PC, standoff PC
- Various actuator lengths
- Some versions UL recognized
- Available button heights from .10 to .50
- Custom actuators, terminals, button colors and hot stamping available
- Temperature range: – 40°C to + 100°C

Part No.	Circuit	Mount	Height	Color	Rating
023-021-008	SPDT	PC	.14	Black	0.5 amp @ 125 VAC/75 VDC
023-021-017	SPST	Panel	.20	Black	1 amp @ 125 VAC
023-021-031	SPST	PC	.20	Black	1 amp @ 125 VAC
023-021-040	SPST	PC	.20	Black	1 amp @ 125 VAC
023-021-105	SPDT	PC	.20	Black	250 ma @ 30 VDC
023-021-112	SPDT	Panel	.20	Black	250 ma @ 30 VDC
023-021-113	DPDT	Panel	.20	Black	100 ma @ 125 VAC
023-021-114	DPDT	PC	.20	Black	100 ma @ 125 VAC
023-021-125	DPDT	PC	.20	White	100 ma @ 125 VAC
023-021-304	Form Z	PC	.14	Black	500 ma @ 125 VAC
029-000-009	SPST	PC	.20	Black	250 ma @ 30 VDC/125 VAC

MR. CLEAN®

Wave Solderable, Miniature Slide



Inches
Millimeters

FEATURES

- Surface mount version available
- Low cost
- Anti-contamination design
- Unique 2-piece assembly
- Gold contacts
- Insert molded base
- Standard configurations: SPST, SPDT, DPST, DPDT, Form Z
- Life expectancy (mechanical): 10,000 actuations
- Temperature range: – 40°C to + 100°C

Part No.	Circuit	Terminal	Rating
124-240-020	SPDT	PC	250 ma @ 125 VAC
124-430-020	DPDT	PC	250 ma @ 125 VAC
124-440-020	DPDT	PC	250 ma @ 125 VAC

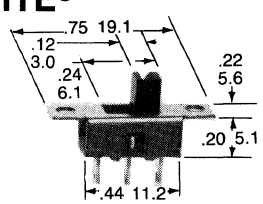
HOW IT WORKS

① Insert lower base half into P.C. board by hand or with automatic insertion equipment. Then wave solder same as other components on board. Clean board in standard manner to remove excess flux.

② After board is cleaned and dried — simply snap the clean uncontaminated upper switch half in place — by hand. No tools, special equipment or orientation needed.

ECONOMITE®

Miniature Slide



Inches
Millimeters

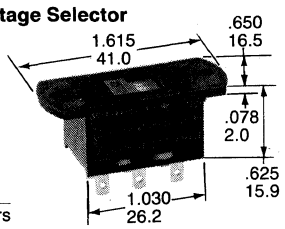
FEATURES

- Available in SPDT, SP 3-position, DPDT, DP 4-position circuits
- Choice of actuators and terminals
- Silver plated contacts standard
- Rating: 125 VAC, 12 VDC resistive

Part No.	Circuit	Current	Mounting	Contacts
043-000-132	SP 3 pos	0.3 amp	PC	Silver plated
043-200-227	DPDT	0.5 amp	PC side	Silver plated
043-901-121	SPDT	0.5 amp	PC	Silver plated

SERIES SE

Line Voltage Selector



Inches
Millimeters

CEE24

FEATURES

- Variety of terminals
- Top of flush handle stamped to indicate which voltage is selected; various markings available
- Electrical Life: 10,000 cycles
- Handle Height: Flush or 11/32
- International Approvals: UL-CSA-VDE-SEV Designed to meet requirements of CEE Publication 24 and the IEC
- Contact Ratings: UL, CSA & SEV–10 amp 125 VAC; 5 amp 250 VAC
  VDE–4A 125 V ~ 2 (0.5)A 250V ~ T85

Part No.	Terminals	Dimensions
18-000-0016	Solder	1.615L x .650W x .625H
18-000-0019	Right-angle	1.030L x .650W x .625H
18-000-0022	PC	1.030L x .650W x .625H

/

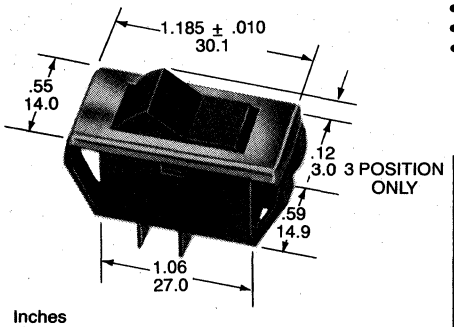
TW Switches 6615 W. IRVING PARK ROAD • CHICAGO, IL 60634

Other versions are available. Call (312) 282-4040

ITW ROCKER SWITCHES

SERIES 16X

Single Pole Lighted and Non-Lighted



Inches
Millimeters

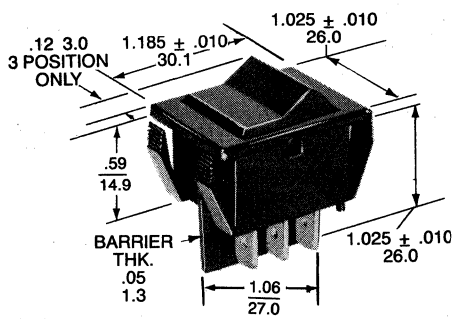
FEATURES

- Snaps into panels from .015″ (0.4) to .125″ (3.2) thick
- Recommended cutout: .48″ (12.2) × 1.08″ (27.4)
- Wide range of circuits, some VDE approved
- Variety of incandescent and neon lamps
- Terminal options—quick connect and solder lugs
- Variety of colors; including custom
- Matte or gloss finish • Hot stamping & metal bezels
- Matching panel lights available • Paddle versions available; non-lighted only
- Ratings: UL Recognized and CSA Approved
  - 161 Series: 10A, ½ HP, 125 VAC; 8A, ½ HP, 250 VAC, 10A, 28 VDC
  - 162 Series: 12A, ½ HP, 125 VAC; 10A, ½ HP, 250 VAC, 12A, 28 VDC
  - 163 Series: 16A, ¾ HP, 125 VAC; 12A, ¾ HP, 250 VAC, 16A, 28 VDC

Part No.	Rating	Color		Circuit	Lighted or Non-Lighted
		Rocker	Case		
161-009-009	10A	White	Black	SPST	Non
161-029-004	10A	Red	Black	SPST	Lighted
161-029-006	10A	Red	Black	SPST	Lighted
161-029-009	10A	Red	Black	SPST	Non
161-049-006	10A	Amber	Black	SPST	Lighted
161-099-009	10A	Black	Black	SPST	Non
161-099-019	10A	Black	Black	SPST No mom.	Non
161-099-029	10A	Black	Black	SPDT	Non
161-099-069	10A	Black	Black	SPDT	Non
163-029-006	16A	Red	Black	SPST	Lighted
163-099-009	16A	Black	Black	SPST	Non

SERIES 17X

Double-Pole and Single-Pole Lighted and Non-Lighted



Inches
Millimeters

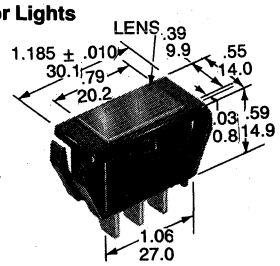
FEATURES

- Snaps into panels from 0.15″ (0.4) to .125″ (3.2) thick
- Recommended cutout: .880″ + .005/ – .000 (22.4) × 1.080″ ± .005 (27.4)
- Wide range of circuits, some VDE approved
- Variety of incandescent and neon lamps
- Terminal options—quick connect and solder lugs
- Variety of colors; including custom • Hot stamping & metal bezels
- Matching panel lights available • Paddle versions available; non-lighted only
- Ratings: UL Recognized and CSA Approved
  - 171 Series: 10A, ½ HP, 125 VAC; 8A, ½ HP, 250 VAC, 10A, 28 VDC
  - 172 Series: 12A, ½ HP, 125 VAC; 10A, ½ HP, 250 VAC, 12A, 28 VDC
  - 173 Series: 16A, ¾ HP, 125 VAC; 12A, ¾ HP, 250 VAC, 16A, 28 VDC

Part No.	Rating	Color		Circuit	Lighted or Non-Lighted
		Rocker	Case		
171-009-109	10A	White	Black	SPST	Non
171-029-109	10A	Red	Black	SPST	Non
171-099-109	10A	Black	Black	SPST	Non
171-099-129	10A	Black	Black	SPDT	Non

SERIES 150

Panel Indicator Lights



Inches
Millimeters

These indicators matches the 16X and 17X series rocker and paddle switches. Features for the panel indicators are the same as the 16X and 17X series.

Part No.	Terminal	Color		Lamp
		Lens	Case	
150-009-109	Slip-on	White	Black	125V neon
150-029-109	Slip-on	Red	Black	125V neon
150-049-109	Slip-on	Amber	Black	125V neon

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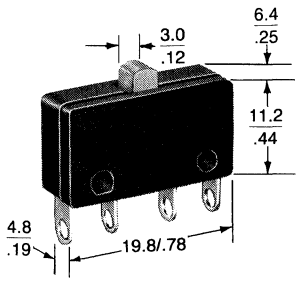
BASIC SNAP-ACTION SWITCHES

TYPE 16



MIL Spec

Millimeters
Inches

FEATURES

- Features the Butterfly® double-break momentary mechanism
- Wide variety of terminal configurations and styles
- Gold plated or silver contacts standard
- Variety of actuators available
- Ratings: UL Recognized at 10.1 Amps @ 125/250 VAC; CSA Certified at 10.1 Amps @ 125/250 VAC
- 16-188051 meets requirements of MS25476-1; 16-388051 meets requirements of MS27217-2; 488051 meets requirements of MS27217-1

ELECTRICAL RATINGS @ 28 VDC

		Sea Level	70,000 Feet
Form C 2 Circuit	Res.	10	10
	Ind.*	3	1.5
	Lamp	3	—
Form Z 2 Circuit	Res.	10 Amps	10 Amps
	Ind.*	5 Amps	2 Amps
	Lamp	3 Amps	—

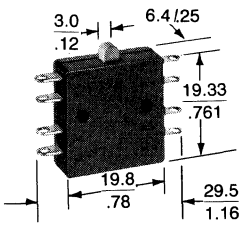
*L/R = .026

Pretravel: .050 max.
Overtravel: .012 min.
Operating Force: 5 oz. + 3 oz. – 2 oz.
Release Force: 2 oz. min.
Movement Differential: .020 ± .005
Movement Differential Type 16-403 Only: .012 ± .005

SPECIFICATIONS

Part Number	Circuit	Temperature Index	Contacts: Fine Silver	Contacts: Gold Plated
16-104	SPDT Form Z	To 275°F Ambient	X	
16-1042		To 400°F Ambient①	X	
16-188051		Ref. MS 25476-1		X
16-204	SPDT Form Z	To 275°F Ambient	X	
16-304		To 275°F Ambient	X	
16-388051		Ref. MS 27217-2		X
16-403	SPDT Form C	To 275°F Ambient	X	
16-404 16-40401	SPDT Form Z	To 275°F Ambient	X	X
16-40402		To 400°F Ambient	X	
16-430112	SPDT-DB Form Z	To 185°F Ambient		X
16-488051		Ref. MS 27217-1		X
16-504	SPDT Form Z	To 275°F Ambient	X	

TYPE 26



MIL Spec

Millimeters
Inches

FEATURES

- DPDT (Form ZZ) contact arrangement
- Provides the option of controlling up to 4 isolated circuits
- May be wired externally to provide two commons to form standard DPDT (Form CC) switch
- Standard contacts are fine silver or gold plated
- End or side solder terminals
- Variety of actuators available
- Ratings: UL Recognized File No. E27957 8 Amps @ 125/250 VAC 75-80% PF
- 26-888051 and 26-988051 meets requirements of MIL-S-8805/77

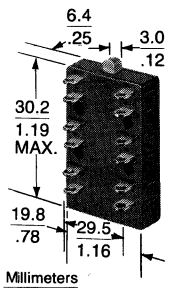
MECHANICAL CHARACTERISTICS

Pretravel: .050 max. Overtravel: .012 min. Operating Force: 12 ± 4 oz.
Release Force: 5 oz. min. Movement Differential: .020 + .010 – .005

Part No.	Circuitry	Simultaneity	Contact Material	Terminal
26-804	DPDT-DB (Form ZZ)	Simultaneous*	Silver	End Solder
26-904		Simultaneous*	Silver	Side Solder
26-888051		Ref. M 8805/77-001	Gold Plated	End Solder
26-988051		Ref. M 8805/77-002	Gold Plated	Side Solder

*Within .004" of plunger travel

TYPE 36



Millimeters
Inches

MIL Spec

FEATURES

- Uses three momentary double-break Butterly® switching mechanisms; 3PDT-DB Form ZZZ
- Standard contacts are fine silver or gold plated
- End or side solder terminals
- Variety of actuators available
- Ratings: UL Recognized File No. E27957 7.5 Amps @ 125/250 VAC 75-80% PF
- Meets requirements of MIL-S-8805/78

MECHANICAL CHARACTERISTICS

Pretravel: .050 max.
Overtravel: .012 min.
Operating Force: 16 ± 4 oz.
Release Force: 4 oz. min.
Movement Differential: .020 ± .010

Part No.	Circuitry	Simultaneity	Contact Material	Terminal
36-604	3 PDT-DB (ZZZ)	Simultaneous*	Silver	End Solder

*Within .004" of plunger travel

ACTUATORS

NOTE: Characteristics may vary depending on type of basic switch used in assembly

Actuator P/N & Style	Switch Series	Oper. Force	Release Force	Pretravel	Over-travel	Movement Diff.
76-1200 Roller Lever	16	4 oz max	1 oz min	.125 max	.025 min	.045 ± .011
	26	8 oz max	1½ oz min	.130 max	.025 min	.054 ± .022
	36	12 oz max	1½ oz min	.125 max	.025 min	.055 ± .022
76-1203 Roller Lever	16	2.5 oz max	1 oz min	.125 max	.025 min	.045 ± .011
76-1210 Lever	16	2.5 oz max	1 oz min	.125 max	.025 min	.047 ± .013
	26	7 oz max	2 oz min	.155 max	.025 min	.065 max
	36	9 oz max	2 oz min	.155 max	.025 min	.065 max
76-1220 Short Roller Lever	16	5 + 3 oz – 2 oz min	2 oz min	.050 max	.023 min	.020 ± .005
	26	16 oz max	5 oz min	.050 max	.012 min	.020 + .010 – .005
	36	16 ± 4 oz	4 oz min	.050 max	.012 min	.020 + .010 – .005
76-1420 Long Lever	16	1.5 oz max	10 grams min	.312 max	.080 min	.135 ± .035
	26	2½ oz max	½ oz min	.450 max	.030 min	.200 max
	36	3½ oz max	½ oz min	.450 max	.030 min	.200 max

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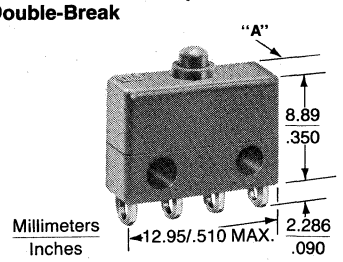
BASIC SNAP-ACTION SWITCHES

TYPE 18

Sub-Miniature, 7 Amp
Double-Break



MECHANICAL CHARACTERISTICS

Operating Force:	5 +3 oz. – 2 oz.
Release Force:	1½ oz. min.
Pretravel:	.030 max.
Overtravel:	.006 min.
Movement Differential:	.015 ± .005

MIL Spec

FEATURES

- Single-pole, double-break
- Utilizes Butterfly® double-break mechanism
- Gold plated contacts, solder lug or PC terminals are standard
- 18-488051 meets requirements of MIL-S-8805/78
- Ratings: UL Recognized File No. E27957, 7 Amps 125/250 VAC 75-80% PF

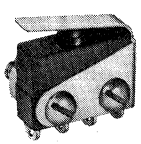
CHARACTERISTICS

"A" Dimension	Electrical Rating	Current	Pretravel	Over-Travel	Operating Force	Release Force	Movement Differential
3.96 $^{+0.00}_{-0.13}$ / .156 $^{+.000}_{-.003}$	Form X or Y	7 amps 125/250 VAC 8 amps 28 VDC IND 4 amps 125/250 VAC	0.89 / .035 Max.	0.15 / .006 Min.	142 $^{+85}_{-57}$ Grams / 5 $^{+3}_{-2}$ oz.	42 gm. / 1.5 oz Min.	0.46 ± 0.20 / .018 ± .008
	Form Z	3 amps 28 VDC IND					
5.08 / .200	Single Ckt Form Z	8 amp. RES. 7 amp IND. 28 VDC	.030 Max.	.006 Min.	5 $^{+3}_{-2}$ oz.	1½ oz. Min.	.015 ± .005
	2-Circuit Form Z	5 amp RES. 3 amp IND. 28 VDC					

SPECIFICATIONS

Part No.	Contact Arrangement	Contacts	Terminals
18-40421	SPDT-DB Form Z	Gold Plated	Solder Lug
18-488051	MS27257-1 Form Z	Gold Plated	Solder Lug

ACTUATOR FOR TYPE 18

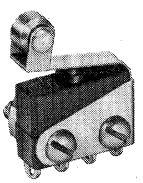


78-3000

78-3000 Spring Lever Actuator. Integral with Mounting Bracket.

MECHANICAL CHARACTERISTICS

Pretravel:	.125″ max.
Overtravel:	.030″ min.
Movement Differential:	.030 ± .015
Operating Force:	6 ± 2 oz.
Release Force:	2 oz. min.
Operating Point:	.325 ± .030



78-3100

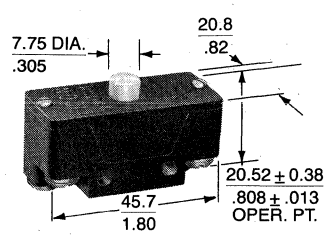
78-3100 Pivot Roller. For cam and slide operation.

MECHANICAL CHARACTERISTICS

Pretravel:	.125″ max.
Overtravel:	.030″ min.
Movement Differential:	.035 ± .015
Operating Force:	6 ± 2 oz.
Release Force:	2 oz. min.
Operating Point:	.560 ± .030

TYPE 14

20 Amp, Double-Break



MIL Spec

FEATURES

- Designed to handle loads up to 20 amps
- Features Butterly® double-break mechanism
- Available in standard and heavy duty mounting, with basic button, overtravel plunger or pivoted lever actuators
- Sealed button version also available
- Semirefractory contacts and offset #6 screw type terminals with cup washers are standard
- Ratings: UL Recognized File No. E27957, 20 Amps @ 125/250/480 VAC. 75-80% PF; CSA Certified No. 16388, 1 HP, 125 VAC, 2 HP 250 VAC

Part No.	Circuitry	Mounting	Terminal	Operating Force	Release Force	Pre-Travel	Over-Travel	Standard Movement Differential	Operating Point	Actuator Style
14-124	SPDT-DB Form Z	Standard		12 ± 3 oz.	4 oz. Min.	.074 Max.	.030 Min.	.020 ± .007		Standard Button Actuator
14-324	SPDT-DB Form Z	Standard		12 ± 3 oz.	4 oz. Min.	.074 Max.	.219 Min.	.020 ± .007		Overtravel Panel Mount
14-724	SPDT-DB Form Z	Standard	#6 Screw with Cup Washer	5 ± 2 oz.	2 oz. Min.	.156 Max.	.060 Min.	.046 ± .012	1.406 ± .031	Roller Lever Actuator
14-72403	SPDT-DB Form Z	Screw	—	5 ± 2 oz.	57 grams Min.	.156 Max.	.060 Min.	.046 ± .017	1.406 ± .034	Roller Lever

TW Switches 6615 W. IRVING PARK ROAD • CHICAGO, IL 60634

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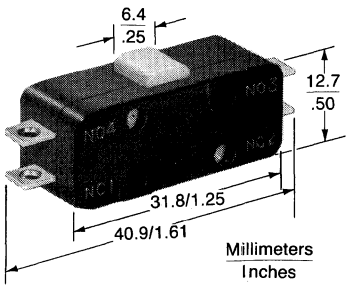
BASIC SNAP-ACTION SWITCHES

TYPE 11

Miniature, 10 Amp, Double-Break



MIL Spec

FEATURES

- Available in standard and low force momentary action, as well as reset action
- Fine silver contacts are standard; Gold plated contacts also available
- Wide variety of terminals and actuators
- Ratings: UL Recognized File No. E27957; CSA File No. 16388
- 11-388051 meets requirements of MIL-S-8805/11

ELECTRICAL CHARACTERISTICS

Circuity	125/250 VAC	28 VDC
SPST-DB N.C. (Form Y) or N.O. (Form X)	10 amp (75-80% PF) ½ HP 125 VAC ¾ HP 250 VAC	10 amp IND. 15 amp RES.
SPDT-DB (Form Z)		
SPDT-SB (Form C)		4 amp IND. 6 amp RES.

SPECIFICATIONS

Part No.	Circuit	Terminal
11-102	SPST-DB N.O. (Form X)	End Solder
11-104	SPDT-DB (Form Z)	End Solder
11-114	SPDT-DB (Form Z)	End Solder
11-204	SPDT-DB (Form Z)	#4 Screw
11-304	SPDT-DB (Form Z)	Side Solder
11-314	SPDT-DB (Form Z)	Side Solder
11-504	SPDT-DB (Form Z)	Quick Disconnect .250
11-388051	SPDT-DB (Form Z)*	Side Solder

MECHANICAL CHARACTERISTICS

Pretravel: .050 max.
Overtravel: .015 min.
Operating Force: 8 ± 3 oz.
Release Force: 4 oz. min.
Movement Differential: .020 ± .007

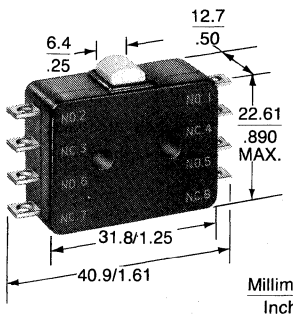
ACTUATORS MECHANICAL CHARACTERISTICS**

Part No.	Actuator	Operating Force	Release Force	Pre-Travel	Over-Travel	Movement Differential	Operating Point
71-1040	Roller Lever	3.5 oz. Max.	2 oz. Min.	.093 Max.	.062 Min.	.030 .015	.671 ± .031
71-2010	Over Travel	8 oz. ± 3 oz.	4 oz. Min.	.050 Max.	.215 Min.	.020 .005	.828 ± .015

**Mechanical characteristics when used with Basic Switch 11-104

TYPE 22

Miniature 10 Amp, Double-Break



MIL Spec

FEATURES

- Contains two individual switching elements which function simultaneously (within .004″ of plunger travel)
- Fine silver contacts are standard; Gold plated contacts also available
- Wide variety of terminals styles and actuators
- Ratings: UL Recognized File No. E27957, 10 Amps @ 125/250 VAC, 75-80% PF ½ HP @ 125 VAC, ¾ HP @ 250 VAC
- MIL-S-8805/15 listed units available

ELECTRICAL CHARACTERISTICS

Circuity	Voltage	Current
DPST-DB N.O. or N.C. (Form XX or YY)	28VDC	15 amp RES. 10 amp IND.
DPDT-DB (Form ZZ)	28VDC	10 amp RES. 7 amp IND.

SPECIFICATIONS

Part No.	Circuit	Terminal
22-104	DPDT-DB (Form ZZ)	End Solder
22-202	DPST-DB N.O. (XX)	#4 Screw
22-204	DPDT-DB (Form ZZ)	#4 Screw
22-304	DPDT-DB (Form ZZ)	Side Solder
22-504	DPDT-DB (Form ZZ)	¼″ Quick Disconnect

MECHANICAL CHARACTERISTICS

Pretravel: .060 max.
Overtravel: .015 min.
Operating Force: 17 ± 5 oz.
Release Force: 4 oz. min.
Movement Differential: .030 ± .009
Terminals: Solder (side or end)
#4 screw ¼″ quick disconnect

ACTUATORS–MECHANICAL CHARACTERISTICS*

Part No.	Actuator	Operating Force	Release Force	Pre-Travel	Over-Travel	Movement Differential	Operating Point
72-2080	Over Travel (2)* Plunger	17 ± 5 oz.	4 oz. Min.	.060 Max.	.215 Min.	.030 ± .007	.828 .031

(1)* when used with 22-104 Basic Switch or 22-204 Basic Switch
(2)* when used with 22-304 Basic Switch

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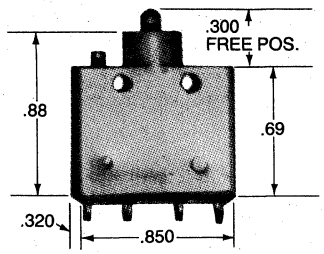
ITW SEALED SWITCHES

TYPE 65



MIL Spec

FEATURES

- Ratings up to 15 amps resistive @ 28 VDC
- Provides the ruggedness and reliability to meet demands of industrial & military applications
- Available with variety of basic switches: Type 11, Type 16, Type 22
- Meets the (watertight) requirements per MIL-S-8805 enclosure design symbol 3
- Wide choice of circuitry, actuators and mountings
- Optional electrical connections—solder, quick disconnect or screw terminals
- Wire leads with or without connectors or plugs
- Temperature range for standard units −65°F to +185°F

SUBMINIATURE SEALED SWITCHES
(SOLDER LUG TERMINALS STANDARD)

Part No.	Actuator	Circuitry	P.T.	O.T.	O.F.	R.F.	M.D.
65-2010	Pin Plunger	SPDT-DB Form Z	.050 max.	.012 min.	24 ± 8 oz.	8 oz. min.	.010-.030
65-3010	Roller Lever	SPDT-DB Form Z	.120 max.	.025 min.	16 oz. max.	5 oz. min.	.058 max
65-4010	Over Travel	SPDT-DB Form Z	.070 max.	.187 min.	.025 max.	8 oz. min.	.020 ± .010
65-4012	Over Travel	SPDT-DB Form Z	.070 max.	.187 min.	2¼ lb. max.	8 oz. min.	.010-.030 max.

Electrical Ratings: 5A IND — 28 VDC 5A RES — 125, 250 VAC

MINIATURE SEALED SWITCHES

Part No.	Actuator	Circuitry	P.T.	O.T.	O.F.	R.F.
65-430098	Over Travel	SPDT-DB Form Z	.070 max.	.140 min.	4.8 lb. max.	1.8 lb. min.

Electrical Ratings: 7.5A IND, 15A RES — 28VDC 10A RES — 125, 250 VAC

BASIC SWITCH KIT

The ITW Switches Basic Switch Kit is now available. It is filled with 9 different styles of Type 16 basic switches and 4 different Type 76 actuators. Many different variations can be built using the basic switches and the actuator parts (44 switches and 24 actuators & hardware).

To order: ask for 16-KIT

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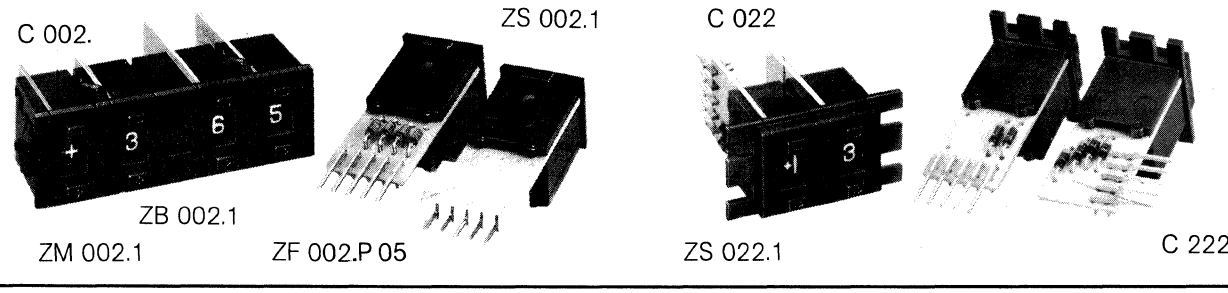
Pushwheel Codeswitches



IVO Industries manufactures a full line of pushwheel codeswitch products for the OEM market. As listed below, our switches are available in a variety of sizes and codes, and with our assortment of accessories, you will be able to design custom assemblies for each application. Feel free to call for more specific product information and/or technical support.

	Model	Cutout Dimensions
Front Mount	C002	7.62 x 14.0 mm
	C003	7.62 x 22.5 mm
	C005	10.0 x 31.0 mm
	C006	8.0 x 31.0 mm
Rear Mount	C022	7.62 x 14.0 mm
	C055	10.0 x 30.5 mm
	C077	8.0 x 19.0 mm
	C088	8.9 x 25.4 mm
Rear Mount w/ right angle connection		
	C222	7.62 x 14.00 mm
	C777	8.0 x 19.0 mm

Codes:

BCD	Decimal 0-9
BCD Complement	BCD + Comp.
Hexadecimal	Plus/minus

Other standard versions available upon request.

Methods of Connection:

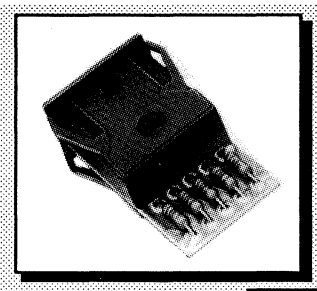
Solder Pin Edge Contacts
Plug in Connector

Accessories:

Sideplates	Blank housings
Spacers	Installed diodes

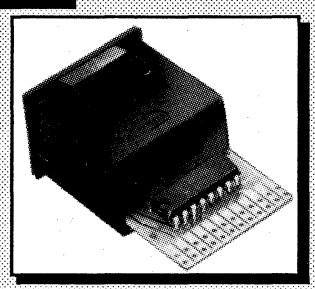
Technical Data:

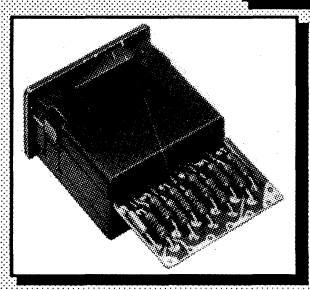
Contact material	Au, Ag, Cu
Circuit board	Au
Max. current	0.5 A ~
Rated current	1 - 100 mA~
Operating voltage	max. 50V~
Contact resistance	100 m ohm
Insulation resistance	10^3 M ohm
Operating life	max. 10^6 operations



RESISTANCE DECADES

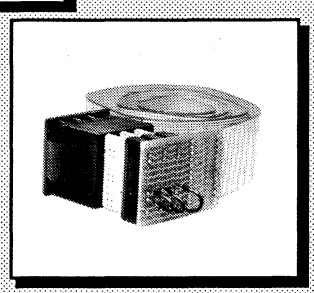
COMPARATORS





KELVIN VARLEY DECADES

CUSTOM ASSEMBLIES



IVO Industries Inc. 201 Industrial Way West, Eatontown, NJ 07724 **Tel.1-800-932-0489** Fax(201)542-2938

Call for immediate engineering assistance, exact price, delivery. Many other models available.

JAE Electronics, Inc.
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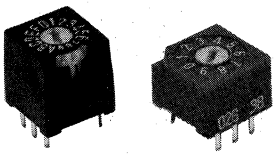
ROTARY DIP SWITCHES 41J/42J SERIES



SPECIFICATIONS:

No. of switching positions: 10, 16 positions • **Life:** 10,000 detent operations min. • **Operating force:** 300 g-cm max. at rotor center • **Operating temperature range:** −10°C to +60°C • **Storage temperature range:** −25°C to +75°C • **Max. recommended non-switching load:** 100 mA at 50 VDC • **Max. recommended switching load** • 100 mA at 5 VDC • **Dielectric withstanding voltage:** • 200 Vrms for one minute • **Insulation resistance:** 1000 megohms min. • **Switch circuit resistance:** 100 milliohms max. (10 mA 5 VDC) • **Weight:** 1 gram (Approx.) • **Materials: Housing:** Nylon; **Contact:** Phosphor bronze, gold over nickel; **PC disk:** Glass epoxy, gold over nickel • **Dielectric withstanding voltage:** 250 Vrms for one minute • **Weight:** 0.9 gram (Approx.).

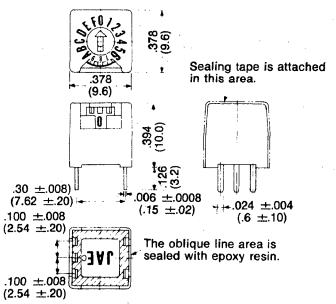
SWITCH MODEL No.:

Model No.	Code Description	Rotor Color	No. of Positions	Truth Table
41J02G	BCD 1-2-4-8	Orange	10	B02
41J12G	BCD 1-2-4-8 Complement	Yellow	10	C12
41J34G	Binary 1-2-4-8, 1 ~ 9, A ~ F Marking	Orange	16	B07
41J41G	Binary 1-2-4-8, 1 ~ 9, A ~ F, Marking Complement	Yellow	16	C16

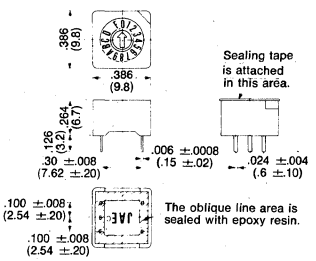
Model No.	Code Description	No. of Positions	Housing Color	Rotor Color	Truth Table
42J02G	BCD 1-2-4-8	10	Blue	Orange	B02
42J12G	Binary 1-2-4-8 Complement	10	Blue	Yellow	C12
42J34G	Binary 1-2-4-8	16	Black	Orange	B07
42J41G	BCD 1-2-4-8 Complement	16	Black	Yellow	C16

OUTLINE DIMENSIONS
INCHES (mm)

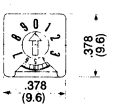
41J — 16 POSITION



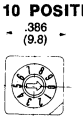
42J — 16 POSITION



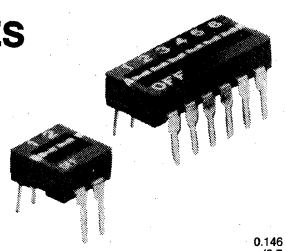
10 POSITION



10 POSITION



SLIDE-DIP SWITCHES 5*D SERIES



FEATURES

- Low profile slide-DIP switch
- Conforms to TO-116 standard IC packages (51D and 52D)
- Machine-insertable with standard automatic insertion equipment
- Recessed actuator types (51D), raised actuator types (52D) and right angle types (53D) available for virtually all applications
- Factory-sealed with removable, heat-resistant polyester tape to withstand automatic solder and cleaning processes

ORDERING INFORMATION

XXD-XX XX

51D: Recessed actuator type
52D: Raised actuator type
53D: Right angle type

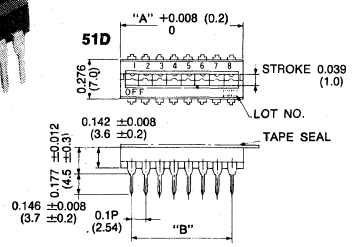
Number of poles: 02-10

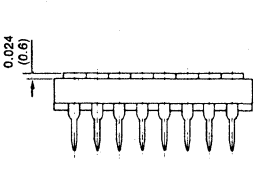
Blank: Without seal tape (51D and 52D)
Bottom ON without seal tape (53D)
01: With seal tape (51D and 52D)
Bottom ON with seal tape (53D)
02. Bottom OFF without seal tape (53D)
03: Bottom OFF with seal tape (53D)

For other requirements, consult JAE.

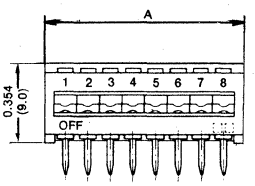
OUTLINE DIMENSIONS
INCHES (mm)

51D



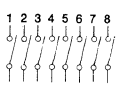


52D

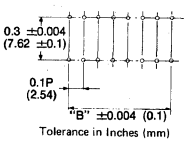


53D

CIRCUIT



HOLE PATTERN



.x ±0.004 (0.1)
.xx±0.0020 (0.05)

STATION	2	3	4	5	6	7	8	9	10
A	0.263 (6.68)	0.363 (9.22)	0.463 (11.76)	0.563 (14.30)	0.663 (16.84)	0.763 (19.38)	0.863 (21.92)	0.963 (24.46)	1.063 (27.00)
B	0.1 (2.54)	0.2 (5.08)	0.3 (7.62)	0.4 (10.16)	0.5 (12.70)	0.6 (15.24)	0.7 (17.78)	0.8 (20.32)	0.9 (22.86)

SPECIFICATIONS:

Number of poles: 2-10 • **Contact Rating: Switching Load:** 100 mA at 50 VDC max. • **Non-switching Load:** 100 mA at 5 VDC max. • **Minimum Switching Load:** 10A at 5 VDC min. • **Contact Resistance:** 100 MΩ at 1mA, 5 VDC max. • **Insulation Resistance:** 1000 MΩ at 100 VDC • **Dielectric Withstanding Voltage:** 500 VDC for 1 minute • **Operating Force:** 600g max. **Resistance to Soldering Heat: Solder Bath:** 260°C, 10 sec. • **Hand Solder:** 350°C, 3 sec. • **Solderability:** 235°C, 2 sec. • **Operating Temperature Range:** −25°C-+70°C • **Storage Temperature Range:** −40°C-+85°C • **Life:** 2000/pole min. • **Materials:** Contact: Phosphor bronze, gold over nickel • **Actuator:** Nylon 94HB • **Housing:** PBT 94V-0.

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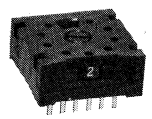
1901-A EAST CARNEGIE AVE., SANTA ANA, CA 92705
714/250-8770 • (800) JAE-PART (523-7278) • FAX (714) 250-8957 • TELEX: 681-438 (JAE US)

DIGITAL THUMBWHEEL SWITCHES 22J SERIES



SPECIFICATIONS:

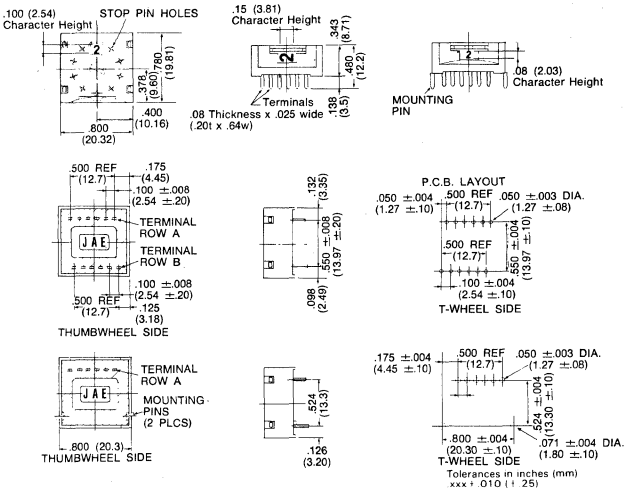
No. of switching positions: 10 positions • **Life:** 250,000 detent • **Operating force:** 400g (max.) • **Operating temperature range:** −25°C to +70°C • **Storage temperature range:** −40C° to +100°C • **Dielectric withstanding voltage:** 500 Vrms for one minute • **Insulation resistance:** 1000 megohms (100 VDC) • **Switch circuit resistance:** 0.100 ohms max. initial; 0.200 ohms max. after life test • **Weight:** 3 grams (Approx.) • **Standard color:** Black • **Electrical ratings: Max. recommended non-switching load:** 3A at 28 VDC; **Max. recommended switching load:** 0.125A at 28 VDC; **Min. recommended switching load:** 10 μA at 0.020 VDC • **Materials: Housing:** Black nylon; **Metal contacts:** Phosphor bronze for spring, gold over nickel; **Circuit disk:** Glass, epoxy, gold over nickel; **Dummy pin:** Tin-plated phosphor bronze.

SWITCH MODEL No.:

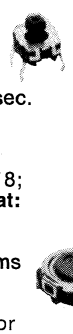
Model No.	Code Description	Number of Positions
22J**01G	DECIMAL	10
22J**02G	BCD 1-2-4-8	10
22J**12G	BCD 1-2-4-8 Complement Only	10
22J**28G	BCD 1-2-4-8 with Complement	10
22J**56G	BCD 1-2-4-8 with Separate Common To Not True Bits	10
22J**11G	2 Pole Repeating + and −	10

** To complete model number, replace ** with Orientation Number.

OUTLINE DIMENSIONS INCHES (mm)



TACTILE-PUSH SWITCHES 61/62T SERIES

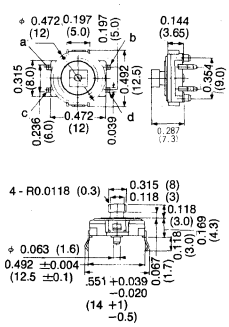


SPECIFICATIONS:

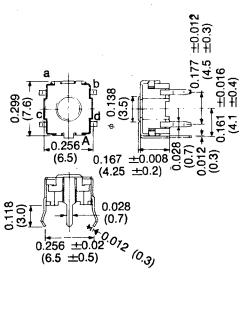
No. of switching positions: 62T Series: SPST Momentary • **Max. recommended switching load: 61T Series:** 30 mA at 12 VDC • **Min. recommended switching load:** 0.1 mA 5 VDC • **Contact bounce: 61T Series:** 4 msec. max.; **62T Series:** 10 msec. max. • **Contact resistance:** 100m ohms max. at 1 mA 5 VDC • **Insulation resistance:** 100 meg ohms min. at 250 VDC • **Dielectric withstanding voltage:** 250 Vrms for one minute • **Operating force/Stroke: 61T Series:** 140 ±30g/0.010 ~ 0.018; **62T Series:** 110 30g/0.010 ±0.004 • **Resistance to solder heat:** Solder bath 260°C 5 sec.; Hand solder 350°C 3 sec. • **Solderability:** Solder bath 230°C 2 sec.; Hand solder 230°C 6 sec. • **Shock: 61T Series:** 20G. 11 ms; **62T Series:** 50G. 11 ms • **Operating temperature range:** −25°C ~ +70°C • **Storage temperature range:** −40°C ~ +80°C • **Life: 61T Series:** 1.000.000; **62T Series:** 300.000 • **Materials: Contact:** Phosphor bronze, silver; **Pusher:** 15% GF PBT; **Housing:** 15% GF PBT.

OUTLINE DIMENSIONS INCHES (mm)

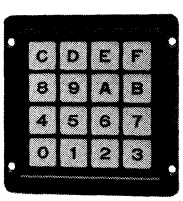
61 T SERIES



62 T SERIES



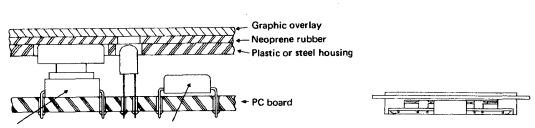
PANEL SWITCHES FP5 SERIES



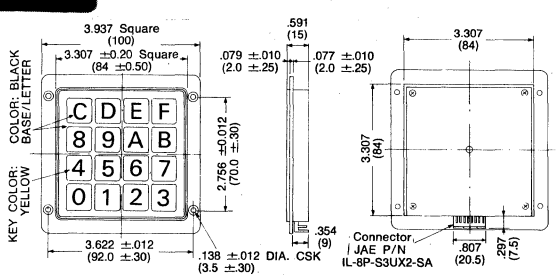
SPECIFICATIONS:

No. of switching positions: 1 SPST • **Life:** 1,000,000 cycles per key • **Contact ratings:** 300 mA, 12 VDC • **Contact resistance:** 1 ohm max. • **Contact bounce:** 4 millisecond max. • **Key travel:** 0.3 to 0.5mm (0.01 to 0.02) • **Key operating force:** 150 ±40g • **Insulation resistance:** 100 megohms min. at 100 VDC • **Dielectric withstanding voltage:** 250 Vrms for 1 minute • **Operating temperature range:** −30°C to +70°C • **Storage temperature range:** −40°C to +80°C.

STRUCTURE:



OUTLINE DIMENSIONS INCHES (mm)



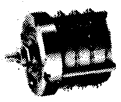
FOR COMPLETE ORDERING INFORMATION CONSULT FACTORY

Series "A" Miniature Rotary Selector Switches

QPL MIL-S-3786

- TOTALLY ENCLOSED
- EXPLOSION PROOF

Series A-15 — 15°

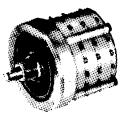


Max. Positions: 24
Body Diameter: 2″

ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

A15-1 Series 1 pole/deck
A15-2 Series 2 pole/deck
A15-3 Series 3 pole/deck
A15-4 Series 4 pole/deck
A15-6 Series 6 pole/deck

Series A-20 — 20°

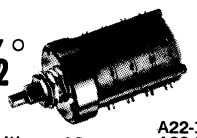


Max. Positions: 18
Body Diameter: 2″

ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

Available only in single pole per deck construction.

Series A-22 — 22½°

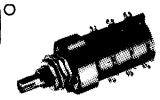


Max. Positions: 16
Body Diameter: 1.5″

ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

A22-1 Series 1 pole/deck
A22-2 Series 2 pole/deck
A22-4 Series 4 pole/deck

Series A-30 — 30°



Max. Positions: 12
Body Diameter: 1.036″

ELECTRICAL RATING:
2 amps 115 v ac Res.
1 amp 28 v dc Res.
0.5 amp 28 v dc Ind.

A30-1 Series 1 pole/deck
A30-2 Series 2 pole/deck
A30-3 Series 3 pole/deck
A30-4 Series 4 pole/deck
A30-6 Series 6 pole/deck

"M" Series
See MIL-S-3786/4

Series A-36 — 36°

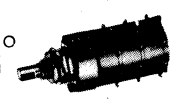
Max. Positions: 10
Body Diameter: 1.036″

ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

A36-1 Series 1 pole/deck
A36-2 Series 2 pole/deck

"M" Series
See MIL-S-3786/4

Series A-45 — 45°



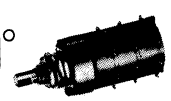
Max. Positions: 8
Body Diameter: 1.036″

ELECTRICAL RATING:
5 amps 115 v ac Res.
5 amps 28 v dc Res.
2.5 amps 28 v dc Ind.

A45-1 Series 1 pole/deck
A45-2 Series 2 pole/deck

"M" Series
See MIL-S-3786/4

Series A-60 — 60°

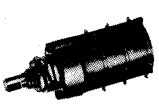


Max. Positions: 6
Body Diameter: 1.036″

ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

Available only in single pole per deck construction.
"M" Series See MIL-S-3786/4

Series A-90 — 90°

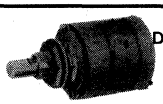


Max. Positions: 4
Body Diameter: 1.036″

ELECTRICAL RATING:
5 amps 115 v ac Res.
5 amps 28 v dc Res.
2.5 amps 28 v dc Ind.

Available only in single pole per deck construction.
"M" Series See MIL-S-3786/4

Series	Index
AA30 —	30°
AA36 —	36°
AA45 —	45°



Directly interchangeable with "A" Series above.

ADJUSTABLE STOPS

Max. Positions: AA30-12 AA36-10 AA45-8
Body Dia.: 1.036″ Meets MIL-S-3786

Janco CORPORATION

Series "B" Micro-Miniature Rotary Selector Switches

QPL MIL-S-3786

- TOTALLY ENCLOSED
- EXPLOSION PROOF
- UNITIZED CONSTRUCTION

All switches offer maximum protection against radio frequency interference.

Body Diameter: .623″

Electrical Rating Continuous:
8 amps at 28 v dc

Switching Rate:
0 to 0.25 amp resistive
0 to 28 v dc
0 to 0.25 amp resistive
0 to 115 v ac
0 to 0.12 amp inductive
0 to 28 v dc

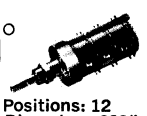
Torque: 5 to 9″ ounces

Contact Resistance:
.005 ohms average

Insulation Resistance:
100,000 megohms minimum at 100 volts
10,000 megohms minimum at 500 volts

Designed and Built to meet the environmental and functional requirements of MIL-S-3786

Series B-30 — 30°

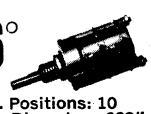


Max. Positions: 12
Body Diameter: .623″

B30-1 Series 1 pole/deck
B30-2 Series 2 pole/deck
B30-3 Series 3 pole/deck

"M" Series
See MIL-S-3786/13

Series B-36 — 36°



Max. Positions: 10
Body Diameter: .623″

B36-1 Series 1 pole/deck
B36-2 Series 2 pole/deck

"M" Series
See MIL-S-3786/13

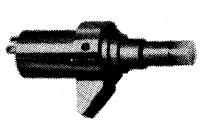
Series B-45 — 45°

Max. Positions: 8
Body Diameter: .623″

B45-1 Series 1 pole/deck
B45-2 Series 2 pole/deck

"M" Series
See MIL-S-3786/13

Typical Unique Applications of Janco Rotary Switches

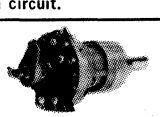


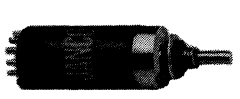
DOUBLE MOMENTARY ACTION

Push button switch designed for grip stick applications. Actuation to first momentary detented position closes first circuit. Second detented position completes second circuit.

FEATURES UNIQUE ON-OFF OPERATION

Actuated by pulling knob out and rotating to "on" positions. While in "on" positions, circuitry cannot be shut off until knob is returned to "off" position and depressed.





MASTER COMMUNICATIONS SWITCH

Provides standard coded outputs and offers unique switching functions by longitudinal shaft movement. Momentary or maintained contact positions actuated by pulling shaft.

JET ENGINE START SWITCH

Knob is depressed and contacts are held in by the solenoid. After jet engine reaches desired RPM, system removes power disengaging solenoid. Lighted knob indicates function.

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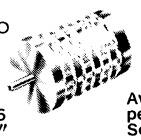
Series "C" Rotary Selector Switches

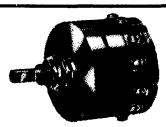
Series C-22 — 22½°



Max. Positions: 16
Body Diameter: 3″

ELECTRICAL RATING:
10 amps 115 v ac Res.
10 amps 28 v dc Res.
6 amps 28 v dc Ind.
Available only in single pole per deck construction.
Screw terminals only.

Series C-30 — 30°



Max. Positions: 11 plus off
Body Diameter: 2.180″

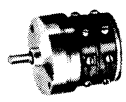
ELECTRICAL RATING:
10 amps 115 v ac Res.
10 amps 28 v dc Res.
5 amps 28 v dc Ind.
C30-1 Series 1 pole/deck
C30-3 Series 3 pole/deck
Screw terminals only.

Series C-36 — 36°

Max. Positions: 9 plus off
Body Diameter: 2.375″

ELECTRICAL RATING:
10 amps 115 v ac Res.
10 amps 28 v dc Res.
5 amps 28 v dc Ind.
Available only in single pole per deck construction.
Screw terminals only.

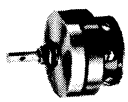
Series C-45 — 45°



Max. Positions: 7 plus off
Body Diameter: 1.93″

ELECTRICAL RATING:
10 amps 115 v ac Res.
10 amps 28 v dc Res.
5 amps 28 v dc Ind.
C45-1 Series 1 pole/deck
C45-2 Series 2 pole/deck
Screw terminals only.

Series C-90 — 90°



Max. Positions: 4
Body Diameter: 2.12″
Screw terminals only.

ELECTRICAL RATING:
1 pole construction:
15 amps Res. 115 v ac
15 amps Res. 28 v dc
10 amps Ind. 28 v dc
2 pole construction
7.5 amps Res. 115 v ac
7.5 amps Res. 28 v dc
5 amps Ind. 28 v dc
C90-1 Series 1pole/deck
C90-2 Series 2 pole/deck

Series "E" Rotary Selector Switches PRINTED CIRCUIT

Series	Indexing	No. of Positions
MINIATURE	EA45	45° 8
	EA36	36° 10
	EA30	30° 12
	EA22	22° 16
MICRO-MINIATURE	EB45	45° 8
	EB36	36° 10
	EB30	30° 12
MINIATURE	EC45	45° 8
	EC36	36° 10
	EC30	30° 12
	EC22	22° 16
	EC18	18° 20
	EC15	15° 24
ED	ED	30° 12
		36° 10
		45° 8
EE	EE	30° 12
		36° 10
		45° 8

- Totally enclosed, explosion proof.
- Printed circuit construction.
- Make and break:
  .125 amp Res. @ 28 v dc
  .125 amp Res. @ 115 v ac
  .05 amp Ind. @ 28 v dc
- All standard codes available.
- Current carrying capacity, 3 amps continuous.
- Will meet or exceed the environmental requirements of MIL-S-3786 and MIL-S-22710.
- O ring sealed shaft available
- For "ED" and "EE" Series, .100 Amp Res. at 115 VAC or at 28 Vdc.

JANCO CORPORATION

Since 1947

Series "D" Pushbutton Rotary Switches

QPL MIL-S-22710

FEATURES: • Totally enclosed, explosion proof. • Printed-circuit construction. • Black or white numbers on black or white background indicate switch positions (black numbers on white background for lighted switches). • All standard codes available. Available in 8, 10, 12 or 16 positions. • Plastic covered buttons, available in black, red, green, yellow, white or blue.

Series	Indexing	No. of Positions
D45U	45°	8
D36U	36°	10
D30U	30°	12
D22B	22½°	16
D22U		
D45B	45°	8
D36B	36°	10
D30B	30°	12
DA45U	45°	8
DA36U	36°	10
DA30U	30°	12

MAKE AND BREAK
.125 amp res. at 28 v dc and 115 v ac
.05 amp ind. at 28 vdc

PUSH FORCE:
55 oz. max.

CONTACT RESISTANCE:
Initial .100 ohms
After life .160 ohms

LIFE:
50,000 cycles
Cycle consists of 720° rotation

INSULATION RESISTANCE:
5,000 megohms

ALTITUDE:
70,000 ft.

TEMPERATURE RANGE:
−65°C to +85°C

PLUNGER TRAVEL:
.180 approx.

DIELECTRIC STRENGTH:
750 volts RMS

WEIGHT:
½ oz. approx.

GENERAL SPECIFICATIONS

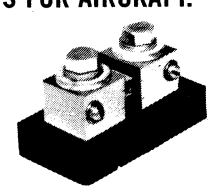
All switches offer maximum protection against radio frequency interference.
ELECTRICAL RATING:
Carry 10 amps continuous.
Make and Break — see individual switch data.
VOLTAGE DROP:
0.1 volt or less at rated amperage.
Initial Contact Resistance: .003 ohm.
LIFE:
10,000 double cycles make and break rated amperage.
TORQUE:
1 to 3 inch lbs.
SWITCHES DESIGNED AND BUILT IN ACCORDANCE WITH THE FOLLOWING SPECS.:
MIL-S-6807 (rotary switches enclosed)
MIL-S-3786 (rotary switches)
MIL-E-5272 (environmental testing)

ON MOST OF THE SWITCHES LISTED, THE FOLLOWING FEATURES ARE AVAILABLE:

- O-ring Shaft and Panel Seal
- Combination of Decks
- Bridging contacts
- Momentary positions
- Isolated positions
- Adjustable stops
- Solenoid driven
- Keylock
- Gang switches
- Concentric shaft switches

ELECTRICAL HARDWARE PRODUCTS FOR AIRCRAFT:

- External Ammeter Shunts MIL-S-61-B
- Flexible Bus Assemblies
- Bus Bars • Bonding Jumpers



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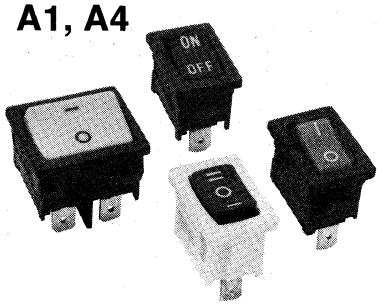
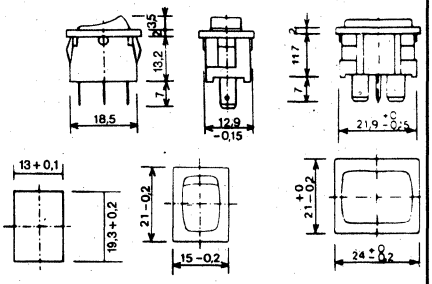
MOLVENO COMETTI

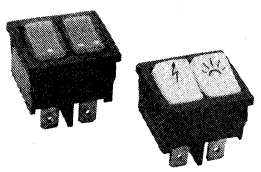
A1, A4

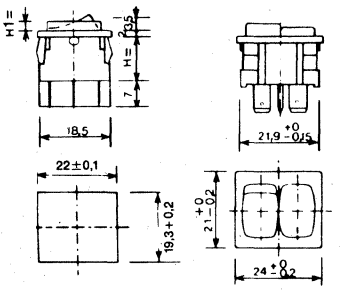




A1, A4 SERIES
Rating: 3, 6, 10, 15 A/120VAC
Temp: 65C / UL & CSA
105 C / European
Colors: Standard: Red, Black, Brown and White
Others available on request
Functions: SPST, SPDT, Momentaries, illuminated AC/DC

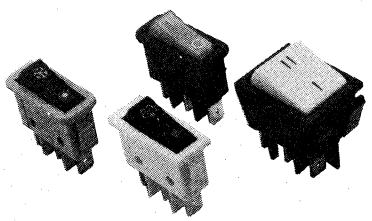
A2

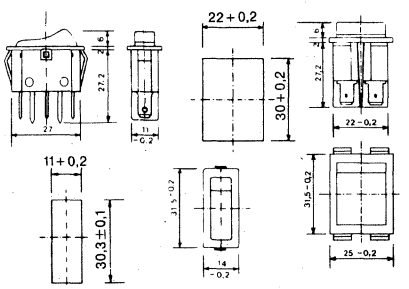




A2 SERIES
Rating: 3, 6, 10, 15 A/120VAC
Temp: 65C / UL & CSA
105C / European
Colors: Standard: Red, Black, Brown and White.
Others available on request
Functions: SPST, SPDT, Momentaries, illuminated AC/DC

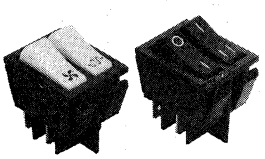
B1, B4

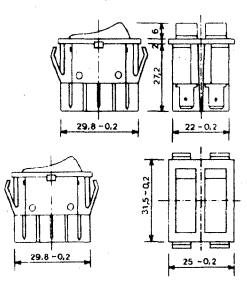




B1, B4 SERIES
Rating: 4, 10, 16, 20 A/120VAC
Temp: 65C / UL & CSA
105C / European
Colors: Standard: Red, Black, Brown and White.
Others available on request
Functions: SPST, SPDT, MOM. DPST, DPDT IN B4, illuminated AC/DC

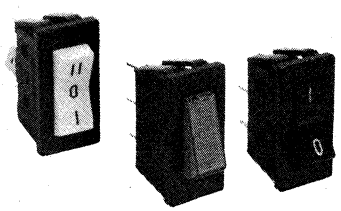
B2

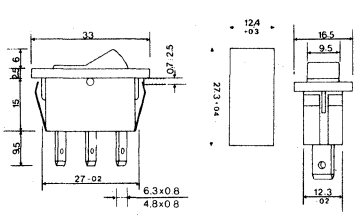




B2 SERIES
Rating: 4, 10, 16, 20 A/120VAC
Temp: 65C / UL & CSA
105 C / European
Colors: Standard: Red, Black, Brown and White.
Others available on request
Functions: SPST, SPDT, Momentaries, illuminated AC or DC

SCM





SCM SERIES
Rating: 3, 10, 16 A/120VAC
Temp: 65C / UL & CSA
105C / European
Colors: Standard: Red, Black, Brown and White.
Others available on request
Functions: SPST, SPDT, and Momentaries, illuminated AC/DC

PLEASE SEE SECTION 2460 FOR ADDITIONAL LAMB/MOLVENO COMETTI PRODUCTS.

ALL DIMENSIONS IN MILLIMETERS

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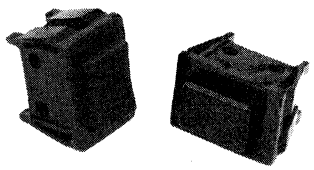
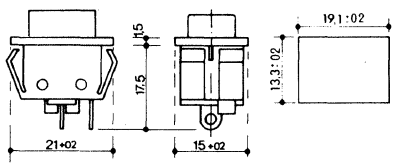
MOLVENO COMETTI

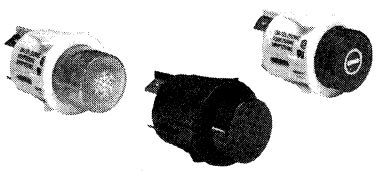
P

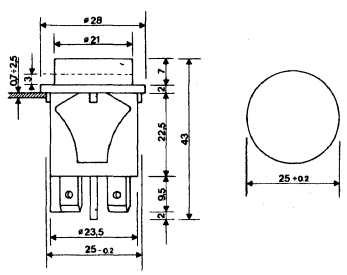




P SERIES
Rating: 2, 6, 10 A/250VAC
Temp: 125C / European (UL/CSA Pending)
Colors: Standard: Black, and White. Other colors available on request
Functions: SPST

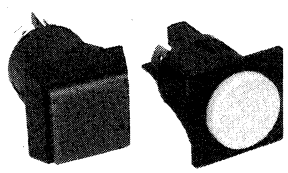
SPL60

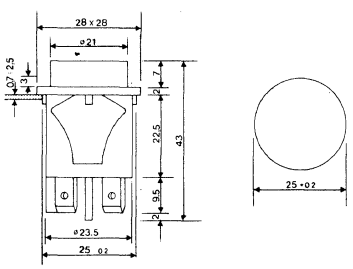




SPL60 SERIES
Rating: 1.5 or 16 A/250VAC
Temp: 65C UL/CSA
Colors: Standard: Black Body, Red, Amber, Green, Lens. Other colors on request.
Functions: SPDT, DPST illuminated or non

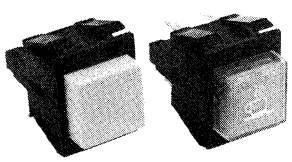
SPL61, 62

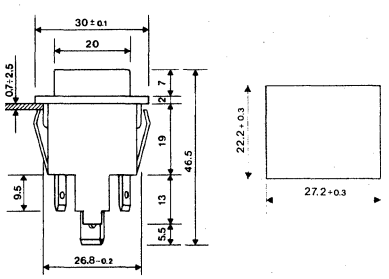




SPL61, 62 SERIES
Rating: 1.5 or 16 A/250VAC
Temp: 65C UL/CSA
Colors: Standard: Black Body, Red, Green, Amber, White, Yellow lenses. Others available.
Functions: SPDT, DPDT illuminated or non.

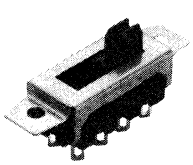
SPL63

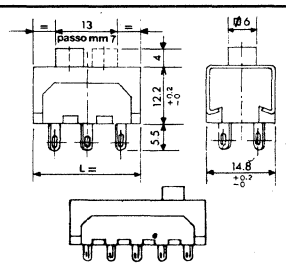




SPL63 SERIES
Rating: 1.5 or 16 A/250VAC
Temp: 65C UL/CSA
Colors: Standard: Black Body. Red, Green, Amber, White, Yellow lenses. Others available.
Functions: SPDT, DPDT illuminated or non.

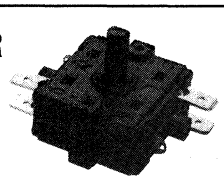
SCL

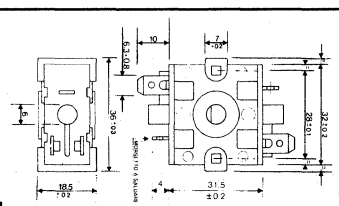




SCL SERIES
Rating: 6 AMPS / 250VAC
Temp: 125C European (UL/CSA Pending)
Thermoplastic or Thermosetting available.
Functions: DPDT up to 5 positions.

SCR





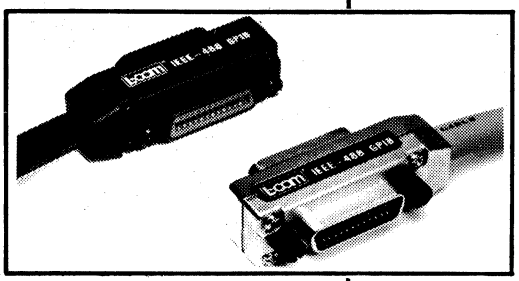
SCR SERIES
Rating: 2 or 10 A/250VAC
Temp: 125C European. (UL/CSA Pending)
Shaft available.
Functions: DP up to 6 positions.

PLEASE SEE SECTION 2460 FOR ADDITIONAL LAMB/MOLVENO COMETTI PRODUCTS.

ALL DIMENSIONS IN MILLIMETERS

L-COM® IEEE-488 CABLE PRODUCTS

FEATURING: Ultimate design. Cable strain relief prevents tearing.

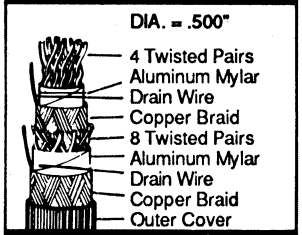


IEEE-488 Cables - *Meet or Exceed Strict Shielding Requirements*

L-COM General Purpose Interface Bus Cables are designed and built to the latest IEEE-488 Standard, covering "Interface for Programmable Instrumentation". Extreme care has been given to provide a cable that's extremely flexible with plated die cast connector housing and a better than average strain relief to prevent the cable from coming apart when bending at sharp angles. This is a common fault with many GPIB cables in the market today and L-COM has definitely resolved this problem!

IEEE-488 Cables are used to facilitate interconnection of programmable measurement and instrumentation devices to form an integrated system. These cables are designed to minimize cross talk between signal lines, susceptibility to external noise and transmission of signals to external environments. Our GPIB Cables are directly interchangeable with: H-P, AMP, and Amphenol equivalents.

CABLE DETAIL

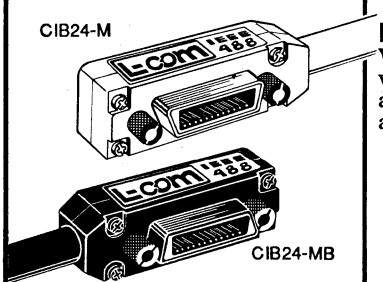


4 SHIELDS

Deluxe IEEE-488 Cables - *Built with No Compromise in Quality or Longevity*

MODEL	LGT / MTRS	LGT / FT	1-9	10-24	25-99
CIB24-03M	0.3	*1.09*	59.50	56.52	53.55
CIB24-05M	0.5	*1.64*	60.50	57.48	54.45
CIB24-1M	1.0	*3.28*	63.00	59.85	56.70
CIB24-2M	2.0	*6.56*	68.00	64.60	61.20
CIB24-3M	3.0	*9.84*	73.00	69.35	65.70
CIB24-4M	4.0	*13.12*	78.00	74.10	70.20
CIB24-5M	5.0	*16.40*	83.00	78.85	74.70
CIB24-6M	6.0	*19.68*	88.00	83.60	79.20
CIB24-8M	8.0	*26.24*	103.00	97.85	92.70
CIB24-10M	10.0	*32.80*	118.00	112.10	106.20
CIB24-15M	15.0	*49.20*	148.00	140.60	133.20

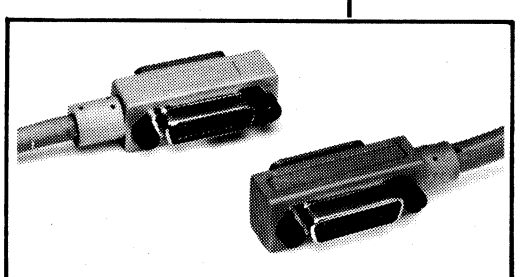
CIB24-M



Deluxe IEEE-488 Cables - *Built to "No Glare" Specs for Specific Industries*

We were urged to produce a series of IEEE-488 cables to resolve the problem of "glare" when used in the vicinity of video cameras, etc. As a result, our best GPIB cables have been modified to include black and anodized cast metal connectors and black interconnecting cable. Now in stock in six basic lengths. See above for specifics of this cable (CIB24 Series) which has 4 shields and is part of our premium line.

CIB24-1MB	1.0	*3.28*	63.50	60.33	57.15
CIB24-2MB	2.0	*6.56*	68.50	65.08	61.65
CIB24-3MB	3.0	*9.84*	73.50	69.83	66.15
CIB24-4MB	4.0	*13.12*	78.50	74.58	70.65
CIB24-5MB	5.0	*16.40*	83.50	79.33	75.15
CIB24-6MB	6.0	*19.68*	88.50	84.08	79.65



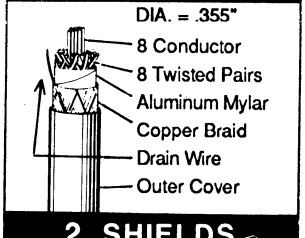
IEEE-488 Cables - *Fully Shielded with Molded Terminations*

L-COM offers a second approach to complete the Interface Bus Cable System. Shielding that is not as stringent as in the CIB24 Series, but adequate for most applications. Featuring all-molded connector ends, which contribute to a long life expectancy, and are impervious to breakage at the point where the cable enters the connector housing. Considerable savings can be realized in volume applications.

Molded IEEE-488 Cables - *Same Entry as Leading Makers*

The CMB Cable Series meets all standards of the IEEE-488 interface, conforms with traditional mounting procedure and is directly compatible with H-P, Amp and Amphenol. By traditional standards our cables conform electrically and physically with the cable entrance always approaching from the same direction as illustrated in Figure A at right.

CABLE DETAIL



2 SHIELDS

CMB24

CMB24-05M	0.5	*1.64*	40.00	38.00	36.00
CMB24-1M	1.0	*3.28*	42.00	39.90	37.80
CMB24-2M	2.0	*6.56*	46.00	43.70	41.40
CMB24-3M	3.0	*9.84*	50.00	47.50	45.00
CMB24-4M	4.0	*13.12*	54.00	51.30	48.60
CMB24-5M	5.0	*16.40*	58.00	55.10	52.20
CMB24-6M	6.0	*19.68*	62.00	58.90	55.80

Interconnection Guidelines when using IEEE-488 cables: (1) Total number of devices is 15 or less. (2) Total length of all cables used does not exceed 2 meters times the number of devices connected, or up to a maximum of 20 meters. (3) It's recommended that not more than 3 connectors be stacked on top of each other; the resulting cantilevered structure can cause damage. Damage can be minimized by using L-COM Multi-Tap bus strips (next pg) and (4) Lock screws finger tightened only.

L-COM®
1755 OSGOOD STREET, N. ANDOVER, MA 01845
ORDERS ONLY: 800-343-1455
TEL: (508) 682-6936
FAX: (508) 689-9484

IEEE-488 ACCESSORIES

L-COM®

MODEL	DESCRIPTION	ENTRY	1-9	10-24	25-99

IEEE-488 Accessories - *Carefully Study These New & Useful GPIB Products*

L-COM is first to offer a full line of GPIB accessory products to the industry. Some of these innovative components are proprietary, a direct result of listening to instrumentation engineers and technicians. We believe that you could also find these accessories useful in your day-to-day test or production endeavors. Fabricated from the best materials for a long and useful life, these products will mate perfectly with all our GPIB Cables and equivalents.

Bulkhead Adaptor - *Most Orderly Way to Feed IEEE-488 Cables Thru Panels*

These bulkhead adaptors were tooled and made available because of a need by design and test engineers. This adaptor provides a simplified means of passing a IEEE-488 cable between isolation walls and will also provide access to a console work table. Two basic models are available. The "BA" version has a conventional male/female entry whereas the "BF" version has two female entries which allows more than one cable to be mounted piggy-back on both sides of the panel.

CIB24BA	Male - Female, Bulkhead Adaptor	A	24.50	23.28	22.05
CIB24BF	Female - Female, Bulkhead Adaptor	A	26.50	25.18	23.85
CIB24BFR	Female - Female, Reverse Entry	B	26.50	25.18	23.85

Reverse Adaptors - *Change Cable Direction 180° to Expediate Wiring*

Normally when an attempt is made to mate and extend two standard IEEE-488 cables, the result is that the cables tend to go in the same direction as shown in sketch "A" (right). These adaptors will properly orient the two cables so as to be in line as shown in sketch "B". All metal construction.

CIB24XR	Male - Female, 180° Reverse Adaptor	B	21.00	19.95	18.90
CIB24XFR	Female-Female, 180° Rev. Adaptor	B	21.00	19.95	18.90

Connector Extender - *This Handy Device Provides 1 Inch Added Clearance*

Our extender is sometimes used to provide a one inch extension allowing a cable that extra margin to clear adjoining test apparatus, and to avoid sharp cable bending which may cause permanent damage.

CIB24X	Male - Female Extension Adaptor	A	19.50	18.53	17.55

Connector Covers - *Protect Against Contamination, Physical Damage RFI*

A cast metal cover that mates to the female end only. This cover has many uses such as in production or shipping to protect against dirt or damage to the exposed connector. In the lab, it provides the added service of warning, identifying, or limiting the ports accessibility. One piece cast aluminum construction with two machine screws which are captivated to prevent loss. Quantity pricing available upon request.

CIB24C	Metal Cover, Mates Female GPIB Connectors	4.50	4.28	4.05
CIB24CB	Metal Cover, As Above but Black Finish	4.50	4.28	4.05

Right Angle Adaptor - *Change Cable Direction 90° and Avoid Tight Bends*

This adaptor is handy to have and to use whenever the cable direction needs to be turned 90° to avoid obstacles that demand sharp bends in cable placement.

CIM24RA	Male - Female, Right Angle Adaptor	28.00	26.60	25.20

Multi-Tap Bus Strip - *Allows a Safe and Orderly Cable Placement Method*

Minimize the hazard of piggy-backing and breakage of IEEE-488 connector plugs and sockets. Four or eight female connectors with locking stand-offs accept GPIB cables on a single plane. All connectors are wired in parallel. Simplify and expedite instrument relocations and changeovers. Mount the Multi-Tap on any flat surface or rest on a bench. Built of heavy chrome plated steel and totally shielded to minimize RFI/EMI disturbances. Comes with rubber feet and optional mounting brackets.

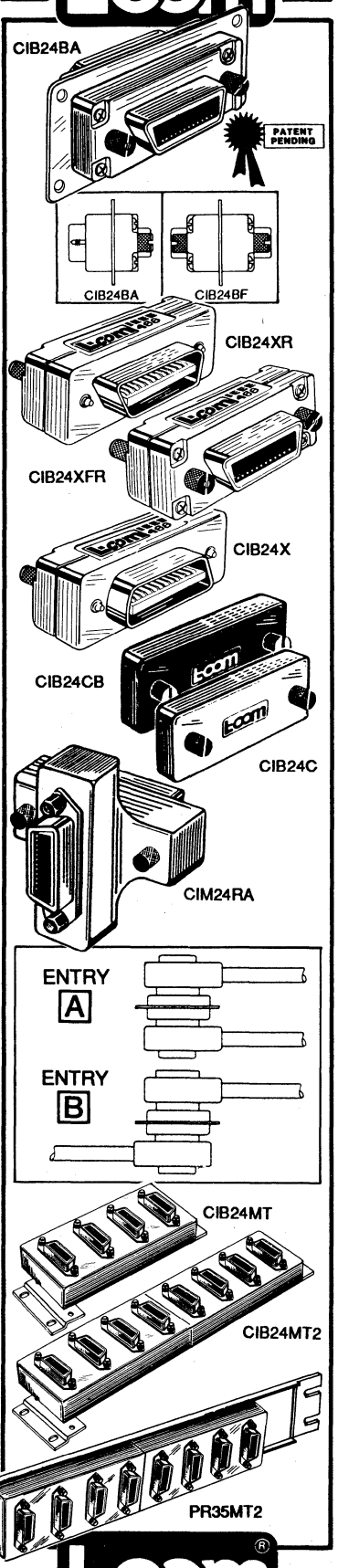
CIB24MT	4 Ganged IEEE-488 Receptacles	78.50	74.58	70.65
CIB24MT2	8 Ganged IEEE-488 Receptacles	159.50	151.53	143.55

Rack Mounted Multi-Tap Bus Strip - *Organizes Multiple Interconnections*

A standard 3-1/2" x 19" rack panel containing an eight outlet IEEE-488 distribution panel. This eliminates tangled interconnection cabling so common in GPIB bus systems. Minimizes the need to piggyback IEEE-488 connectors and prevents breakage due to leveraging. Other benefits include; improved cabling, easy tracing of cables and simplified instrument relocation or changeovers.

PR35MT2	8 Ganged Receptacles on Rack Panel	180.00	171.00	P.U.R.

CUSTOM: L-COM is willing to customize GPIB cables to meet your specific needs. Furthermore, we're in an excellent position to offer our services for the development and fabrication of custom accessory IEEE-488 products. We aim to maintain our lead position and to continue our development pace by working with engineers to help us define and achieve many other new product objectives.



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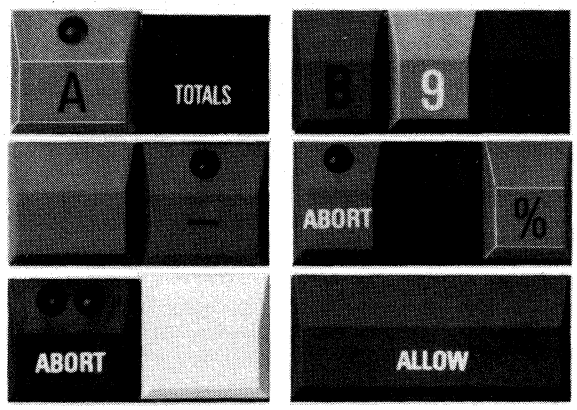
L-COM®

Lucas Ledex Keyboard, Security, & Code Switches*

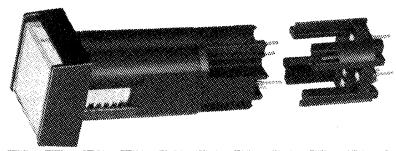
Keylite® keyboard switches–comprehensive line of tactile feel momentary or latching switches for solder mounting on boards, shown at right. Many choices of 12 or 17 mm size, shape, color, LEDs. Request catalog.
Elastomeric pushbutton–miniature 9 and 12 mm pushbuttons for snap fit board mounting after soldering is completed. Request catalog.
Keyloc® rotary security switches–6 position key operated rotary switch, 22 mm dia., 10 colors, 1024 combinations and variations. Request catalog.
Subminiature rotary code switches–panel or PC board mount with extreme reliability and wide code capability. Std. variations include binary and hex, with up to 4 pole 8 way capability. Request catalog.



*Manufactured by Lucas NSF of England, marketed by Lucas Ledex Inc.

Series 75 Switches*

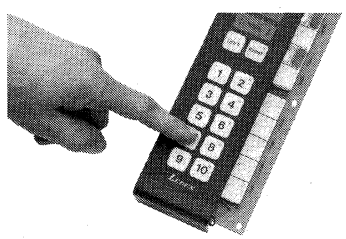
Also available in watertight version.



Switch	Series 75-SL	Series 75-SL (watertight)	Series 75-PC	Series 75-PC (watertight)
Housing with bezel	Makrolon	Durethan BKV	Makrolon	Durethan BKV
Contact enclosure	Thermosetting plastic	Thermosetting plastic	Durethan BKV	Thermosetting plastic
Outer lens	Makrolon	Makrolon	Makrolon	Makrolon
Key lock	Cylinder lock with 4 operating positions and 3 keys		Cylinder lock with 4 operating positions and 3 keys	
Operating stroke	2.5 mm (.1")	2.5 mm (.1")	2.5 mm (.1")	2.5 mm (.1")
Operating force	3 to 5 N (10.8 oz. to 18 oz.) max.	3 to 6.5 N (650p) (10.8 to 23.4 oz.)	3 N (10.8 oz.)	3 N (10.8 oz.)
Contacts	Spring-loaded silver contacts, non-shorting		Self-cleaning bridging contact, 5μ gold plated	Self-cleaning bridging contact, 8μ gold plated
Life (mechanical)	Momentary >2×10^6 Push-Push >1×10^6		Momentary >2×10^7 Push-Push >1×10^6	
Switching	4 amps at 250 VAC		250 mA @ 50 VAC or DC	
Weight	.53 oz. max. (lockable latching pushbutton 1.4 oz. max.)		.53 oz. max.	

For detailed specifications, request literature. *Licensee rights by Rafi of West Germany.

Series RF 15/19 Flat Panel Switches*



Housing	Actuator Cap	Reflector	Lens	Spring Contact	Fixed Contact	Voltage max.	Current max.
PBT (Pocan)	Polycarbonate (Makrolon)	PBT (Pocan)	PMMA (Resarit)	Au Model X 12 Cr Ni 177 1.5 μ Au (contact material); Connection material 4... 8 μ Sn Pb 60/40; Ag model X 12 Cr Ni 177 5 μ Ag (contact material); Connection material 4... 8 μ Ag	Cu Zn 28 F 43, 2 μ Ni, μ Au (contact material); Connection material 4... 8 μ Sn Pb 60/40; Ag Model Cu Zn 28 F 43, 2 μ Ni, 5 μ Au (contact material), Connection material 0.5 μ Ag	42 V⎓Au 60 V Ag	100 mA⎓Au 250 mA Ag

For further information, request literature. *Licensee rights by Rafi of West Germany.

Lucas Ledex

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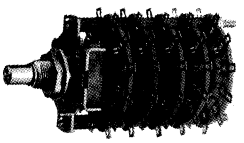
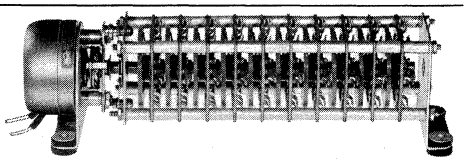
FAX: 513-898-8624

Rotary Manual Switches



Series	206	208	210	212	304	306	312	404	406	412	504	506	512	524
Poles–throws per deck	6P60°T	8P45°T	10P36°T	12P30°T	4P90°T	6P60°T	12P30°T	4P90°T	6P60°T	12P30°T	4P90°T	6P60°T	12P30°T	24P15°T
Combinations	6	4	5	6	2	6	6	2	6	7	2	6	7	8
Contact ratings	Brass, Silver plated		Solid Silver					Brass, Silver plated		Solid Silver				
Make/break	.5A/28VDC		1A/28VDC					1A/28VDC		2A/28VDC				
	.25/110VAC		.5A/110VAC					.5A/110VAC		1A/110VAC				
Carry	5A		5A					5A		5A				
Dielectric	750 volts, contact to contact							1000 volts, contact to contact 500 volts when contacts are insulated back to back						

For more information, request literature.

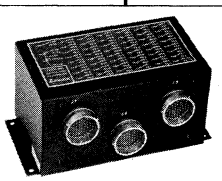


Stepping Switches (Stock Models)

Specifications

Electrical positions	4	6	8	10	10	12	12
Poles–throws per deck	3P4T	2P6T	3P8T	1P10T	2P10T	1P12T	1P12T
No. of load decks	4	5	2	7	4	5	9
Control deck	notch	notch	notch	notch	notch	notch	notch
Additional circuit on control deck	1P4T	1P6T	1P8T				
Total Circuitry	13P4T	11P6T	7P8T	7P10T	8P10T	5P12T	9P12T
Carry amperes, res. max.	5	5	5	5	5	5	10
Break amp. res. max @ 28 VDC (@120 VDC)	2.5 (0.5)	2.5 (0.5)	2.5 (0.5)	2.5 (0.5)	2.5 (0.5)	2.5 (0.5)	5 (1)
Dielectric, clip-to-clip, VRMS	1000	1000	1000	1000	1000	1000	1000
insulated back-to-back clips	500	500	500	500	500	500	500
Coil to case dielectric	1200 VRMS	1200 VRMS	1200 VRMS	1200 VRMS	1200 VRMS	1000 VRMS	1200 VRMS
Weight	6 oz.	6½ oz.	1 lb. 4 oz.	1 lb. 5 oz.	1 lb. 4½ oz.	7 oz.	1 lb. 4 oz.

For more information, request literature.



Packaged Switches (Stock Models)

Poles–throws per deck	13P2T	18P2T	22P2T	35P2T	39P3T	40P2T
Operating Voltage	28 VDC	28 VDC	28 VDC	28 VDC	28 VDC	28 VDC
Current @ rated coil voltage	2.5 amps	3.5 amps	3.5 amps	5 amps	5.7 amps	3.6 amps
Coil Duty Cycle	1/10	1/10	1/10	1/10	1/10	1/4
Dielectric strength (VRMS) coil	1000	1200	1200	1200	1200	1200
Coil resistance @ 20°C (Ohms ±5%)	11.03	8.02	8.02	5.67	4.91	7.72
Dielectric strengths (VRMS) decks	500	500	500	500	500	500
Circuit deck ratings						
Carry amps resistive, max.	5	5	5	5	5	5
Break amps, resistive, @ 28 VDC (@120 VAC)	1 (.5)	2 (1)	2 (1)	2 (1)	2 (1)	2 (1)
Weight	1 lb. max.	1 lb. 8 oz. max.	1 lb. 15 oz. max.	2 lb. 8 oz. max.	4 lb. 6 oz. max.	3 lb. 8 oz. max.

For more information, request literature.

Lucas Ledex

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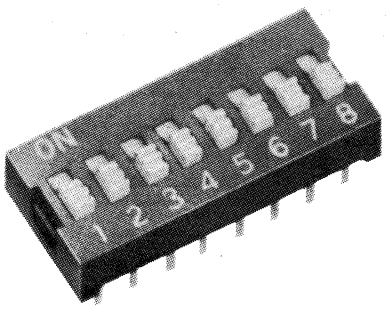
DIP SWITCHES

• High Quality • Economical

All LZR DIP switches offer remarkable performance, priced competitively. Standard features include gold-plated contacts, and your choice of raised or recessed actuators. Every model is available with top tape seal, to withstand solvent cleaning.

GA Series



SINGLE POLE SINGLE THROW

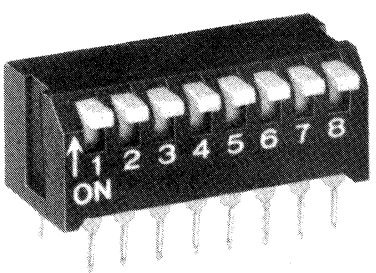
Popular slide actuator style

Reliable self-wiping contacts rated for 10,000 operations

Standard epoxy bottom seal

Right angle leads available

GC Series



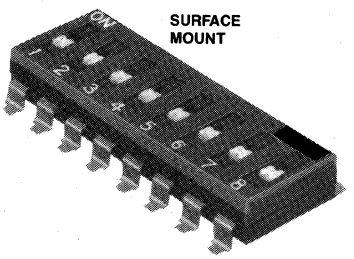
SINGLE POLE SINGLE THROW

"Piano key" actuator style

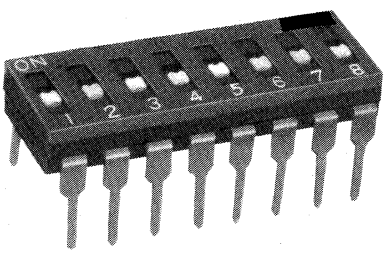
Available two ways: Switch open (off) in "up" position, or closed (on) in "up" position

Standard epoxy bottom seal

GH Series GK Series



SURFACE MOUNT



SINGLE POLE SINGLE THROW

Designed and packaged for automated processing and assembly

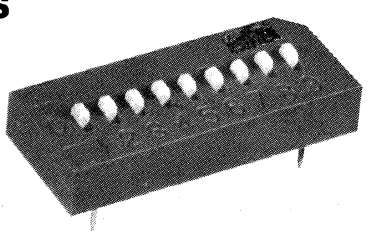
GK models have surface-mount leads

Molded body is IC equivalent, and end-stackable on tenth-inch grid.

GR Series

NEW!

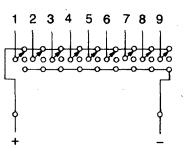
BUSSED SINGLE POLE TRIPLE THROW



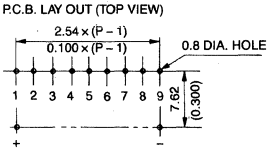
Unique SP3T design, ideally suited to a wide range of applications

Standard epoxy bottom seal

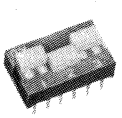
CIRCUITRY

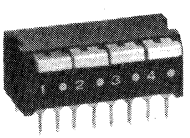


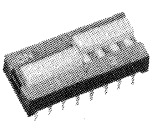
P.C.B. LAY OUT (TOP VIEW)



GA and GC series switches are also available in 2, 3, and 4 Pole, single throw, and 1 and 2 Pole, double throw versions.





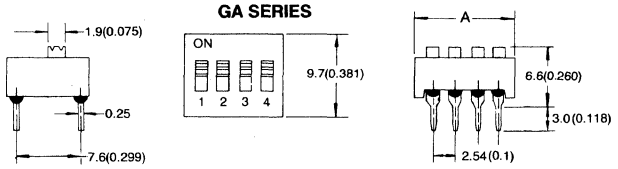


LZRelectronics,inc.
8051 Cessna Ave., Gaithersburg, MD 20879
Telephone (301)921-9440 Fax (301)670-0436

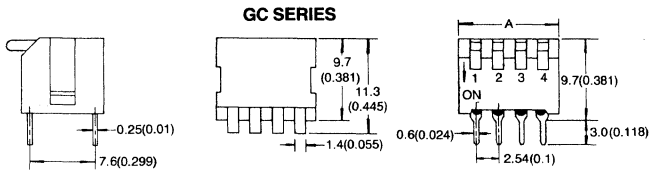
DIP SWITCHES

All dimensions in mm (inch)

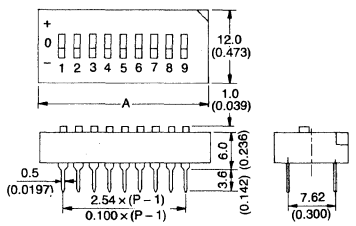
GA SERIES



GC SERIES

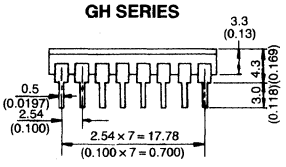


GA and GC SERIES			
POSITONS	PART NUMBER		DIM. "A"
2	GA102___	GC102___	6.70 (0.264)
3	GA103___	GC103___	9.20 (0.362)
4	GA104___	GC104___	11.70 (0.461)
5	GA105___	GC105___	14.20 (0.559)
6	GA106___	GC106___	16.70 (0.657)
7	GA107___	GC107___	19.20 (0.756)
8	GA108___	GC108___	21.70 (0.854)
9	GA109___	GC109___	24.20 (0.953)
10	GA110___	GC110___	26.70 (1.050)
12	GA112___	GC112___	32.00 (1.260)

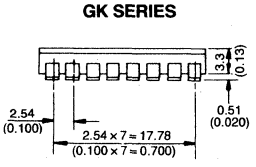


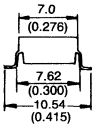
GR SERIES		
POSITONS	PART NO.	DIM. "A"
4	GR104___	15.30 (0.602)
6	GR106___	20.38 (0.802)
8	GR108___	25.46 (1.002)
9	GR109___	28.00 (1.102)
10	GR110___	30.54 (1.202)

GH SERIES

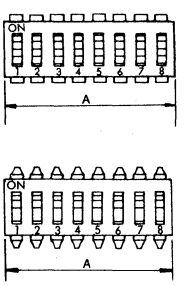


GK SERIES





GH and GK SERIES			
POSITONS	PART NUMBER		DIM. "A"
2	GH102___	GK102___	5.04 (0.198)
3	GH103___	GK103___	7.58 (0.298)
4	GH104___	GK104___	10.12 (0.398)
5	GH105___	GK105___	12.66 (0.498)
6	GH106___	GK106___	15.20 (0.598)
7	GH107___	GK107___	17.74 (0.698)
8	GH108___	GK108___	20.28 (0.798)
9	GH109___	GK109___	22.82 (0.898)
10	GH110___	GK100___	25.36 (0.998)



HOW TO ORDER

SERIES		NO. OF POSITIONS (SEE TABLES)	OPTIONS (SEE BELOW)
☐☐	1	☐☐	☐☐

OPTION CODES (all except GC Series)

10 Raised actuator

20 Low profile actuator

(30) Raised actuator, tape sealed (GA and GR Series only)

(40) Low profile actuator, tape sealed

OPTION CODES (GC Series)

50 Switches open (off) in "up" position

60 Switches closed (on) in "up" position

(70) Same as code 50 above, tape sealed version

(80) Same as code 60 above, tape sealed version

CIRCLED OPTION CODES ARE MOST READILY AVAILABLE

SPECIAL-ORDER OPTIONS: Call for details

Custom body colors and markings

Single- and Double-Throw switching, in 1- through 4-pole configurations (available for GA and GC Series)

Lower cost silver-plated contacts (available for GA and GC Series)

SPECIFICATIONS

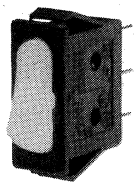
Material	Fire retardant to UL 94V-0
Color	Blue, with white actuators
Operating range	−40 to +85° C
Contact ratings (GA, GC)	24VDC, 28mA switching, 50VDC, 100mA non-switching
Contact ratings (others)	5VDC, 100mA switching, 50VDC, 100mA non-switching
Contact resistance (GA)	30 milliOhms maximum initial, 100 milliOhms maximum after life test
Contact resistance (others)	50 milliOhms maximum initial, 100 milliOhms maximum after life test
Operating life (GA)	10,000 opns. minimum per pole
Operating life (GC)	3,000 opns. minimum per pole
Operating life (others)	2,000 opns. minimum per pole
Vibration test	per MIL-STD 202, Method 204B
Heat shock test	260° C for 5 seconds

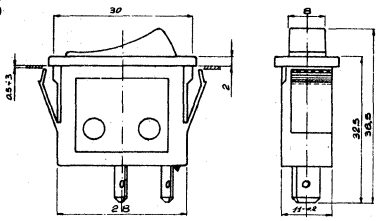
LZR electronics, inc.
8051 Cessna Ave., Gaithersburg, MD 20879
Telephone (301)921-9440 Fax (301)670-0436

Manufacturers Components Incorporated

POWER SWITCHES WITH INTERNATIONAL APPROVALS

MD 36/L SERIES





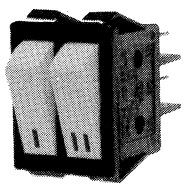
PANEL CUT OUT - 30mm x 11mm

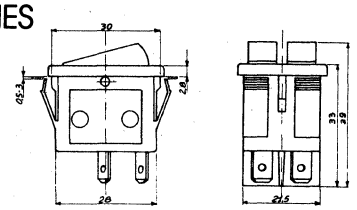
SINGLE POLE LIGHTED AND UNLIGHTED

16 AMPS 125 VAC/250 VAC "R"
TEMPERATURE: T120°C
TERMINALS: .250 SILVER PLATED BRASS

APPROVALS:

MODEL 36/2 SERIES





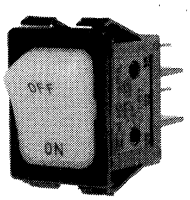
PANEL CUT OUT - 30mm x 22mm

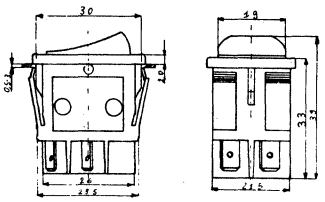
DUAL ROCKER LIGHTED AND UNLIGHTED

(2) SPST SWITCHES IN COMMON BASE
16 AMPS 125 VAC/250 VAC "R"
TEMPERATURE: T120°C
TERMINALS: .250 SILVER PLATED BRASS

APPROVALS:

MD 401 SERIES





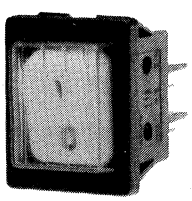
PANEL CUT OUT - 30mm x 22mm

DOUBLE POLE LIGHTED AND UNLIGHTED

16 AMPS 125 VAC/250 VAC "R"
TEMPERATURE: T100°C
TERMINALS: .250 SILVER PLATED BRASS

APPROVALS:

MD 36/2/G SERIES & MD 401/G SERIES

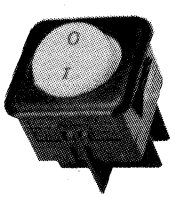


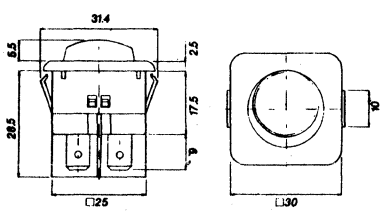
SPLASHGUARD - SWITCHES WITH PLASTIC COVER

TRANSPARENT COVER DESIGNED TO MEET
FRONT PANEL PROTECTION
SINGLE AND DOUBLE POLE
LIGHTED AND UNLIGHTED

SEE SERIES MD 36/2 AND MD 401 FOR APPROVALS & DIMENSIONS

MD 50 SERIES





PANEL CUT OUT - 27.8mm x 25mm

SINGLE & DOUBLE POLE LIGHTED & UNLIGHTED

16 AMPS 125 VAC/250 VAC
TEMPERATURE: T125°C
TERMINALS: .250 SILVER PLATED BRASS

APPROVALS: PENDING:

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED

OPTIONS AVAILABLE

FLAT OR OVAL KNOB
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SWITCHES MATRICES SYSTEMS

TYPES:

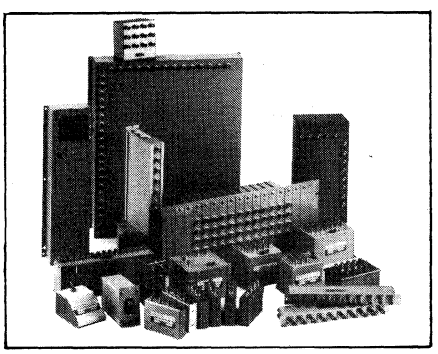
- AUDIO
- DATA
- VIDEO
- R.F.
- MULTI-WIRE
- BALANCED LINE
- COAX
- TWINAX

OPTIONS:

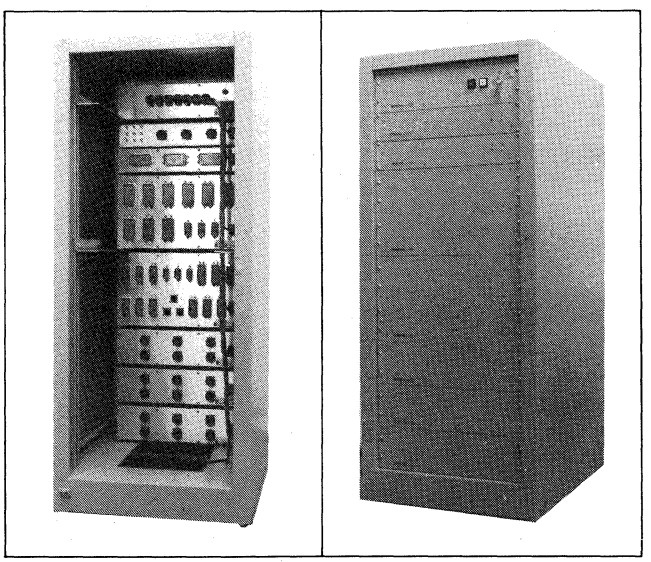
- PROGRAMMABLE
- COMPUTER INTERFACE
- ELECTRO-MECHANICAL
- SOLID STATE
- DESK TOP
- RACK MOUNT
- MODULAR
- COMPLETE SYSTEMS

MarLee Switch Company uses the latest designs and highest quality components, to provide superior performance and reliable operation. In addition we specialize in modifying our standard products to meet your specific requirements. We have a proven record of delivering on time and at a very competitive price.

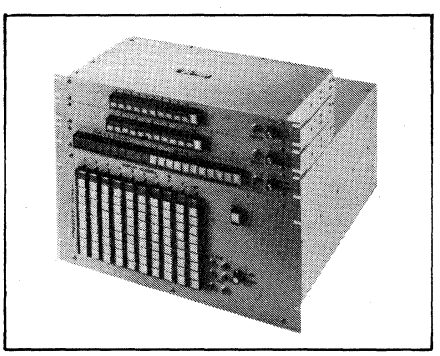
When they need their signals switched, many of the world's leading businesses come to MarLee Switch Company.



MODULAR SWITCHES AND MATRICES



1000 WIRE A-B SWITCHING SYSTEM



MULTI SWITCH MATRIX SYSTEMS

TYPICAL SPECIFICATIONS:

Switches:	1 to N poles, 1 to N throws
Matrices:	1 to N inputs, 2 to N outputs
Frequency Range:	DC to 1.2 GHz
Switching Speed:	100 ms. down to 1 ns.
Switching Types:	Solid State, Reed, Relay
Switch Life:	Greater than 100 million operations
Isolation (open contact):	To −110 db
Insertion Loss (RF):	Less than 0.5 db, typically 0.2 db
VSWR:	1.5 to 1
Shock:	200 G max., 11 ± 1 msec.
Vibration:	20 G max. @ 0 to 600 Hz
Temperature Range:	−50° to +150°F
Xtalk Between Channels:	To −180 db

Let us show you how WE can satisfy your switching requirements.
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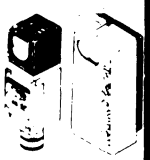
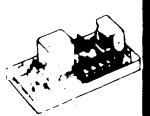
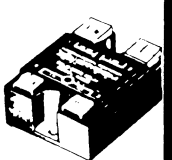
TOGGLE SWITCHES

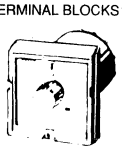

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS


TEMPERATURE CONTROLS

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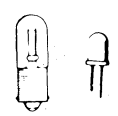
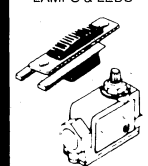
KNOBS


LAMPS & LEDS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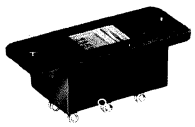
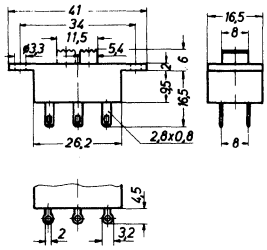
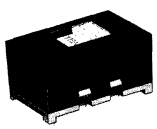
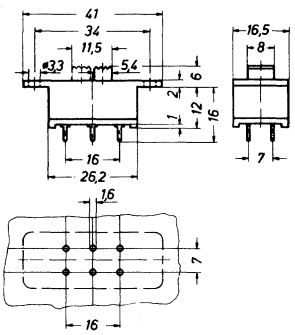


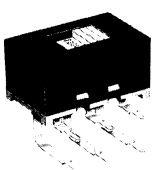


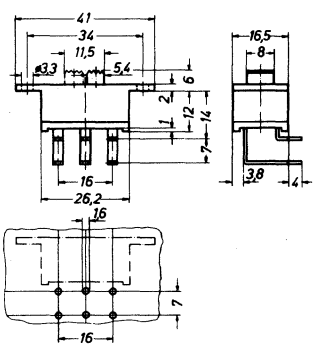
DOUBLE POLE, DOUBLE THROW SOLDER TERMINALS R48 5A 250VAC 10A 125VAC



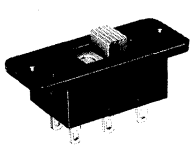


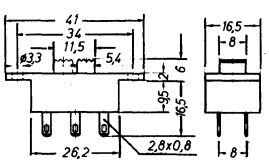
DOUBLE POLE, DOUBLE THROW STRAIGHT PC TERMINALS





DOUBLE POLE, DOUBLE THROW RIGHT ANGLE PC TERMINALS





DOUBLE POLE, DOUBLE THROW, SLIDE BUTTON, QUICK CONNECT TERMINALS (Combination Solder or Plug-In)

Circuit	Function	Terminals	Catalog Number
DPDT	ON-ON	Solder	4021.0214 (Black Slider, No Marking)
DPDT	ON-ON	Quick Connect	4021.0506 (No UL & CSA) (Red Slider - 220V-240V Marking)
DPDT	ON-ON	Quick Connect	4021.0512 (Red Slider - 230V-115V Marking)
DPDT	ON-ON	Quick Connect	4021.0513 (Red Slider - High-Low Marking)
DPDT	ON-ON	Quick Connect	4021.0521 (Black Slider - No Marking)
DPDT	ON-ON	Quick Connect	4021.0525 (Red Slider - No Marking)
DPDT	ON-ON	Quick Connect	4021.0526 (Red Slider - 115V-220V Marking) (100 Microinch Silver)
DPDT	ON-ON	Quick Connect	4021.0527 (Red Slider - 120V-240V) (100 Microinch Silver)
DPDT	ON-ON	Quick Connect	4021.0530 (Red Slider - 115V-220V)
DPDT	ON-ON	Quick Connect	4021.0532 (Red Slider - 100V-250V)
DPDT	ON-ON	Quick Connect	4021.0820 (Red Slider Button - No Marking)
DPDT	ON-ON	Quick Connect	4021.0821 (Black Slider Button - No Marking)
DPDT	ON-ON	Quick Connect	4021.1912 (Red Slider - - No Marking) (No Mounting Ears)
DPDT	ON-ON	Quick Connect	4021.1913 (Black Slider - 115V -230V White Marking) (No Mounting Ears)
DPDT	ON-ON	Quick Connect	4021.1914 (Black Slider - High, Low White Marking) (No Mounting Ears)
DPDT	ON-ON	Right Angle P.C.	4021.4220 (Red Slider - 220V-115V Black Marking)
DPDT	ON-ON	Right Angle P.C.	4021.4221 (Red Slider - 115V-220V Black Marking)
DPDT	ON-ON	Straight P.C.	4021.4302 (No UL & CSA) (Red Slider - 240-220V Black Marking)
DPDT	ON-ON	Straight P.C.	4021.4321 (Red Slider - 230-115V Black Marking)
DPDT	ON-ON	Straight P.C.	4021.4322 (Black Slider - No Markings)
DPDT	ON-ON	Straight P.C.	4021.4420 (Black Slider Button - No Marking) (No Mounting Ears)
DPDT	ON-ON	Straight P.C.	4021.4620 (Red Slider - 230-115V Black Marking) (No Mounting Ears)
DPDT	ON-ON	Straight P.C.	4021.4621 (Black Slider - No Marking) (No Mounting Ears)
DPDT	ON-ON	Right Angle P.C. RH	4021.4711 (Red Slider - 230-115V - Black Markings) (No Mounting Ears)
DPDT	ON-ON	Right Angle P.C.	4021.4720 (Red Slider - 220V-115V - Black Marking) (No Mounting Ears)
DPDT	ON-ON	Right Angle P.C.	4021.4721 (Red Slider - 115V-230V - Black Marking) (No Mounting Ears)
DPDT	ON-ON	Right Angle P.C.	4021.4722 (Red Slider - No Markings) (No Mounting Ears)
DPDT	ON-ON	Right Angle P.C. LH	4021.4723 (Red Slider - 230-115V) (No Mounting Ears)
DPDT	ON-ON	Right Angle P.C.	4021.4725 (Red Slider 0, — Black Marking) (No Mounting Ears)
DPDT	ON-ON	Left Side P.C.	4021.4920 (Red Slider - 230-115V - Black Marking) (No Mounting Ears)
SPDT	ON-ON	Left Side P.C.	4021.5920 (Red Slider 0, — Black Marking) (No Mounting Ears)

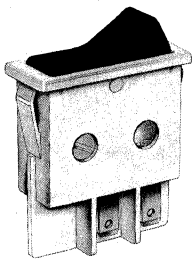
Technical Data: Double pole, double throw with sliding contact.
Resistance to Tracking: ⊏◎< KB 175 ⊏> KB 250 ⊏◎< KB 175
Life Endurance: Mechanical 10,000 Cycles; Electrical 10,000 Cycles. Screw fixing, mounting holes ϕ 3.3 mm

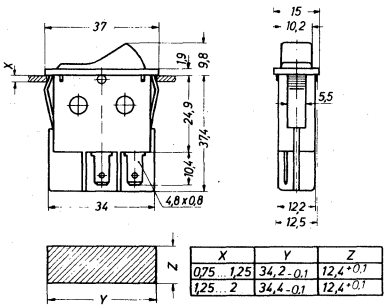
Materials: Slide made of thermoplastic; housing made of black thermoplastic; ground plate made of nature thermoplastic; glass fiber reinforced, contacts CuSn/Cu silver-plated; terminals silver-plated

MARQUARDT

Rocker Switch

1540 SERIES



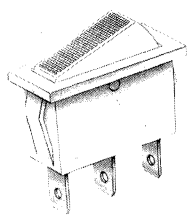


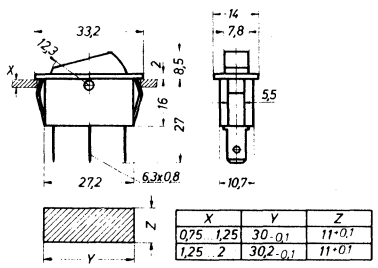
Circuit	Function	Terminals	Catalog Number
DPST	ON-OFF	6.3 (.250)	1542.1121 R70 (Black Rocker & Base - White Markings — ON, 0-OFF)
DPST	ON-OFF	6.3 (.250)	1542.1123 R70 (Black Base & Rocker - White Markings I, 0)
DPST	ON-OFF	6.3 (.250)	1545.1120 R72 (White Base - Lighted Red Rocker - 220V Bulb)
DPST	ON-OFF	6.3 (.250)	1545.1122 R72 (Black Base - Lighted Red Rocker - 110V Bulb)

DOUBLE POLE R70 16A 125V-250V AC 1/4HP 125VAC 1/2HP 250VAC R72 16A 250VAC 1/2HP

Mechanical — 50,000 Operations
Electrical — 10,000 Cycles

1600 SERIES





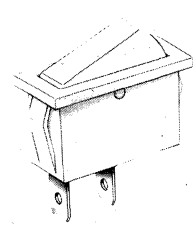
Circuit	Function	Terminals	Catalog Number
SPST	ON-OFF	6.3 (.250)	1600.0120 R19 (Black Base - Red Rocker - 110V Bulb)
SPST	ON-OFF	6.3 (.250)	1600.0121 R19 (White Base - Red Rocker - 110V Bulb)
SPST	ON-OFF	6.3 (.250)	1600.0105 R19 (Black Base - Red Rocker- 220V Bulb)
SPST	ON-OFF	6.3 (.250)	1600.0126 R19 2-3.5mm Panel (Black Base - Red Rocker - 110V Bulb - Frame Alum)
SPST	ON-OFF	6.3 (.250)	1600.0127 R19 (Brown Base - Red Rocker - 110V Bulb)
SPST	ON-OFF	6.3 (.250)	1600.0128 R19 (Black Base - Green Rocker - 110V Bulb)
SPST	ON-OFF	6.3 (.250)	1600.0420 R19 (Black Base - Red Rocker - 110V Bulb - Frame Alum)
SPST	ON-OFF	6.3 (.250)	1600.0421 R19 Black Base - Green Rocker - 110V Bulb — Frame Alum)
SPST	ON-OFF	Solder	1600.3108 R19 (White Base - Green Rocker - 110V Bulb)

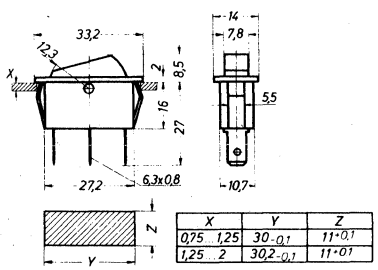
SINGLE POLE ILLUMINATED R19 16A 125V AC 1/8HP

Resistance to Tracking: > KB250
Life Endurance: Mechanical—100,000 operation; Electrical—10,000 cycles
Snap in Fixing: for a wall thickness (X) of 0.75. . .2mm recommended cut-out (Y x Z) see table under dimensions

Materials: Rocker and housing made of thermoplastic, contacts made of Ag, terminals silver-plated

1601 SERIES





Circuit	Function	Terminals	Catalog Number
SPST	ON-OFF	6.3 (.250)	1601.0117 R62 (Black Base & Rockers, Markings - White OFF-ON, Horizontal Mtg.)
SPST	ON-OFF	6.3 (.250)	1601.0118 R62 (White Base & Rockers, Markings - Black OFF-ON, Horizontal Mtg.)
SPST	ON-OFF	6.3 (.250)	1601.0101 R62 (White Base & Rocker)
SPST	ON-OFF	6.3 (.250)	1601.0105 R62 (Black Base & Rocker)
SPST	ON-OFF	6.3 (.250)	1601.0122 R62 (Black Base & Rocker, 3.5mm Panel)
SPST	ON-OFF	6.3 (.250)	1601.0123 R62 (Black Base & Rocker, White Marking 0 on Bezel)
SPST	ON-OFF	6.3 (.250)	1601.0124 R62 (White Base & Rocker - Black I, 0)
SPST	ON-OFF	6.3 (.250)	1601.0125 R62 (Black Base & Rocker, Marking White OFF-ON, Vertical Mtg.)

SINGLE POLE NON-ILLUMINATED R62 10A 250VAC 1/3HP 16A 125VAC 1/8HP

Resistance to Tracking: > KB250
Life Endurance: Mechanical—100,000 operation; Electrical—10,000 cycles
Snap in Fixing: for a wall thickness (X) of 0.75. . .2mm recommended cut-out (Y x Z) see table under dimensions

Materials: Rocker and housing made of thermoplastic, contacts made of Ag, terminals, silver-plated

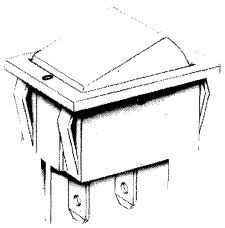
Contact Resistance < 10 milliohms — Dielectric Resistance > 5 megohms

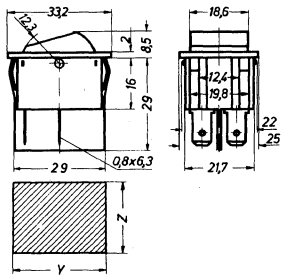
Marquardt Switches Inc. • **2711 Route 20 East** • **FAX 315-655-8042** • **Cazenovia, New York 13035** • **(315) 655-8050**

MARQUARDT

Rocker Switch

1602 SERIES





X	Y	Z
0,75...1,25	30 -0,1	22 +0,2
1,25...2	30,2 -0,1	22 +0,2

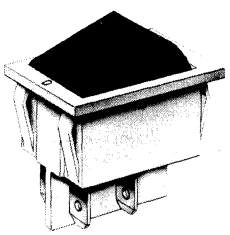
NON-ILLUMINATED DOUBLE POLE
R46 16A 125V AC 10A 250V AC
R62 16A 125V AC 1/8HP
10A 250V AC 1/3 HP

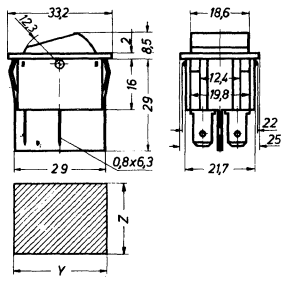
Technical Data:
Resistance to Tracking: > KB250
Life Endurance: Mechanical—100,000 operation; Electrical—10,000 cycles
Snap in Fixing: for a wall thickness (X) of 0.75. . .2mm recommended cut-out (Y x Z) see table under dimensions

Materials: Rocker and housing made of thermoplastic, contacts made of Ag, terminals silver-plated

Circuit	Function	Terminals	Catalog Number
DPST	ON-OFF	6.3 (.250)	1602.0114 R46 (White Base & Rocker - Marking Black 0, I
DPST	ON-OFF	6.3 (.250)	1602.0101 R62 (White Base & Rocker - Marking - Red - 0 on Bezel
DPST	ON-OFF	6.3 (.250)	1602.0105 R62 (Black Base & Rocker - Marking Red - 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1602.0119 R62 (Black Base & Rocker - Marking White - 0, I)
DPST	ON-OFF	6.3 (.250)	1602.0126 R62 (Black Base & Rocker - Marking - White OFF-0 ON-1)
DPST	ON-OFF	6.3 (.250)	1602.0127 R62 (Black Base, Red Rocker - Marking - Red 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1602.4120 R62 (White Base & Rocker - Side Guards on Rocker - Marking Red 0 on Bezel)
DPDT	ON-ON	6.3 (.250)	1604.0101 R62 (White Base & Rocker)

1605 SERIES





X	Y	Z
0,75...1,25	30 -0,1	22 +0,2
1,25...2	30,2 -0,1	22 +0,2

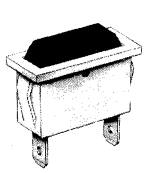
ILLUMINATED DOUBLE POLE
R19 16A 125V AC 1/8 HP
R61 10A 250V AC 1/3HP

Technical Data:
Resistance to Tracking: > KB250
Life Endurance: Mechanical—100,000 operation; Electrical—10,000 cycles
Snap in Fixing: for a wall thickness (X) of 0.75. . .2mm recommended cut-out (Y x Z) see table under dimensions

Materials: Rocker and housing made of thermoplastic, illuminated rockers and windows of lights made of transparent thermoplastic, contacts made of Ag, terminals silver-plated

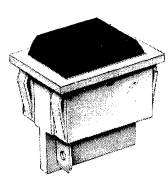
Circuit	Function	Terminals	Catalog Number
DPST	ON-OFF	6.3 (.250)	1605.0120 R19 (Black Base, Red Lens, 110V Bulb Marking Red 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1605.0105 R61 (Black Base, Red Lens, 220V Bulb Marking Red 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1605.0122 R19 (White Base, Red Lens, 110V Bulb Marking Red 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1605.0123 R19 (White Base, Green Lens, 110V Bulb Marking Red 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1605.0124 R19 Black Base, Green Lens, 110V Bulb Marking Red 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1605.0112 R61 (Black Base, Green Lens, 220V Bulb Marking Red 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1605.0127 R61 (Black Base, Orange Lens, 220V Bulb, Marking Red 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1605.0128 R61 (White Base, Green Lens, 220V Bulb Marking Black 0-1 on Bezel)
DPST	ON-OFF	6.3 (.250)	1605.0427 R61 (White Base, Red Lens, 220V Bulb Marking Black 0, I)

1607 SERIES Pilot Light



6.3 (.250) 1607.0420
(White Base, Red Lens, 110V Bulb)

6.3 (.250) 1607.0520
(Black Base, Orange Lens, 110V Bulb)



6.3 (.250) 1607.5101
(White Base, Red Lens, 220V Bulb)

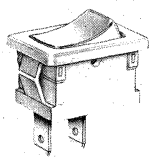
6.3 (.250) 1607.5110
(White Base, White Lens, 220V Bulb)

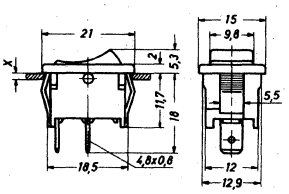
Not UL or CSA Approved
(Approval Pending)

MARQUARDT

Rocker Switch

1800 SERIES





X	Y	Z
0,75...1,25	19,2 -0,1	12,9 +0,1
1,25...2	19,4 -0,1	12,9 +0,1
2 ...3	19,8 -0,1	12,9 +0,1

Technical Data:
Resistance to tracking ▭ > KB250 ▭ > KB 175
Life endurance, mechanical:
ST, DT — 100,000 operations
DT with off-position — 50,000 operations
Life endurance, electrical:
ST, DT 6(4)A — 50,000 cycles
ST, DT 10(4)A — 10,000 cycles
Snap in fixing:
for a wall thickness (X) of 0,75...3 mm recommended
cut-out (Y x Z) see table under dimensions

SINGLE POLE

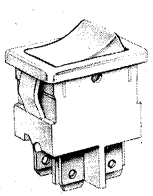
R30 6A 125V-250V AC 1/4 HP 125 - 1/2 HP 250V AC
R50 10A 125V-250V AC 1/3 HP 125V - 1/2 HP 250V AC
R52 6A 125V - 4A 250V AC 1/10 HP 125V-250V AC
R58 6A 125V-250V AC 1/8 HP
R73 10A 125V AC - 1/3 HP
R87 6A 250V AC - 1/2 HP

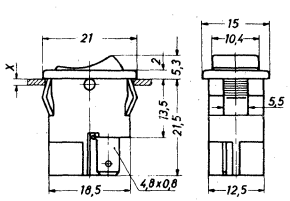
Materials
Rocker and housing made of thermoplastic
Contacts Ag/Cu silver-plated
Terminals silver-plated

Circuit Function		Terminal	Catalog Number
SPST	ON-OFF	4.8(.187)	1800.1121 R73 (Black Base, Red Lighted Rocker, 125V Bulb)
SPST	ON-OFF	Solder	1801.0102 R30 (Black Base & Rocker)
SPST	ON-OFF	Solder	1801.0101 R30 (White Base & Rocker)
SPST	ON-OFF	Solder	1801.0121 R50 (Black Base & Rocker)
SPST	ON-OFF	Solder	1801.0105 R30 (Black Base, Red Rocker)
SPST	ON-OFF	Solder	1801.0123 R30 (Brown Base & Rocker)
SPST	ON-OFF	Solder	1801.0124 R30 (Black Base & Rocker, Marking, Red —)
SPST	ON-OFF	Solder	1801.0130 R30 (Black Base, Orange Rocker, Marking, Black 0, I)
SPST	ON-OFF	Solder	1801.0134 R50 (Brown Base & Rocker)
SPST	ON-OFF	Solder	1801.0136 R50 (Black Base & Rocker White Marking 0, —)
SPST	ON-OFF	Solder	1801.0138 R30 (Black Base & Rocker, Marking, White - 0)
SPST	ON-OFF	Solder	1801.0149 R30 (Black Base & Rocker, Marking, Red 0, —)
SPST	ON-OFF	4.8(.187)	1801.1102 R30 (Black Rocker & Base)
SPST	ON-OFF	4.8(.187)	1801.1110 R30 (Brown Rocker & Base)
SPST	ON-OFF	4.8(.187)	1801.1121 R50 (Black Rocker & Base)
SPST	ON-OFF	4.8(.187)	1801.1124 R50 (Brown Rocker & Base, Red Bar on Rocker)
SPST	ON-OFF	4.8(.187)	1801.1139 R30 (Black Rocker & Base, White Marking 0, —)
SPST	ON-OFF	4.8(.187)	1801.1142 R30 (White Rocker & Base, Black Bar on Rocker)
SPST	ON-OFF	4.8(.187)	1801.1143 R30 (Black Rocker & Base, White Bar on Rocker)
SPST	ON-OFF	4.8(.187)	1801.1132 R30 (Black Base, Red Rocker)
SPST	ON-OFF	4.8(.187)	1801.1147 R50 (Brown Base & Rocker)
SPST	ON-OFF	4.8(.187)	1801.1148 R50 (Black Base & Rocker, White Marking 0, —)
SPNO	ON-OFF Momentary	4.8(.187)	1801.1210 R52 (Brown Base & Rocker)
SPNO	ON-OFF Momentary	4.8(.187)	1801.1202 R52 (Black Base & Rocker)
SPNO	ON-OFF Momentary	4.8(.187)	1801.1222 R52 (Black Base, White Rocker)
SPST	ON-OFF	P.C.	1801.2152 (Black Base & Rocker, 30mA, 12VDC)
SPNC	ON-OFF Momentary	P.C.	1801.2322 R52 (Brown Base & Rocker)

Circuit Function		Terminal	Catalog Number
SPDT	ON-ON	Solder	1803.0107 R50 (Brown Base & Rocker)
SPDT	ON-ON	Solder	1803.0120 R50 (White Base & Rocker)
SPDT	ON-ON	Solder	1803.0121 R50 (Black Base & Rocker)
SPDT	ON-ON	4.8(.187)	1803.1101 R30 (White Base & Rocker)
SPDT	ON-ON	4.8(.187)	1803.1121 R50 (Black Base & Rocker)
SPDT	ON-ON	4.8(.187)	1803.1122 R50 (Brown Base & Rocker)
SPDT	ON-ON Momentary	4.8(.187)	1803.1202 R52 (Black Base & Rocker)
SPDT	ON-ON Momentary	4.8(.187)	1803.1222 R52 (Brown Base & Rocker)
SPDT	ON-OFF-ON	Solder	1808.0102 R58 (Black Base & Rocker)
SPDT	ON-OFF-ON	Solder	1808.0124 R58 (Brown Base & Rocker)
SPDT	Mom ON -OFF-ON	Solder	1808.0201 R58 (White Base & Rocker)
SPDT	Mom ON -OFF- Mom ON	Solder	1808.0301 R58 (White Base & Rocker)
SPDT	Mom ON -OFF- Mom ON	Solder	1808.0302 R58 (Black Base & Rocker)
SPDT	Mom ON -OFF- Mom ON	Solder	1808.0323 R58 (Black Base & White Rocker)
SPDT	Mom ON -OFF- Mom ON	Solder	1808.0324 R58 (Black Base & Red Rocker)
SPDT	ON-OFF-ON	4.8(.187)	1808.1102 R58 (Black Base & Rocker)
SPDT	ON-OFF-ON	4.8(.187)	1808.1123 R58 (Brown Base & Rocker)
SPDT	Mom ON -OFF-ON	4.8(.187)	1808.1204 R58 (Brown Base & Rocker)
SPDT	Mom ON -OFF- Mom ON	4.8(.187)	1808.1302 R58 (Black Base & Rocker)
SPDT	Mom ON -OFF- Mom ON	4.8(.187)	1808.1322 R58 (Brown Base & Rocker)

1852 SERIES





NON-ILLUMINATED R52 6A 125V 4A 250V AC
1/10 HP 125V-250V AC
MAX. INRUSH - 51A 125V AC

X	Y	Z
0,75...1,25	19,2 -0,1	12,9 +0,1
1,25...2	19,4 -0,1	12,9 +0,1
2 ...3	19,8 -0,1	12,9 +0,1

Technical Data:
Single pole or double pole ST
Lifting contact
Resistance to tracking > KB 250
Life endurance:
Mechanical - 50,000 operations
Electrical - 10,000 cycles
Snap in fixing:
for a wall thickness (X) of 0,75...3 mm recommended
cut-out (Y x Z) see table under dimensions

Materials
Rocker and housing made of thermoplastic
Contacts made of Ag
Terminals silver-plated

Circuit Function		Terminal	Catalog Number
DPST	ON-OFF	Solder	1852.0122 R52 (Black Base & Rocker, White Marking, on Rocker I, 0)
DPST	ON-OFF	4.8(.187)	1852.1102 R52 (Black Base & Rocker, Red Marking, 0 on Rocker)
DPST	ON-OFF	4.8(.187)	1852.1122 R52 (Black Base, Red Rocker, White Marking, 0 on Rocker)
DPST	ON-OFF	4.8(.187)	1852.1123 R52 (Black Base, Red Rocker, White Marking, on Rocker I, 0)
DPST	ON-OFF	4.8(.187)	1852.1124 R52 (Black Base & Rocker, White Marking OFF-ON on Rocker)
DPST	ON-OFF	4.8(.187)	1852.1125 R52 (Black Base & Rocker, White Marking 0 I on Rocker)
DPST	ON-OFF	4.8(.187)	1852.1126 R52 (Black Base, Red Rocker, White Marking on Rocker 0, —)
DPST	ON-OFF	4.8(.187)	1852.1128 R52 (Black Base & Rocker, White Marking on Rocker 0, I)
DPST	ON-OFF	2.8(.110)	1852.3122 R52 (Black Base & Rocker)
DPST	ON-OFF	P.C. Right Angle	1852.5120 R52 (Black Base & Rocker) White Marking, 0)

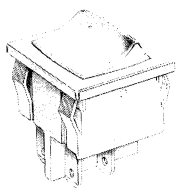
Additional Models
Rocker, window and housing in other colors
Rocker with different symbols

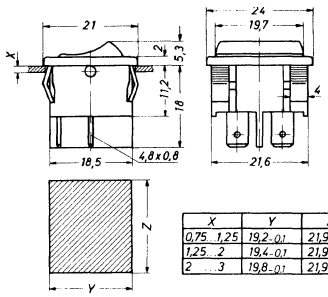
Marquardt Switches Inc. • 2711 Route 20 East • FAX 315-655-8042 • Cazenovia, New York 13035 • (315) 655-8050

MARQUARDT

Rocker Switch

1802 SERIES





X	Y	Z
0,75 1,25	19,2 -0,1	21,9 +0,1
1,25 2	19,4 -0,1	21,9 +0,1
2 3	19,8 -0,1	21,9 +0,1

DOUBLE POLE

R30 6A 125V-250V AC
1/4 HP 125 - 1/2 HP 250V AC
R50 10A 125V-250V AC 1/3 HP 125V - 1/2 HP 250V AC
R52 6A 125V - 4A 250V AC 1/10 HP 125V-250V AC

R55 6A 125V AC 1/4 HP
R58 6A 125V-250V AC 1/8 HP
R73 10A 125V 1/3 HP
R87 6A 250V AC 1/2 HP

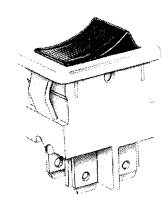
Technical Data:
Resistance to tracking > KB250 > KB 175
Life endurance, mechanical:
ST, DT — 100,000 operations
DT with off-position — 50,000 operations
Life endurance, electrical:
ST, DT 6(4)A — 50,000 cycles
ST, DT 10(4)A — 10,000 cycles
Snap in fixing:
for a wall thickness (X) of 0,75...3 mm recommended cut-out (Y x Z) see table under dimensions

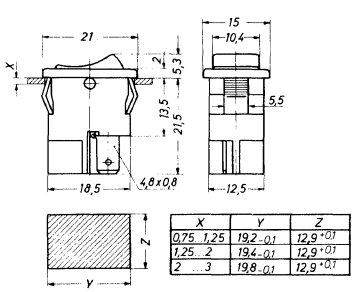
Materials
Rocker and housing made of white or black thermoplastic
Window made of red transparent thermoplastic
Contacts Ag/Cu silver-plated
Terminals silver-plated

Circuit	Function	Terminal	Catalog Number
DPST	ON-OFF	Solder	1802.0121 R50 (Black Base & Rocker, Red 0 on Rocker)
DPST	ON-OFF	Solder	1802.0122 R50 (White Base & Rocker, Black Markings 0, I)
DPST	ON-OFF	4.8(.187)	1802.1112 R50 (Brown Base, Red Rocker, White Markings 0, I)
DPST	ON-OFF	4.8(.187)	1802.1113 R50 (Black Base, Red Rocker, White Markings 0, I)
DPST	ON-OFF	4.8(.187)	1802.1120 R50 (White Base & Rocker, Red 0 on Rocker)
DPST	ON-OFF	4.8(.187)	1802.1121 R50 (Black Base & Rocker, Red 0 on Rocker)
DPST	ON-OFF	4.8(.187)	1802.1122 R50 (Black Base, White Rocker) Red 0 on Rocker)
DPST	ON-OFF	4.8(.187)	1802.1123 R50 (Black Base & Rocker, White Markings 0, I)
DPST	ON-OFF	4.8(.187)	1802.1124 R50 (Brown Base & Rocker, White Marking 0, —)
DPST	ON-OFF	4.8(.187)	1802.1127 R30 (Dark Gray Base & Rocker, White 0, on Rocker)
DPST	ON-OFF	4.8(.187)	1802.1102 R30 (Black Base & Rocker, Red 0, on Rocker)
DPST	ON-OFF	4.8(.187)	1802.1133 R50 (Black Base & Rocker, White Marking - ON, OFF on Rocker)

Circuit	Function	Terminal	Catalog Number
DP.NO	ON-OFF Momentary	4.8(.187)	1802.1221 R52 (Black Base & Rocker)
DPST	ON-OFF	P.C.	1802.2402 (No UL, CSA) (Black Base & Rocker, Red Marking 0 on Rocker)
DPDT	ON-ON	Solder	1804.0102 R30 (Black Base & Rocker)
DPDT	ON-ON	Solder	1804.0103 R30 (Black Base & Rocker, White Marking Bar on Rocker)
DPDT	ON-ON	Solder	1804.0121 R50 (Black Base & Rocker)
DPDT	ON-ON	4.8(.187)	1804.1121 R50 (Black Base & Rocker)
DPDT	ON-ON	4.8(.187)	1804.1102 R30 (Black Base & Rocker)
DPDT	ON-ON	4.8(.187)	1804.1152 (White Base & Rocker, Contact Gold, 30mA - 12 VDC)
DPDT	ON-ON	4.8(.187)	1804.1153 (Black Base & Rocker, Contact Gold, 30mA - 12VDC)
DPDT	CN-ON	P.C.	1804.2152 (Black Base & Rocker, Contact Gold, 30mA - 12VDC)
DPST	ON-OFF	4.8(.187)	1805.1102 R87 (Black Base, Red Lighted Rocker, White Marking 0 on Rocker, 220V Bulb)
DPST	ON-OFF	4.8(.187)	1805.1121 R55 (Black Base, Red Lighted Rocker, White Marking 0 on Rocker, 125V Bulb)
DPDT	ON-OFF -ON	4.8(.187)	1809.1102 R58 (Black Base & Rocker)
DPDT	Mom ON -OFF- Mom ON	4.8(.187)	1809.1302 R58 (Black Base & Rocker)

1850 SERIES





X	Y	Z
0,75 1,25	19,2 -0,1	12,9 +0,1
1,25 2	19,4 -0,1	12,9 +0,1
2 3	19,8 -0,1	12,9 +0,1

ILLUMINATED

R69 4A 250V AC 1/10 HP
R53 6A 125V AC 1/10 HP

Technical Data:
Single pole or double pole ST
Lifting contact
Resistance to tracking > KB 250
Life endurance:
Mechanical - 50,000 operations
Electrical - 10,000 cycles
Snap in fixing:
for a wall thickness (X) of 0,75...3 mm recommended cut-out (Y x Z) see table under dimensions
Illumination:
neon lamp with Rv 220V or 110V AC (not interchangeable)

Materials
Rocker and housing made of thermoplastic
Contacts made of Ag
Terminals silver-plated

Circuit	Function	Terminal	Catalog Number
SPST	ON-OFF	4.8(.187)	1850.1121 R69 (Black Base, Red Lighted Rocker, 220V Bulb)
SPST	ON-OFF	4.8(.187)	1850.1122 R53 (White Base, Red Lighted Rocker, 125V Bulb)
SPST	ON-OFF	4.8(.187)	1850.1123 R53 (Black Base, Red Lighted Rocker, 125V Bulb)
DPST	ON-OFF	4.8(.187)	1855.1122 R53 (Black Base, Green Lighted Rocker, 125V Bulb, White Marking, 0)
DPST	ON-OFF	4.8(.187)	1855.1123 R53 (White Base, Red Lighted Rocker, 125V Bulb, White Marking, 0)
DPST	ON-OFF	4.8(.187)	1855.1124 R53 (Black Base, Red Lighted Rocker, 125V Bulb, White Marking, 0)
DPST	ON-OFF	4.8(.187)	1855.1125 R53 (Black Base, Amber Lighted Rocker, 125V Bulb, White Marking, 0)
DPST	ON-OFF	4.8(.187)	1855.1126 R69 (Black Base, Green Lighted Rocker, 220V Bulb, White Marking, 0)
DPST	ON-OFF	4.8(.187)	1855.1127 R69 (Black Base, Red Lighted Rocker, 220V Bulb, White Marking, 0)
DPST	ON-OFF	4.8(.187)	1855.1128 R69 (Black Base, Orange Lighted Rocker, 220V Bulb, White Marking, 0)

Additional Models
Rocker, window and housing in other colors
Rocker with different symbols
With incandescent lamp

MARQUARDT

Rocker Switches/Keymodules

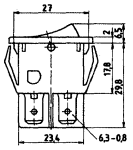
SERIES 1550—SINGLE POLE AND DOUBLE POLE ROCKER SWITCHES OF ONE SIZE FOR 16 A 250V ~

SWITCH FUNCTIONS

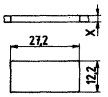
Series 1550 include SPST and DPST-switches with or without indicator lamp.

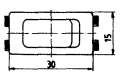
VERSIONS FOR SNAP-IN FIXING IN THE FRONT PLATE

front-frame
30 x 15mm



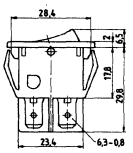
Cut-out for snap-in fixing



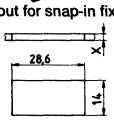


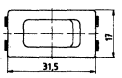
Suitable for snap-in fixing (x) from 0,8mm to 5mm

front-frame
31,5 x 17mm



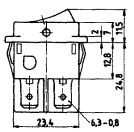
Cut-out for snap-in fixing



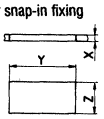


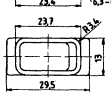
Suitable for snap-in fixing (x) from 0,8mm to 5mm

VERSIONS FOR SNAP-IN FIXING IN THE MOUNTING-FRAME



Cut-out for snap-in fixing





X	Y	Z
0,75 ... 1,25	26.2$_{-0,1}$	12,4$^{+0,1}$
1,25 ... 2	26,4$_{-0,1}$	12,4$^{+0,1}$
2 ... 3	26,8$_{-0,1}$	12,4$^{+0,1}$

APPROVAL MARKS

Suited for appliances of class II.

MARKINGS

According to the regulations of the approval authorities, the positions of the double pole switches are marked on the rocker.

SPST/DPST with yellow 16(4)A 250V AC ½ HP

DUETTE

Reference Numbers			single pole	double pole
SPST/DPST rocker and housing black	16(4)A 16A 16A	250V ~ 250V AC ½ HP 125V AC ¼ HP	1551.3102	1552.3102
			1551.0102	1552.0102
	10(4)A 10A 10A	250V ~ 250V AC ½ HP 250V AC ¼ HP	1551.2102	1552.2102
			1551.4102	1552.4102
SPST/DPST with yellow indicator lamp rocker and housing black	16(4)A 16A	250V ~ 250V AC ½ HP	1550.3104	1555.3104
			1550.0104	1555.0104
	16A	125V AC ¼ HP	1550.3124	1555.3124
			1550.0124	1555.0124

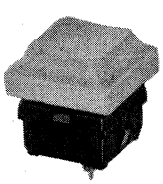
SPST/DPST rocker and housing black	16(4)A 16A 16A	250V ~ 250V AC ½ HP 125V AC ¼ HP	1551.8102	1552.8102
			1551.5102	1552.5102
	10(4)A 10A 10A	250V ~ 250V AC ½ HP 125V AC ¼ HP	1551.7102	1552.7102
			1551.9102	1552.9102
SPST/DPST with yellow indicator lamp, rocker and housing black	16(4)A 16A	250V ~ 250V AC ½ HP	1550.8104	1555.8104
			1550.5104	1555.5104
	16A	125V AC ¼ HP	1550.8124	1555.8124
			1550.5124	1555.5124

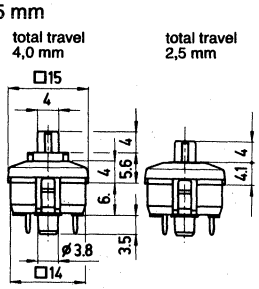
Reference Numbers			single pole	double pole
SPST/DPST rocker and housing black	16(4)A 16A 16A	250V ~ 250V AC ½ HP 125V AC ¼ HP	1551.3602	1552.3602
			1551.0602	1552.0602
	10(4)A 10A 10A	250V ~ 250V AC ½ HP 125V AC ¼ HP	1551.2602	1552.2602
			1551.4602	1552.4602
SPST/DPST with yellow indicator lamp, rocker and housing black	16(4)A 16A	250V ~ 250V AC ½ HP	1550.3604	1555.3604
			1550.0604	1555.0604
	16A	125V AC ¼ HP	1550.3624	1555.3624
			1550.0624	1555.0624

Rights of technical alterations reserved. Drawings available with information regarding tolerances.

SERIES 6184—MARQUARDT KEYMODULES WITH OR WITHOUT TACTILE FEEL

SPN-0 WITH TOTAL TRAVEL
OF 4,0 mm or 2,5 mm





Keycaps upon request.

Snap-in fixing into metal frame
recommended cut-out □ 14,05 mm
recommended frame thickness
1,2 mm

Keymodules with total travel of 4,0 mm		Keymodules with total travel of 2,5 mm	
SPN-0	6184.0101	SPN-0	6184.1101
with red LED	6184.0201	with red LED	6184.1201
with green LED	6184.0202	with green LED	6184.1202
with yellow LED	6184.0204	with yellow LED	6184.1204
with diode	6184.0301	with diode	6184.1301
with tactile feel	6184.0701	with tactile feel	6184.1701
with tactile feel and diode	6184.0801	with tactile feel and diode	6184.1801
alternating action	6184.0501	Rights of technical alternations reserved. Drawings available with information regarding tolerances.	
with red LED	6184.0601		
with green LED	6184.0602		
with yellow LED	6184.0604		

MARQUARDT

Rocker Switches

SERIES 1830—SINGLE POLE AND DOUBLE POLE ROCKER SWITCHES FOR MAXIMUM 16 A 250 V AC

SWITCH FUNCTIONS

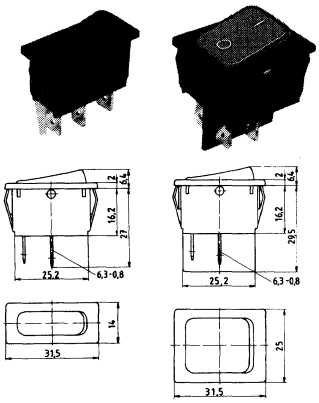
• SPST/DPST • SPN-C/DPN-C
• SPN-0/DPN-0 • SPDT/DPDT
• SPDT/DPDT momentary function
• SPDT/DPDT with centre-off • SPDT/DPDT with centre-off, momentary from one or both sides • SPST/DPST with indicator lamp • Pilot lights

INRUSH CURRENT

16 A-versions are suitable for an inrush current of up to 80 A, 10 A-versions can withstand up to 40 A. Versions with special contacts allow an inrush current of up to 160 A.

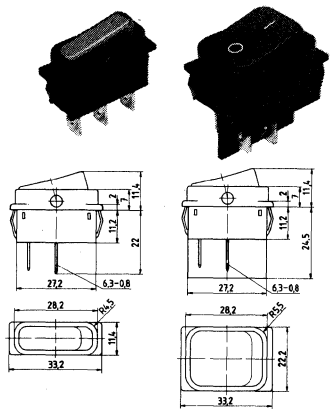
VERSIONS FOR SNAP-IN FIXING IN THE FRONT PLATE

single pole double pole

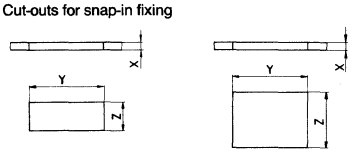


VERSIONS FOR SNAP-IN FIXING IN THE MOUNTING-FRAME

single pole double pole



Cut-outs for snap-in fixing



X	Y	Z
0,75 ... 1,25	$30_{0,1}$	11+0,1
1,25 ... 2	$30,2_{0,1}$	11+0,1
2 ... 3	$30,6_{0,1}$	11+0,1

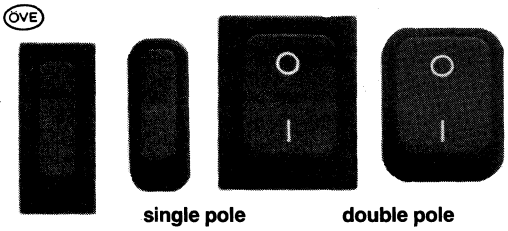
X	Y	Z
0,75 ... 1,25	$30_{0,1}$	22+0,2
1,25 ... 2	$30,2_{0,1}$	22+0,2
2 ... 3	$30,6_{0,1}$	22+0,2

APPROVAL MARKS

Suited for appliances of class II.

DIMENSIONS

The indicated dimensions are not binding. Samples and drawings including tolerances are available on request.



Reference Numbers

				single pole		double pole	
SPST/DPST	16A 250V AC ½ HP 16A 125V AC ¼ HP 16(4)A 250V ~		6,3	1831.3312	1831.8112	1832.3312	1832.8112
	6A 250V AC ½ HP 6A 125V AC ¼ HP 10(4)A 250V ~ 6(4)A 250V ~ +++		6.3	1831.3302	1831.8102	1832.3307	1832.8102
			4,8	1831.1102	1831.6102	1832.1102	1832.6102
				1831.0102	1831.5102	1832.0102	1832.5102
				1831.2102	1831.7102	1832.2102	1832.7102
				—	1831.9102	—	1832.9102
SPN-C/DPN-C	4A 250V AC 1/10 HP 6A 125V AC 1/10 HP 4(2)A 250V ~		6.3	1831.3502	1831.8302	1832.3502	1832.8302
			4,8	1831.1702	1831.6302	1832.1302	1832.6302
SPN-0/DPN-0	4A 250V AC 1/10 HP 6A 125V AC 1/10 HP 4(2)A 250V ~		6,3	1831.3402	1831.8202	1832.3407	1832.8202
			4,8	1831.1202	1831.6202	1832.1202	1832.6202

without marking

SPDT/DPDT	6A 250V AC ½ HP 6A 125V AC ¼ HP 10(4)A 250V ~ 6(4)A 250V ~ +++		6,3	1833.3302	1833.8102	1834.3302	1834.8102
			4,8	1833.1102	1833.6102	1834.1102	1834.6102
				1833.0102	1833.5102	1834.0102	1834.5102
				1833.2102	1833.7102	1834.2102	1834.7102
				—	1833.9102	—	1834.9102
SPDT/DPDT momentary function	4A 250V AC 1/10 HP 6A 125V AC 1/10 HP 4(2)A 250V ~		6,3	1833.3402	1833.8202	1834.3402	1834.8202
			4,8	1833.1202	1833.6202	1834.1202	1834.6202
SPDT/DPDT with centre-off	6A 250V AC 1/8 HP 6A 125V AC 1/8 HP 6(4)A 250V ~		6,3	1838.3502	1838.8102	1839.3502	1839.8102
			4,8	1838.1502	1838.6102	1839.1502	1839.6102
				1838.0102	1838.5102	1839.0102	1839.5102
momentary from one side	6A 250V AC 1/8 HP 6A 125V AC 1/8 HP 6(4)A 250V ~		6,3	1838.3602	1838.8202	1839.3602	1839.8202
			4,8	1838.1602	1838.6202	1839.1602	1839.6202
momentary from both sides	6A 250V AC 1/8 HP 6A 125V AC 1/8 HP 6(4)A 250V ~		6,3	1838.3402	1838.8302	1839.3402	1839.8302
			4,8	1838.1402	1838.6302	1839.1402	1839.6302

LIGHTED (Below Numbers are Amber Color–Lense–Other Colors on Request)

SPST/DPST with Indicator Lamp	16A 250V AC ½ HP 16(4)A 250V ~		6,3	1830.3114	1830.8114	1835.3114	1835.8114
	6A 250V AC ½ HP 10(4)A 250V ~ 6(4)A 250V ~ +++		6,3	1830.3104	1830.8104	1835.3104	1835.8104
			4,8	1830.1114	1830.6104	1835.1114	1835.6104
				1830.0104	1830.5104	1835.0104	1835.5104
	6A 125V AC ½ HP		6,3	1830.3124	1830.8124	1835.1124	1835.8124
			4,8	1830.1124	1830.6124	1835.1124	1835.6124

without marking

Pilot Light	220V ~ VDE	6,3	1837.3104	1837.3504	1837.8104	1837.8504
	125V AC UL CSA	6,3	1837.3124	1837.3524	1837.8124	1837.8524

Plug in terminals **6,3** **4,8 Solder terminals** **Straight PC-terminals** **Angled PC-terminals**

We reserve the right to alter our switches in accordance with technical improvements.

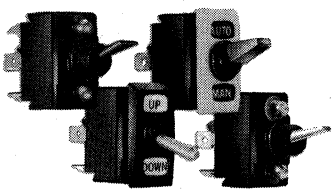
Marquardt Switches Inc. • 2711 Route 20 East • FAX 315-655-8042 • Cazenovia, New York 13035 • (315) 655-8050

engineered switches

McGILL®

McGILL MFG. CO., INC., ELECTRICAL DIV.,
VALPARAISO, IN 46383 (800) 233-8828

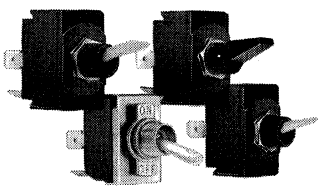
TOGLITE™ LIGHTED TOGGLE SWITCHES



- **Broad Selection** of bat styles, colors, indicating plates and legends to fit design and functional requirements.
- **Reliable, long-life mechanisms** for exceptional performances.
- **Variety of circuit arrangements.**
- **Environmental ratings**—150°F., 85% relative humidity.
- **Choice of terminals:** Screw, 1/4″ wide spade, or solder.
- **Choice of lights:** 6V, 14V, 28V or 250V AC, 125V AC Standard.

15 Amp 277V AC
3/4 HP 125-277V AC
Single Pole & Double Pole
Case Dimensions
1.35″ x .80″
15/32″-32 thd. bushing
UL Listed
CSA Approved

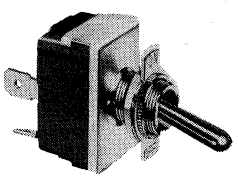
DESIGNER LINE TOGGLE SWITCHES



- **Choice of designer-style lighted or unlighted bats** in colors to your specifications.
- **Reliable, long-life mechanism** for exceptional performance.
- **Polycarbonate or die-cast zinc coverplates.**
- **25,000-hour 14V incandescent standard** (other incandescent and neon lamps available on special order).
- **Environmental ratings:** 150°F., 85% relative humidity.
- **Choice of terminals:** Screw, 1/4″ wide spade, or solder.

15 Amp 277V AC
3/4 HP 125-277V AC
Single Pole & Double Pole.
Case Dimensions: 1.35″ x .80″
15/32″ thd. bushing
UL Listed
CSA Approved

STANDARD TOGGLE SWITCHES



- **Wide selection of circuitry, ratings, terminals.**
- **Time-proven, reliable long-life mechanism.**
- **Variety of bat styles and colors.**
- **SP, DP, 3+4 pole models available.**

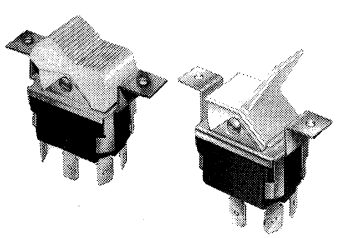
UL Listed
CSA Approved

20 A 125 V AC
10 A 250 V AC
1 HP 125-250 V AC
20 A 250 V AC Non-Inductive
Also available 25 A 125-250 V AC Non-Inductive

UL Listed
C.S.A. Approved

Silver cadmium oxide contacts
Brown general-purpose phenolic cases
Nickel plated bats

ROCKER AND PADDLE SWITCHES



- **Distinctive styling**—With your choice of standard or specially designed actuators to meet style requirements.
- **Reliability**—Mechanical excellence from one of the most experienced manufacturers of switches of this type.
- **Extra electrical capacity**—20 Amp models provide an extra margin of reliability.
- **Broad range of variations**—Terminals, circuitry, coverplates, actuators are available or can be engineered to fit your needs.

0801 SP and 0801 DP Series

UL Listed	CSA Approved
20 Amp 277V AC	16 Amp 277V AC
1 1/2HP 125-250V AC	1 1/2HP 125-250V AC

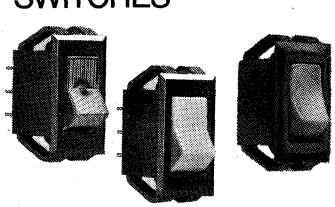
20 Amp 12V DC

1801 SP and 1801 DP Series

UL Listed	CSA Approved
6 Amp 125V AC	
3 Amp 250V AC	
1/4HP 125-250V AC	

6 Amp 12V DC
Case Dimensions: 1 15/64″ x 51/64″

MINIATURE ROCKER SWITCHES



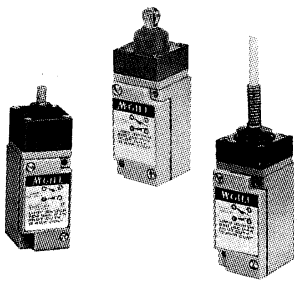
- **Choice of Stylette™**—(new softer designer lines that enhance product styling) **or standard miniature rocker switches.**
- **Choice of illuminated or solid** two surface smooth colored rocker.
- **Rocker colors available**—
  Light-Clear-Amber-Red-*Green-*Blue
  Non-lighted-White-Black-Red
  (other colors, consult factory).
- **Plastic snap-in bezels**—for fast easy installation.
- **Available in black & white bezels** (other colors, consult factory).
- **Terminals**—1/4″ quick disconnect-standard. Also available 16-ga. wire.
- **Lamps**—115V AC neon standard. Also available 6V AC or DC, 14V AC or DC, 28V AC or DC & 250V AC neon.

McGILL MANUFACTURING COMPANY, INC., ELECTRICAL DIVISION, VALPARAISO, IN 46383

engineered switches **McGILL®**

McGILL MFG. CO., INC., ELECTRICAL DIV.,
VALPARAISO, IN 46383 (800) 233-8828

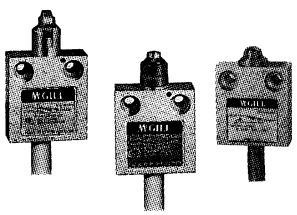
1506 SERIES ROTARY ACTUATED SWITCHES



- plug-in and non plug-in body styles with convenient on-the-spot adjusting
- wobble actuated switches have flexible levers that operate with any movement except direct pull
- rollers on side plungers in horizontal position
- head adjusts clockwise and counterclockwise
- light on indicator versions wire to N.O. circuit
- Meet NEMA 1,3,4, and 13 standards

Circuitry: SPDT, DPDT
Types: Side/Top Rotary, Maintained, Center Neutral, Plain Top, Roller, Roller-Side Plungers, Wobble, Coil Spring
Body Styles: Plug-in, Non-Plug-in 1/2″ or 3/4″ conduit
Make/Break Voltages: 120, 240, 480, 600 VAC; 120, 240 VDC
UL Listed
CSA certified

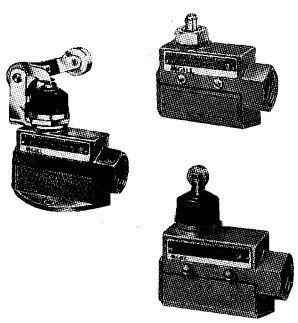
1505 SERIES MINIATURE PRE-WIRED ENCLOSED SWITCHES



- pre-wired at factory with industrial quality cable (SJTO)
- eliminate need to wire at switch, so they're ideal for use in limited access areas
- gang-mountable to build multi-plunger switch .63″ between plunger
- seals keep liquids from entering switch cavity
- complete range of actuators, including plain and roller plungers, and side rotary
- Meet NEMA 1, 3, 4, 12 and 13

Circuitry: SPDT
Types: Plain, Boot-Sealed, Roller and Cross-Roller Plunger, Side Rotary
Make/Break Voltages: 120, 240 VAC; 28 VDC
UL Listed
CSA certified

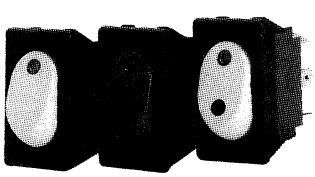
1502 SERIES COMPACT ENCLOSED SWITCHES



- side and flange mounted switches available with or without actuator seal boots
- combination insulator/seal cemented inside bottom enclosure
- lead washers seal mounting holes on side mount switches
- side mounts installed with #6 screwshead adjusted clockwise and counterclockwise operation
- removal of bottom enclosure exposes terminals for easy wiring
- NEMA 1 rated

Circuitry: SPDT, DPDT
Types: Straight, Roller Plunger, Roller Lever, One-Way Roller Lever, Manual, Coil Spring
Body Styles: Side or Flange mounted, with/without seal boot
Make/Break Voltages: 125, 250, 480, 600 VAC; 125, 250 VDC
UL Listed
CSA certified

0852 EURO-STYLED ROCKER SWITCHES



- patented sleek, rounded ultra-modern design
- rugged, reliable rocker mechanism proven in millions of applications
- fits standard cutouts
- available with moisture-resistant seals
- .187 spade, screw terminals, solder and wire leads optional

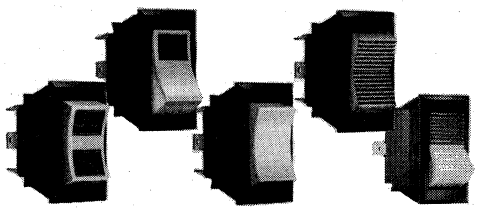
Circuitry: SPDT, DPDT
Types: one-light, two-lights, non-lighted with three different rocker colors: red, white, black
Electrical: 15A, 277V AC; 3/4 HP, 125-277V AC; 6-28V DC Incandescent; 115V Neon
Terminals: 1/4″ Spade
UL Listed
CSA certified

engineered switches

McGILL®

McGILL MFG. CO., INC., ELECTRICAL DIV.,
VALPARAISO, IN 46383 (800) 233-8828

LIGHTED ROCKER SWITCHES WITH SNAP-ON COLORED CAPS



0851, 1851, 1861, 0871, 1871, 0881 and 1881 switch series standard construction features:
These switches have black plastic bezels for snap-in-mounting, 1/4" quick-disconnect spade terminals, 115V neon lamps. Available with 6-28V DC incandescent lamp consult factory. Optional splash-resistant gasket model available—request new Sealtite™ switch.

Underwriters' Lab. Inc. Listed
CSA Approved
0851, 0861, 0871, 0881
15 Amp 277V AC
3/4 HP-125 277V AC

1851, 1861, 1871, 1881
6 Amp 125V AC
3 Amp 277V AC
1/4 HP-125 277V AC

SINGLE POLE (Black Bezel, White Rocker, Red Lens)

Circuit Arrangement A B C			Poles	Lights	CATALOG NUMBERS Spade Terminals	
A	B	C			15 A (0851)	6 A (1851)
ON	—	OFF	SPST	1	0851-1301	1851-1301
ON	OFF	ON	SPDT	2	0851-2302	1851-2302
ON	—	ON	SPDT	2	0851-2303	1851-2303
(ON)	—	OFF	SPST	1	0851-1304	1851-1304
(ON)	OFF	(ON)	SPDT	2	0851-2305	1851-2305
(ON)	OFF	ON	SPDT	2	0851-2306	1851-2306
ON	—	(OFF)	SPST	1	0851-1307	1851-1307
(ON)	—	ON	SPDT	2	0851-2308	1851-2308

( ) = Momentary.

SINGLE POLE LIGHTED (Black Bezel)

Circuit Arrangement A B C			Poles	Lights	CATALOG NUMBERS Spade Terminals	
A	B	C			15 A (0871)	6 A (1871)
ON	—	OFF	SPST	1	0871-1601	1871-1601
ON	OFF	ON	SPDT	2	0871-2602	1871-2602
ON	—	ON	SPDT	2	0871-2603	1871-2603
(ON)	—	OFF	SPST	1	0871-1604	1871-1604
(ON)	OFF	(ON)	SPDT	2	0871-2605	1871-2605
(ON)	OFF	ON	SPDT	2	0871-2606	1871-2606
ON	—	(OFF)	SPST	1	0871-1607	1871-1607

( ) Momentary. Above numbers do not include cap.

SEALTITE™ SWITCHES

Protects switch against liquids, dust, dirt and many other contaminants. Lighted or unlighted versions. Consult factory for part number.

DOUBLE POLE (Black Bezel, White Rocker, Red Lens)

Circuit Arrangement A B C			Poles	Lights	CATALOG NUMBERS Spade Terminals	
A	B	C			15 A (0861)	6 A (1861)
ON	—	OFF	DPST	1	0861-1301	1861-1301
ON	OFF	ON	DPDT	2	0861-2302	1861-2302
ON	—	ON	DPDT	2	0861-2303	1861-2303
(ON)	—	OFF	DPST	1	0861-1304	1861-1304
(ON)	OFF	(ON)	DPDT	2	0861-2305	1861-2305
(ON)	OFF	ON	DPDT	2	0861-2306	1861-2306
ON	—	(OFF)	DPST	1	0861-1307	1861-1307
(ON)	—	ON	DPDT	2	0861-2308	1861-2308

( ) = Momentary.

DOUBLE POLE LIGHTED (Black Bezel)

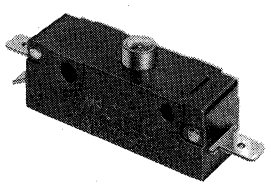
Circuit Arrangement A B C			Poles	Lights	CATALOG NUMBERS Spade Terminals	
A	B	C			15 A (0881)	6 A (1881)
ON	—	OFF	DPST	1	0881-1601	1881-1601
ON	OFF	ON	DPDT	2	0881-2602	1881-2602
ON	—	ON	DPDT	2	0881-2603	1881-2603
(ON)	—	OFF	DPST	1	0881-1604	1881-1604
(ON)	OFF	(ON)	DPDT	2	0881-2605	1881-2605
(ON)	OFF	ON	DPDT	2	0881-2606	1881-2606
ON	—	(OFF)	DPST	1	0881-1607	1881-1607
(ON)	—	ON	DPDT	2	0881-2608	1881-2608

( ) Momentary. Above numbers do not include cap.

SNAP-ON COLORED CAPS

Color	Full Cap Serrated	½ Cap Serrated	Curved Full Satin Clear Cap	Curved Full Satin Opaque Cap
White	0871-0000	0871-0010	0871-0020	0871-0030
Clear	0871-0100	0871-0110	0871-0120	0871-0130
Amber	0871-0200	0871-0210	0871-0220	0871-0230
Red	0871-0300	0871-0310	0871-0320	0871-0330
Green	0871-0400	0871-0410	0871-0420	0871-0430
Blue	0871-0500	0871-0510	0871-0520	0871-0530
Chrome	—	—	—	0871-0730
Black	0871-0800	0871-0810	—	0871-0830

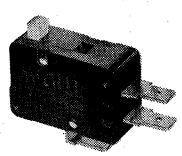
SNAP-ACTION SWITCHES



2600 Series
20 Amp 125-250V AC
1 HP 125-250V AC
2 HP 250V AC
SPDT & SPST, NO or NC
Less than .005" differential travel
Operating force 20 oz. max.
Underwriters' Laboratories, Inc. Listed
CSA Approved
Dimensions 1 13/16" x 41/64" x 41/64"
Standard Terminals
Spade Terminals .250" x .032"

2700 Series
20 Amp 125-250V AC
1 HP 125-250V AC
2 HP 250V AC
Underwriters' Laboratories, Inc. Listed
CSA Approved
Dimensions 1 21/64" x 1-13/16" x 43/64"
Spade Terminals .250" x .032"

MINIATURE SNAP-ACTION SWITCHES



McGill® 4775 Series Rolling Cam* SNAP-ACTION SWITCHES. An engineering breakthrough that provides 150,000,000 cycle reliability, less contact bounce (1.5 millsec), LIGHT OPERATING FORCE—75gm. Max.

4777 Series available rated:
15 Amp 125-250V AC, 1/2 HP 125-250V AC
25 Amp 125-250V AC, 1 HP 125V AC
2 HP 250V AC, 85°C. Max. Ambient Temp.

10 Amp
125-250V AC
1/2 HP 125-250V AC
4 Amp "L" 125V AC

Underwriters' Laboratories, Inc. Listed;
CSA Approved
Optional UL 100,000 cycle listing and 20.1 Amp
Case Dimensions: 1 3/32" x 5/8" x 13/32"

ACTUATOR	CATALOG NUMBERS SPADE TERMINALS SPDT	SPST NO	SPST NC	OPERATING CHARACTERISTICS Operating Force Max. gm.	Release Force Min. gm.	Movement Diff. Max. In.	Pre-travel Max. In.	Total Over-travel Min. In.	Actuator Length
Basic plunger	4775-1100	4775-1200	4775-1300	75	10	.016	.047	.050	
Short rigid lever	4775-1120	4775-1220	4775-1320	75	9	.018	.052	.050	$^{27}/_{32}$
Long rigid lever	4775-1130	4775-1230	4775-1330	37	4	.037	.108	.090	$1^{13}/_{32}$
Short rigid lever w/roller	4775-1140	4775-1240	4775-1340	75	9	.018	.052	.050	$^{25}/_{32}$
Long rigid lever w/roller	4775-1150	4775-1250	4775-1350	37	4	.037	.108	.090	$1^{11}/_{32}$
Simulated roller	4775-1160	4775-1260	4775-1360	37	5	.033	.096	.090	$1^{9}/_{32}$

NOTE: Operating characteristics are given for levers mounted in the support farthest from the plunger. When the levers are mounted in the support closest to the plunger, multiply the given force values by .57 and the travel values by 1.76 to obtain the correct values.

4600 Series 15 Amp switches with berylium copper mechanism also available.

SWITCH BUYER HOTLINE (800) 233-8828; FAX (219) 465-2456; PHONE (219) 465-2200

MEI T-5 SERIES LIGHTED KEYSWITCHES

DESCRIPTION

The T-5 lighted keyboard switch has long life (greater than 10 million cycles), low bounce, gold-plated cross bar contacts usually found in more expensive switches.

Mechanically, the T-5 switch incorporates precision tracking surfaces providing a smooth "feel" throughout its .170 travel. Each switch has two alignment studs and four to six solder points. This makes hand or wave soldered PC board assemblies extremely rugged for the most demanding applications, while keeping the manufacturing costs down by eliminating the need for metal mounting frames.

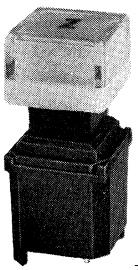
Electrical configurations include normally open, normally closed, double pole normally open, and alternate action. MEI stocks a 5V, 60 milliamp, 100,000 hour bulb for these switches. Lamp terminal spacing is .100 inch, to fit T-1 size lamps which can be changed from the front panel by end users. Lenses are stocked in eight colors.

MEI offers a complete line of non lighted T-5 switches and accessories for keyboard construction. These include the switches and keytops shown below, keytops for both 16mm and 19mm center arrays, relegendable keytops, space bars, wide keytops, leveling mechanisms, etc. In house engraving and printing is available for prototyping and low volume applications.

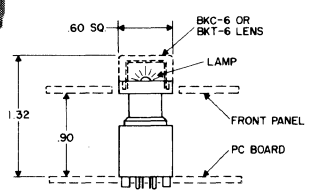
SPECIFICATIONS

CONTACT RATING, DC RESISTIVE: 3W max.
VOLTAGE: 24V max.
INITIAL CONTACT RESISTANCE: 100 mΩ max.
PLUNGER TRAVEL: .170 ±.010 in.
PRE-TRAVEL: .080 ±.030 in.
OPERATING FORCE
SINGLE POLE, MOMENTARY: 3.5 ±0.5 oz.
DOUBLE POLE AND/OR ALT. ACTION: 6.0 ±0.5 oz.
TEMPERATURE
OPERATING: −25°C to +65°C
STORAGE: −40°C to +70°C
CONTACT BOUNCE: 4 ms max.
MIN. ACTUATIONS, @ 5V, 100μ AMPS: 10 x 10^6

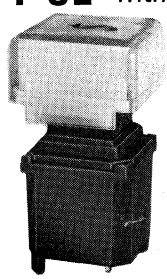
T-5K With Box Lens



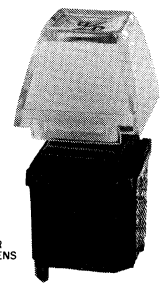
- LIGHTED WITH T-1 BI-PIN LAMP, SOCKETED
- FOR 5/8" CENTER MOUNTING

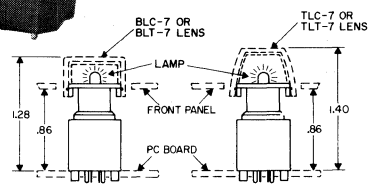


T-5L With Box Lens or Truncated Lens

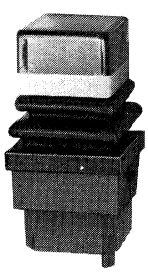


- FOR 3/4" CENTER MOUNTING
- LIGHTED WITH T-1 BI-PIN LAMP, SOCKETED

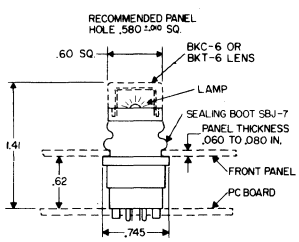




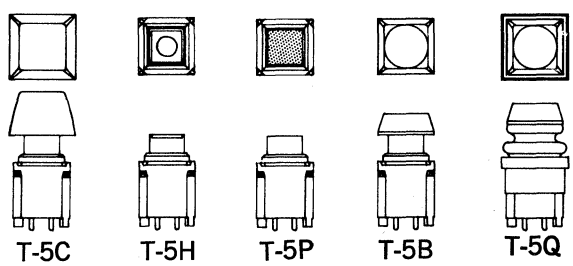
T-5J With Panel Sealing Boot and Box Lens



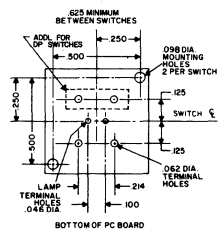
- ENVIRONMENTALLY SEALED ABOVE AND BELOW MOUNTING PANEL
- VINYL BOOT SEALS AGAINST LIQUID AND DUST
- FOR 3/4" CENTER MOUNTING
- LIGHTED WITH T-1 BI-PIN LAMP, SOCKETED



OTHER MODELS



PC BOARD LAYOUT



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FAX (703) 435-1837

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Oakland, CA 94606
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(415) 834-5888

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- Semi Inc.
- Semitronics

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- G.C.
- McGill
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- G.E.
- National
- Raytheon
- R.C.A.
- Varian (Klystrons)

TUBING
- Alpha
- Electrovert
- Heli-Tube
- Panduit

WIRE & CABLE
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- Belden
- Cablewave
- Carol
- Iboco
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CHERRY

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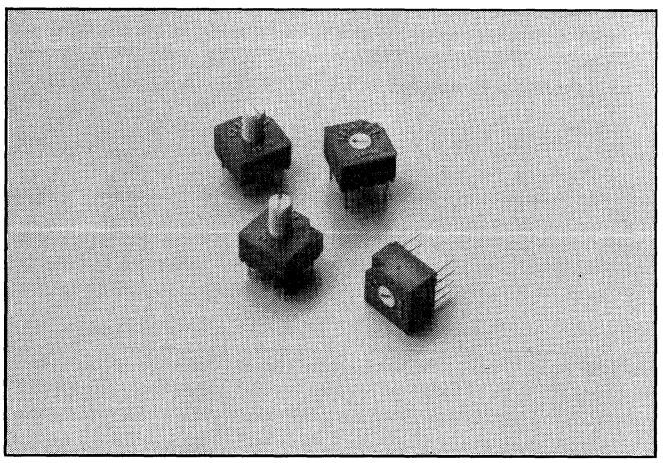
MEPCOPAL

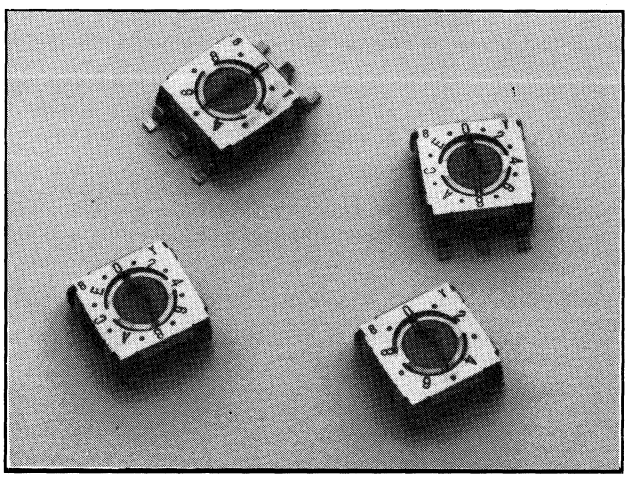
Trimmers & Switches. Pure and Simple.

SELECTOR AND BINARY CODED DIP AND SMD ROTARY SWITCHES



SS-10 SWITCHES

S-7000 SWITCHES



Switch	Number of Positions	Type	Mounting	Size
CS-4	2 (Single Pole) 3 (Single Pole) 2 (Double Pole)	Selector Selector Selector	SMD SMD SMD	4 mm sq. 4 mm sq. 4 mm sq.
SS-10	6 (Single Pole) 3 (Double Pole)	Selector Selector	DIP DIP	10 mm sq. 10 mm sq.
S-1000	16 BCH	Digital	DIP	1/2" sq.
S-2000	10 BCD	Digital	DIP	1/2" sq.
S-5000	10 BCD*/16 BCH*	Digital	DIP	1/2" sq.
S-7000	10 BCD*/16 BCH*	Digital	SMD	7 mm sq.
S-8000	8 (3 bits)	Digital	DIP	7 mm sq.

*Built-in resistor and/or diode arrays.

MEPCOPAL Mepcopal Company, 11468 Sorrento Valley Road, San Diego, California 92121
619/453-0332, FAX: 619/481-1123

MICRO SWITCH
a Honeywell Division

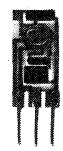
Solid State Hall Sensors

Hall effect sensors respond to a magnetic field, or—in the case of Hall vane sensors—to the interruption of a magnetic field. Hall sensors are not rate sensitive. They operate at extremely high speed and include signal conditioning. They offer high reliability, long life, and compatibility with microprocessors and other electronic circuitry.

Sensors are used in:

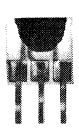
- Ignition systems
- Brushless DC motors
- Utility meters
- Water softeners
- Gasoline pumps
- Welding equipment
- Balance scales
- Interlocks
- Flowmeters
- Magnetic card readers
- Vending machines
- Home appliances
- Computer equipment
- Medical instruments
- Copy machines
- Laboratory equipment

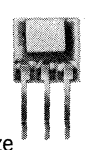
MAGNETIC POSITION SENSORS

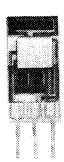


Listing	Actual Size **513SS16**	Actual Size **613SS4**	Actual Size **8SS3**	Actual Size **91SS12-2**
Operation	Proximity to external magnet	Proximity to external magnet	Proximity to external magnet	Proximity to external magnet
Supply Voltage	6 to 24 VDC	6 to 24 VDC	6 to 24 VDC	8 to 16 VDC
Construction	Molded plastic package Threaded flux concentrator	Molded plastic package	Ceramic hybrid circuit	Ceramic hybrid circuit
Termination	Solder/quick connect	Printed circuit board	Printed circuit board	Printed circuit board
Operating Speed	0 to over 100 kHz	0 to over 100 kHz	0 to 100 kHz	5 µ seconds (Res. Time)
Operating Gauss (25°C typical) Rel.	230 170	330 245	400 300	span (−400 to +400) 6V.
Output Type	Digital, current sink 20mA	Digital, current sink 10mA	Digital, current sink 20mA	Linear, current source
Other options— Request Catalog 20	4.5 to 5.5 VDC supply. Bipolar magnetics. Source output.	4.5 to 5.5 VDC supply. Current source or analog output.	4.5 to 5.5 VDC supply.	

MAGNETIC POSITION SENSORS





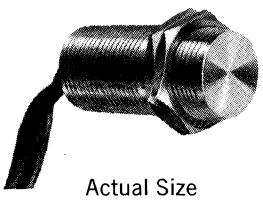


Listing	Actual Size **SS22PE**	Actual Size **SS31EA** **SS83CA**	Actual Size **SS41**	Actual Size **SS94A1**
Operation	Proximity to external magnet	Proximity to external magnet	Proximity to external magnet	Proximity to external magnet
Supply Voltage	6 to 24 VDC	4.5 to 24 VDC	4.5 to 24 VDC	6.6 to 12.6 VDC
Construction	Ceramic hybrid circuit	Ceramic hybrid circuit	Molded plastic	Ceramic hybrid circuit
Termination	Printed circuit board	Printed circuit board	Printed circuit board	Printed circuit board
Operating Speed	0-100 kHz	0 to over 100 kHz	0 to over 100 kHz	3 µ seconds (Res. Time)
Operating Gauss (25°C typical) Rel.	15 11	40 15 −40 −15	40 −40	Span (−500 to +500) .63Vs.
Output Type	Digital, current sink 20mA	Digital, current sink 10mA	Digital, current sink 10mA	Linear, current sinking or sourcing
Other options— Request Catalog 20	4.5 to 5.5 VDC supply.	Pinout options.	Operating gauss.	

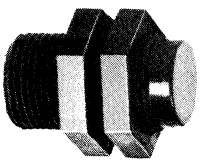
MICRO SWITCH
a Honeywell Division

Solid State Hall Sensors

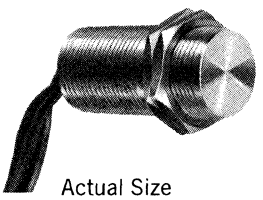
MAGNETIC POSITION SENSORS



Actual Size
SR1G-A1



Actual Size
SR3B-A1



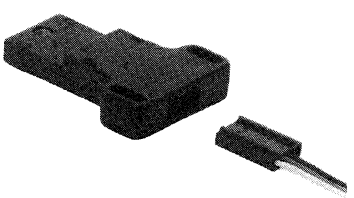
Actual Size
103SR17A-1

Actual Size
413SR10

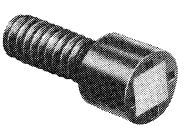
Listing	SR1G-A1	SR3B-A1	103SR17A-1	413SR10
Operation	Proximity to external magnet	Proximity to external magnet	Proximity to external magnet	Proximity to external magnet
Supply Voltage	4.5 to 24 VDC	4.5 to 24 VDC	6 to 24 VDC	6 to 24 VDC
Construction	Threaded aluminum housing	Thermoplastic	Threaded aluminum housing	Molded plastic housing (Can be gang mounted)
Termination	Leadwires	Leadwires	Leadwires	Solder/quick-connect
Operating Speed	0 to over 100 kHz	0 to over 100 kHz	0 to over 100 kHz	0 to over 100 kHz
Operating Gauss (25°C typical) Rel.	350 275	90 −90	50 −50	400 300
Output Type	Digital, current sink 20mA	Digital, current sink 10mA	Digital, current sink 20mA	Digital, current sink 20mA
Other options— Request Catalog 20	Threaded stainless steel housing. Bipolar magnetics.	Unipolar magnetics.	Source output. Unipolar magnetics.	Bipolar magnetics.

GEAR TOOTH SENSORS

1.38 × 1.14 × .46
GT01GA



1.78 × 1.25 × .34H
SR7PA



Listing	GT01GA	SR7PA
Operation	Ferrous metal	Ferrous metal
Supply Voltage	4.5 to 24 VDC	4 to 6 VDC
Construction	Thermoplastic	Thermoplastic
Termination	Leadwires	Plug-in connector
Operating Speed	0.01 to over 100 kHz	0 to over 12 kHz
Sensing gap min.	—	.005
max.	.060	.025
Output Type	Digital, current sink 20mA	Digital, current sink 6mA typ.

MG MAGNETS

MICRO SWITCH supplies bar and ring magnets for operating our Hall effect sensors. These are provided in a wide variety of magnetic materials, sizes, shapes, and mounting options. Request Catalog 20.

SALES AND SERVICE

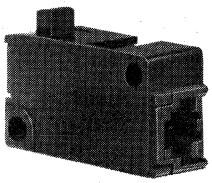
MICRO SWITCH serves its customers through a worldwide network of sales offices and distributors. For ordering, application assistance, pricing or name of nearest Authorized Distributor, contact a nearby MICRO SWITCH sales office. See the EEM Yellow Pages or contact:

MICRO SWITCH
11 W. Spring St.
Freeport, Illinois 61032
Tel. 815/235-6600

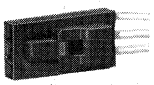
MICRO SWITCH
a Honeywell Division

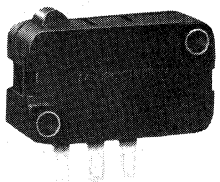
MECHANICALLY OPERATED HALL EFFECT SWITCHES

VANE SENSORS

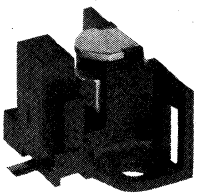


1.14 × .40 × .62H.

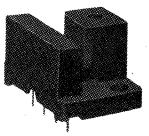




1.09 × .40 × .97H.



Actual Size

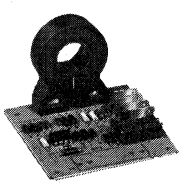


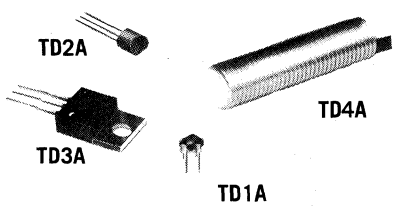
Actual Size

Listing	VX12-A1	47XL31-01	1AV2A	4AV12A
Operation	Mechanical plunger	Mechanical plunger	Ferrous vane	Ferrous vane
Supply Voltage	4.5 to 24 VDC	6 to 24 VDC	6 to 24 VDC	6 to 24 VDC
Construction	Plastic housing	Plastic housing	Molded plastic housing	Molded plastic housing
Termination	Plug-in connectors (molex type)	Solder/quick-connect	Leadwires	Leadwires
Operating Speed	Depends on actuator	Depends on actuator	0 to over 100 kHz	0 to over 100 kHz
Temperature Range	–40 to 70°C	–40 to 100°C	–40 to 125°C	–40 to 125°C (4AV)
Output Type	Digital, current sink Normally high 10mA	Digital, current sink Normally high 20mA	Digital, current sink 20mA	Digital, current sink 20mA
Other options— Request Catalog 20	Normally low output. Many actuator types. AMP connectors.	Normally low output. Many actuator types.	Solder/QC terminals. Source output.	PC Board term. Connector block.

CURRENT SENSORS

TEMPERATURE SENSORS



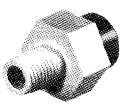


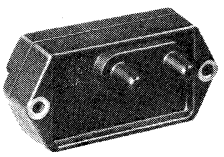
Listing	CS Holder Assemblies CSLA2CD	CS Adjustable Linear Sensors CSLF4AD	CS Digital Sensors CSDDIED	TD Temperature Sensors
Operation	Current sensor	Current sensor	Current sensor	Proximity to temperature
Supply Voltage	6 to 12 VDC	10.5 to 24 VDC	4.5 to 24 VDC	1mA (Supply Current)
Construction	Plastic housing	Plastic housing	Plastic housing	Ceramic, plastic or aluminum
Termination	PC board	PC board Quick conn.	PC board	Printed circuit board, leadwire or connector compatible
Operating Speed	3μ sec.	8μ sec	150μ sec.	Depends on packaging
Sensed Current max.	72a AC/DC	57a DC	3.5a operate 2.6a release	–40 to 150°C Temp. Range
Output Type	Linear, voltage ratio metric	Linear 4-20mA	Digital sinking 40mA	Analog
Other options Request Catalog 20	up to 950a sensing. Side mount.	1-5 V output. AC or DC sensing. Enclosed versions.	5V or 6-16V supply. Thru hole design. 1.3 to 22a sensing.	Various packages and materials.

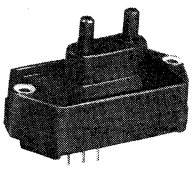
MICRO SWITCH
a Honeywell Division

PIEZORESISTIVE PRESSURE SENSORS

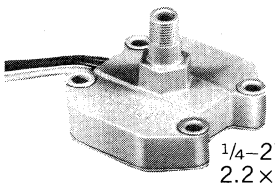
Piezoresistive pressure sensors convert air or liquid pressure to an analog signal. Overall, MICRO SWITCH pressure sensors are small, low cost and reliable. They feature excellent repeatability, high accuracy, and reliability under varying environmental conditions. In addition, they feature highly consistent operating characteristics from one sensor to the next and interchangeability without recalibration. Low cost to keep your systems costs down.

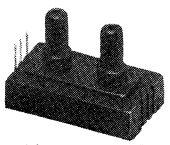






Listing	136PC15G1	236PC100GW	142PC15D	162PC01D
	0.64 sq. × .82H.	1/4-18 NPTF port 1 inch hex.	2.35 × 1.18 × 1.12H.	2.35 × 1.18 × 1.32H.
Operation	Deflection of silicon diaphragm	Deflection of silicon diaphragm	Deflection of silicon diaphragm	Deflection of silicon diaphragm
Supply Voltage	10 VDC or 2 mA typ.	10 VDC or 2mA typ.	8 VDC typ.	8 VDC typ.
Construction	Plastic package	Stainless steel housing	Thermoplastic	Thermoplastic
Termination	PCB	Cable	PCB	PCB
Temperature Range	– 40 to 85 °C	– 30 to 70 °C	– 40 to 85 °C	– 40 to 85 °C
Output Type F.S.O. typical	Low level, 100 mV Linear, proportional to pressure	Low level, 100 mV Linear, proportional to pressure	High level, 5 Volts	High level, 5 Volts
Pressure Range	0 to 15 psi gage	0 to 100 psi gage	0 to 15 psi differential	0 to 27.68" H_2O differential
Other options— Request Catalog 15	0-5 to 0-100 psi. Absolute versions.	0-5 to 0-150 psi.	Various in 0 to 30 psi and ± 15 psi ranges. Absolute and gage versions.	Various in 0 to 10" and ± 5" H_2O. Gage and vacuum versions.





Listing	242PC100G	16PC15GF	184PC15D
	1/4–27 NPT Port 2.2 × 2.3 × 1.57H.	.6 × .5 × .91H	1.15 × .64 × .84H.
Operation	Deflection of silicon diaphragm	Deflection of silicon diaphragm	Deflection of silicon diaphragm
Supply Voltage	8 VDC typ.	10 VDC	8 VDC typ.
Construction	Die-cast aluminum housing Buna N seal	Plastic package	Plastic package
Termination	Leadwires	PCB	PCB
Temperature Range	– 40 to 85 °C	– 40 to 85 °C	– 40 to 85 °C
Output Type F.S.O. typical	High level, 5 Volts Linear, proportional to pressure	Low level, 100 mV Linear, proportional to pressure	High level, 5 Volts Linear, proportional to pressure
Pressure Range	0 to 100 psi gage	0 to 15 psi gage	0 to 15 psi vacuum gage
Other options— Request Catalog 15	Various in ± 2.5 to 0-250 psi ranges.	0-5 and 0-30 psi. Differential and absolute versions.	0-5 and 0-30 psi. Differential versions. Terminal or housing mount.

SALES AND SERVICE

MICRO SWITCH serves its customers through a worldwide network of sales offices and distributors. For ordering, application assistance, pricing or name of nearest Authorized Distributor, contact a nearby MICRO SWITCH sales office. See the EEM Yellow Pages or contact:

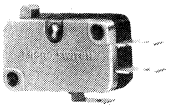
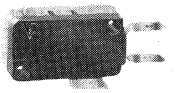
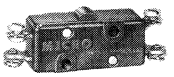
MICRO SWITCH
11 W. Spring St.
Freeport, Illinois 61032
Tel. 815/235-6600

MICRO SWITCH
a Honeywell Division

SUBMINIATURE/MINIATURE BASIC SWITCHES

SM subminiature basic switches are a versatile collection of small size and ample electrical capacities. SX subminiature basic switches are the smallest snap-action switches available from MICRO SWITCH, yet are big in performance and selection. They provide up to 7 amp power load capacity. V3 miniature basic switches put a 25 amp power load capacity and a choice of 11 other electrical ratings into a relatively small package. V7 miniature basic switches have electrical ratings up to 15 amp power load capacity, and offer two versions—commercial and European designed to meet all leading European approval agency requirements. TB miniature basic switches are small double-break units which offer means of controlling 2, 3 or 4 isolated circuits.

MINIATURE AND SUBMINIATURE BASIC SWITCHES

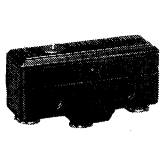
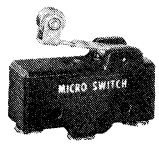
Listing	11SX21-T	11SM1-T	V3-101-D8	V7-1B11E9	1TB1-1
PHYSICAL DESCRIPTION					
Package Size (inches)	.35H .20W .50L	.49H .25W .78L	.63H .40W 1.09L	.63H .40W 1.14L	.50H .50W 1.25L
Actuator	Pin plunger	Pin plunger	Pin plunger	Pin plunger	Pin plunger
Terminals	T solder	T solder	D8 QC	E9 QC	screw
Mounting Centers	.19	.38	.88	.88	.37
CHARACTERISTICS					
UL/CSA Rating	5a 250VAC	5a 250 VAC	11a 1/3HP 277 VAC	11a 1/3HP 277VAC	10a 250VAC 1/2HP 125 VAC
Circuitry	SPDT	SPDT	SPDT	SPDT	2 CKT DB
Operating Force	2.5 to 5 oz.	3 to 5 oz.	8 oz.	5.3 oz.	7 to 13 oz.
Differential Travel (inches)	.002	.004	.006-.016	.002-.010	.010-.025
ENVIRONMENT					
Temperature Range (°F) Upper	250°	180°	180°	185°	180°
Lower	−65°	−65°	−65°	−40	—
Sealing		Elastomer sealed plunger avail.			
Housing Material	General purpose phenolic	General purpose phenolic	General purpose phenolic	Polyester	General purpose phenolic
Other options Request Catalog 10	Pin, integral or auxiliary leaf and lever, overtravel plunger actuators. Many terminal variations. SPST NO or NC ctry.			Pin, integral or auxiliary leaf and lever actuators. Meets European and UK standards.	Pin, auxiliary leaf actuators. 4 CKT DB. Solder term.
	400° temp. 7a rating. Gold contacts. Low force/low DT versions. MIL-S-8805 listings.	400° temp. 11a rating. Gold contacts. Low force/low DT versions. MIL-S-8805 listings. BEAB, TV-2 listings.	600° temp. 25a rating. Gold alloy contacts. Low force/high force versions. MIL-S-8805 listings. TV-3,4,5 listings.		

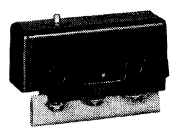
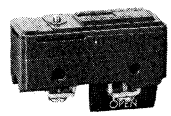
MICRO SWITCH
a Honeywell Division

STANDARD BASIC SWITCHES

Power load switching and motor handling capacity are among the attractions of thumb-size BZ/BA standard basic switches. Double-pole double-throw switching is added by DT switches.

Where there's a need for reliable switching of high capacity systems involving DC motors and solenoids, MT magnetic blow-out switches do the job. The 3MN has double-break switching.

Listing	BZ-2R-A2	BA-2RV22-A2	DT-2R-A7	MT4R-A28	3MN1
PHYSICAL DESCRIPTION					
Package Size (inches)	.95H .69W 1.94L	.95H .69W 1.94L	1.28H .69W 1.94L	1.30H .69W 1.94L	1.20H .68W 2.50L
Actuator	Pin	Short roller lever	Pin	Pin	Plunger
Terminals	Screw	Screw	Screw	Screw	Screw
Mounting Centers (inches)	1	1	1	1	2.13
CHARACTERISTICS					
UL/CSA Rating	15A-480VAC	20A-480VAC	10A-250VAC	10A-125VAC or VDC	15A-600VAC 1 Hp at 240 VAC
Circuitry	SPDT	SPDT	DPDT	SPDT	2 CKT DB
Operating Force	9-13 oz.	14-22 oz.	20 oz.	12-18 oz.	12-20 oz.
Differential Travel (inches)	.0004-.002	.002-.0075	.005	.005	.015-.025
ENVIRONMENT					
Temperature Range (°F) Upper	180°	180°	180°	180°	180°
Lower	−65°	−65°	—	—	—
Sealing	Neoprene or Elastomer sealed plunger avail.				
Housing Material	General purpose phenolic	General purpose phenolic	General purpose phenolic	Arc resistant melamine	General purpose phenolic
Other options Request Catalog 10	Pin, integral or auxiliary leaf and lever, overtravel plunger actuators. Many terminal variations. Manual reset versions. Special ctry. available.		Pin, integral or auxiliary leaf actuators.	Pin, integral or auxiliary leaf or lever actuators SPST ctry.	
	22a rating. 250° and 400° temperature. Alloy contacts. Low force/low DT versions. MIL-S-8805 listings.	25a rating. 250° temp.			

SALES AND SERVICE

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Freeport, Illinois 61032
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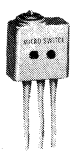
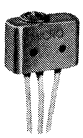
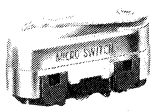
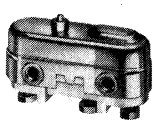
MICRO SWITCH
a Honeywell Division

SEALED AND HIGH TEMPERATURE BASIC SWITCHES

Specially adapted basic switches include: SE/XE environment-proof switches which protect subminiature SM/SX basic switches within a sealed housing; HM hermetically sealed switches are interchangeable in operating point with the SM switches; HS hermetically sealed switches which parallel the size and mounting scheme of the standard basic switches; and HT high temperture switches for use up to +1000°F.

Listing	1XE1	1SE1	1HM1	1HS1	2HT1
PHYSICAL DESCRIPTION					
Package Size (inches)	.75H .32W .62L	.75H .34W .88L	.72H .25W .79L	1.18H .67W 1.96L	1.25H .70W 1.96L
Actuator	Pin	Pin	Integral lever	Integral lever	Pin
Terminals	Leadwire 1′	Leadwire 1′	Solder	Screw	Screw
Mounting Centers (inches)	.19	.38	.37	1	1
CHARACTERISTICS					
Electrical Data	7A-28 VDC, 115,250 VAC	5A-28 VDC, 125, 250 VAC	4A-28 VDC, 115, 400 Hz	25A-28 VDC	3A-125, 250 VAC
Circuitry	SPDT	SPDT	SPDT	SPDT	SPDT
Operating Force	5-17 oz.	5-17 oz.	7 oz.	10-22 oz.	10-20 oz.
Differential Travel (inches)	.005	.004	.006	.020	
ENVIRONMENT					
Temperature Range (°F) Upper	221°	221°	250°	180°	1000°
Lower	−65°	−65°	−85°	−67°	—
Sealing	Environment MIL-S-8805	Environment MIL-S-8805	Hermetic	Hermetic MIL-S-8805	NO
Housing Material	Aluminum	Aluminum	Stainless steel	Monel	Stainless steel
Other options Request Catalog 10	Aux. leaf actuators. SPST ctry. 300° temp. longer leads. Solder term. UL/CSA listing.	Aux. leaf or lever actuator, SPST ctry. 500° temp. UL/CSA listing.	Aux leaf or lever actuator. MIL-S-8805 listing. 300° & 500° temp. Leadwire termination.	Leadwire termination. Roller lever actuators. 250° & 300° temp. UL/CSA listing.	Overtravel plungers. Panel mount. UL Recognized.

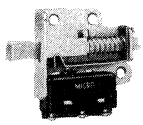
MICRO SWITCH
a Honeywell Division

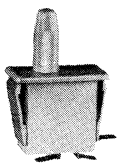
INTERLOCK SWITCHES

Interlock switches automatically cut power when a service door or drawer is opened helping protect personnel and equipment.

MERCURY SWITCHES

Mercury switches use electrodes and mercury pool in a hermetically sealed glass tube to satisfy needs in contaminated atmospheres or where available operating force is extremely low. Tilting operates the switch.





Listing	17AC18-T	1DM1	WW-1G03A-D7	AS412A1
PHYSICAL DESCRIPTION				
Package Size (inches)	1.53 × .34 × 1.18H	1.25H .68W 1.95L	1.93H .54W 1.58L	.35 dia. 1.75L.
Actuator	Rod	Plunger	Plunger	Tilt to operate
Terminals	Solder	Quick-connect	Quick-connect	Leadwire
Mounting Centers (inches)	.437 × .578	Snap-in mount	Snap-in mount	Not applicable
CHARACTERISTICS				
Electrical Data	5A 125, 250, VAC	10A, 125 250, 277 VAC UL/CSA	16A, 125 250 VAC UL/CSA	1A- 115 VAC
Circuitry	SPDT	SPDT	2-N.O.	SPST
Operating Force	—	15 oz.	15 oz.	Not applicable
Differential Travel (inches)	—	—	—	.3 to 1.2°
ENVIRONMENT				
Temperature Range (°F) Upper	185°	180°	185°	140°
Lower	−67°	−35°	−40°	−38°
Sealing	Depends on basic switch	—	—	Hermetic
Housing Material	Stainless steel bracket, stainless steel rod	Polyester	Polyester	Glass
Other options Request Catalog	Various plastic and steel plungers. Various termination. Many basic switch and ctry. options.	Alternate action. Push-pull action. Pull-to-cheat action. DPDT ctry. Various color and shaped plungers.	1, 2 or 3 circuit. Various term. Designed to comply with worldwide certification standards.	20 amp. versions. −65 to 500° temperature. SPDT, 2 CKT DB. Various sizes and tilt angles.

SALES AND SERVICE

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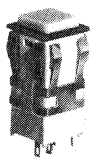
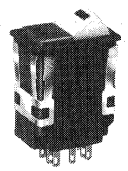
Tel. 815/235-6600

MICRO SWITCH
a Honeywell Division

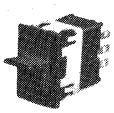
MANUAL SWITCHES

Many options in colors, legending, shapes, sizes, and mounting available as well as power, electronic or solid state switching. AML's comprehensive line blends with other panel components for total display harmony. MML provides a full line of manuals in an economical miniature package. Series 2 provides modular assembly with 1 to 4 section display. Many other pushbutton lines are available. Request Catalog 30 or Catalog 80 for military qualified products.

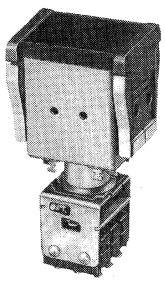




AML Series



MML Series



Series 2

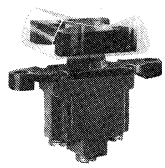
Because of the many variations of these products a listing is not being given.

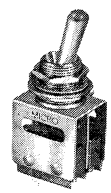
PHYSICAL DESCRIPTION Panel Area	Pushbuttons: .80″ (20,5 mm) square. PB's, paddles, and rockers: .80 × 1.20″ (20,5 × 30,5 mm).				PWB mount: .40″ (10,2 mm) square and .60 × .40″ (15,2 × 10,2mm), except 2-pole power duty paddles and rockers.				1.0 × 1.41″ (2,5 × 35,8 mm) .86 × 1.35″ (21,8 × 34,3 mm)
Display	Pushbuttons: .59″ (15,0 mm) square and .59 × .99″ (15,0 × 25,0 mm). Transmitted, projected, and dead front full and split color. Rockers: Full and split color rockers, with lens. Paddles: Full and split color covers, with lens.				Pushbuttons: .26″ (6,6 mm) square and .46 × .26″ (11,7 × 6,6 mm). Transmitted color. Rockers: Optional lenses for transmitted color.				.85 × 1.08″ (21,6 × 27,4 mm) buttons. 1-4 section display Transmitted and projected color.
Illumination	Incandescent T-1-3/4 lamps—6, 14, 28 v LEDS—2.4, 5, 10, 15 V Neon lamps—125, 250 V				LEDs—1.7, 2.1, 2.2, 2.3 V Incandescent T-1 lamps—5 V (other voltage avail.) Neon lamps—125, 250 V				Incandescent T-1-3/4 lamps—6, 14, and 28 V.
Behind Panel Depth (max.)	1.7″ (43,1 mm)				.67″ (17,0 mm)				3.28″ (83,3 mm)
Mounting	Snap-in individual, strip, matrix, sub-panel PC board mounting				Printed wiring board, snap-in strip, matrix.				Snap-in flange mount and units with mounting barriers for individual or strip mount.
Termination	Solder, quick-connect, PC board, push-on				Printed wiring board, solder, quick-connect.				Solder, quick-connect and screw terminals.
Sealing	Optional panel seal for pushbuttons.				—				Optional panel seal.
SPECIAL FEATURES	Keylock switches available for controlled access applications.				Mechanically interlocked switches provide latching functions.				Coil equipped units for remote operation (pull-in and hold-in)
CHARACTERISTICS Electrical Data	Solid State: 5 or 6-16 VDC	Electronic Control: Up to 3 a., 125 VAC	Power Duty Push buttons: Up to 10 a., 125/250 VAC	Power Duty Rockers, Paddles: Up to 15 a., 125/250 VAC	Solid State: 5-24 VDC	Electronic Control: Up to 1 a., 125 VAC res.	Power Duty Push buttons: Up to 6 a., 250 VAC res.	Power Duty Paddles: Up to 6 a., 250 VAC res.	1-20 a., 125, 250, 480 VAC, depending on switch module specified.
Circuitry	Current Sinking	1, 2, or 4 Form C	2 Form X	1 or 2 Form A	Current Sinking	1 or 2 Form C	1 or 2 Form X	1 or 2 Form C	1-4 Form C.
AGENCY LISTINGS	UL, CSA, CEE (European approvals being obtained as needed, from individual countries), MIL-S-22885				UL and CSA				UL, CSA. For MIL-S-22885 versions, refer to Catalog 80.

MICRO SWITCH
a Honeywell Division

TOGGLE SWITCHES

We offer a wide selection of size, circuitry, capacity sealing and toggle action. Plus a great array of levers, paddles and rockers that offer positive tactile feedback in a variety of colors.





Listing	11TS95-2	1TL1-7	1TP201-3	13AT1
PHYSICAL DESCRIPTION	1-pole 1.13×.62″ (28,7×15,7 mm)	1-pole 1.12×62″ (28,4×15,7 mm)	1-pole 2.17×.62″ (55,1×15,7 mm)	2-pole .84×.72″ (21,3×18,3 mm)
Display	Toggle lever.	Toggle lever.	Rocker actuator.	Toggle lever operator.
Illumination	Not applicable.	Not applicable.		Not applicable.
Behind Panel Depth (max.)	1.08″ (27,4 mm)	1.35″ (34,3 mm)	1.45″ (36,8 mm)	.98″ (24,8 mm)
Mounting	Threaded bushing. 15/32-32	Threaded bushing.	3-hole flush panel mtg.	Threaded bushing. 15/32-32
Termination	Quick connect	Screw	Screw	Solder
Sealing	Bushing seal.	Bushing and cover-to-case seals. Environment proof.		
CHARACTERISTICS **Electrical Data**	15 a., 125 or 250 VAC.	10 a. 125, 250 or 277 VAC.	15 a., 125, 250 or 277 VAC.	5 a., 125 or 250 VAC.
Circuitry	1-pole, 2 positions, maint. action	1-pole, 3 positions, mom. action	1-pole, 2 positions, maint. action	3 positions, mom. action.
AGENCY LISTINGS	UL, CSA.	UL, CSA. MIL-S-3950	UL, CSA.	UL, CSA.
Other options **Request Catalog 30**	1 or 2-pole, 2 or 3 positions, mom. and maint. action. Solder or screw terminals. Colored lever sleeves.	1, 2 or 4 pole, 2 or 3 positions. mom. and maint. action.		1-10 poles. 2 or 3 positions, mom. and maint. action. Some meet MIL-S-8805/26 and MIL-S-8805/98. Gold contacts. Colored lever sleeves. Screw or QC term. Bushing and panel seals, hermetically sealed switch units. Pull-to-unlock and tab lever options.
		Solder, IWTS termination. 15 a. 277 VAC. Pull-to-unlock toggle option.	Full color and transparent rockers. Above panel mounting.	

SALES AND SERVICE

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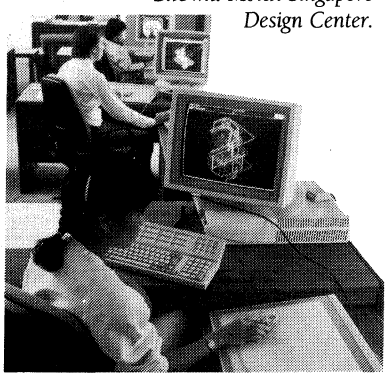
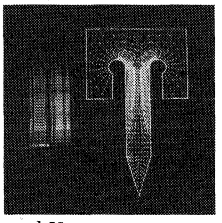
Worldwide Capabilities

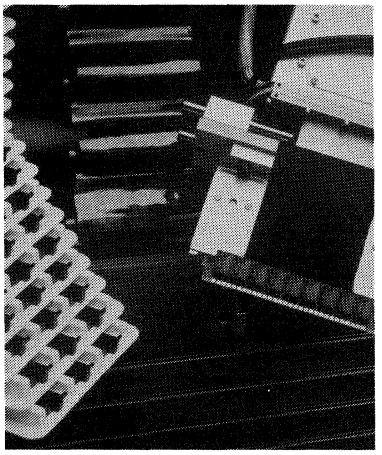


Shown: *Molex Singapore Design Center.*

Design Centers



Molex engineering design centers located in the U.S., Singapore, Japan, Germany, Ireland, U.K., France, Brazil and Korea are connected by a worldwide CAD network. Our use of Finite Element Analysis, a predictive engineering "tool," enables the creation of mathematical prototype and simulated performance.



Shown: *Robotic Delivery System.*

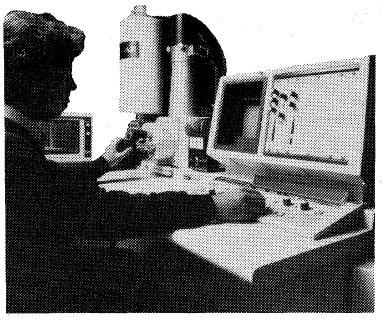
Tooling Support

Application tooling for crimp and insulation displacement termination, and robotic delivery systems, lower your applied costs. Molex is committed to designing and building quality equipment to support your assembly operations — from hand tools for prototypes and repairs, to fully automated, high-volume termination machines.

Manufacturing

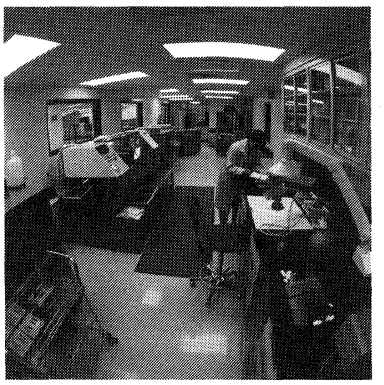
Continuous monitoring of manufacturing systems and processes combined with consistent investments in capital equipment result in improved utilization and the highest quality products.

Shown: *CNC operation allows tooling utilization up to 24 hrs.*



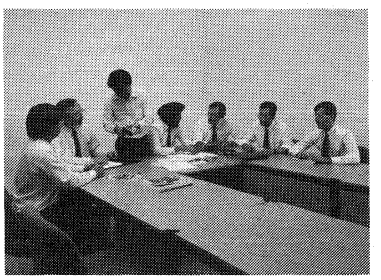
SPC/Quality

Quality at all levels of work at Molex is our #1 priority. To this end, Statistical Process Control training is required of **all** employees; classes are conducted year-round to educate and update.



Reliability Labs

Reliability test labs are located at all manufacturing locations worldwide. The labs' engineering technicians evaluate Molex designs and products, and with the aid of the latest in monitoring equipment, insure long-term dependability. They perform design development and qualification testing as well.



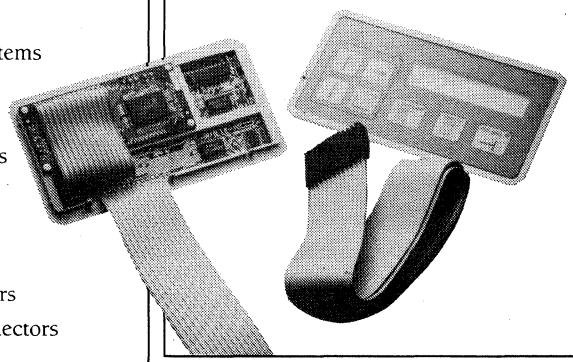
Multi-National Coordination

Our special team coordinates the needs of customers who design, purchase and manufacture in different countries.

Products

- Custom Automotive Products
- Overmolded/Insert Molded
- Sealed Connectors
- Dense Packaging Systems
- IDT System
- Cable
- PCB Interconnections
- Sockets
- FCC Connectors
- Fiber Optics
- Telephone Connectors
- Pin and Socket Connectors
- Switches
- Application Tooling
- Solderless Terminals
- I/O Connector Systems
- D-Subminiatures
- SMT Components

Membrane Switches
(Control Panels)

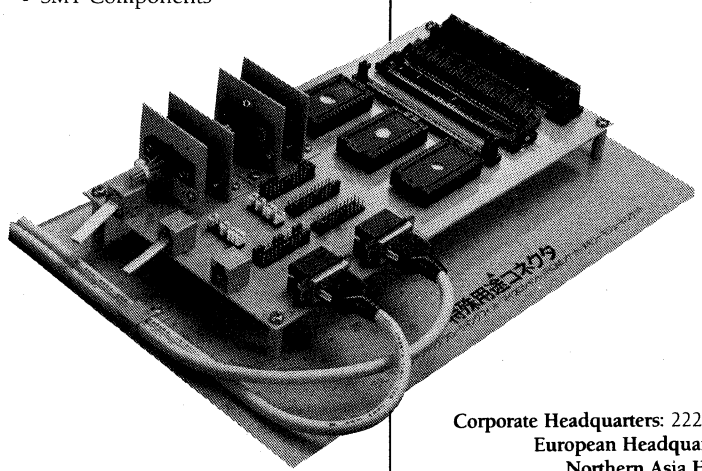


Molex offers the highest quality custom and standard control panels for application in television channel selectors, printers, microwave ovens, security systems and other electronic equipment.

Molex's custom hybrid control panels allow integral displays and electronic components to be included in one switch assembly.

Hybrids use a printed circuit board for the lower switch circuit. Electronic components such as LEDs, resistors, and capacitors can be soldered directly onto the switch assembly. The complete plug-in hybrid unit eliminates separate PC board assemblies for each component.

Shown: *Longest plating line in S.E. Asia located at MX Singapore.*

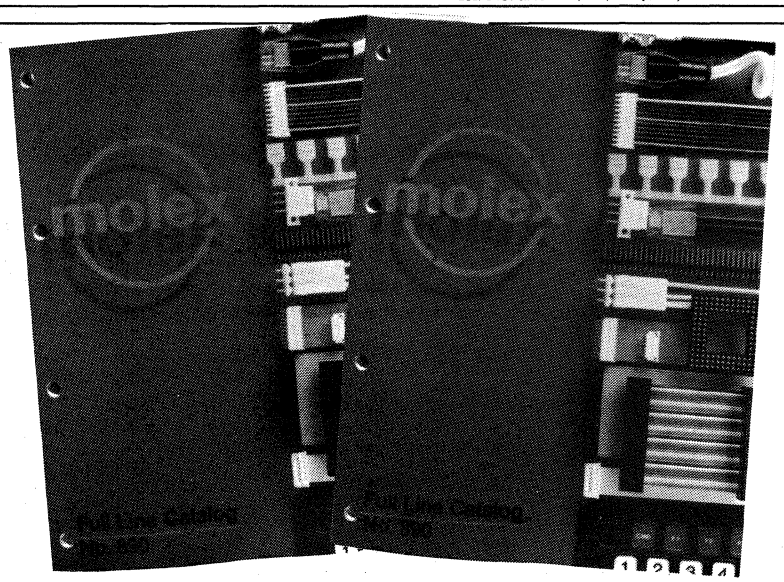


molex

Corporate Headquarters: 2222 Wellington Ct., Lisle, IL 60532 USA, (312) 969-4550*
European Headquarters: Munich, West Germany, 49-89-496093
Northern Asia Headquarters: Tokyo, Japan, 03-487-8333
Southeast Asia Headquarters: Jurong Town, Singapore, 65-660-8555
*Tel. No. after 11/11/89 (708) 969-4550

Our New 1989 Full Line Catalog is Here!

Don't be caught with last year's model! Call or write now for your free copy of the NEW Molex No. 890 Full Line Catalog with 760 pages of interconnection products, switches, and application tooling. The No. 890 Catalog provides design assistance and complete ordering information.

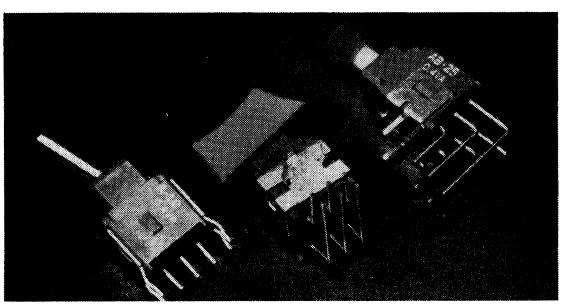


CALL 602/991-0942 FOR FAST DELIVERY, GREAT PRICES ON 38 SWITCH FAMILIES, OVER 873,000 SWITCHES FROM WORLD'S SMALLEST WASHABLES TO 50 AMP POWERHOUSES

NEW EXPANDED & UPDATED BIG CAT. CONTAINS 400 PAGES OF SWITCH DEVICES

The new Big Cat — biggest catalog in the switch jungle is now fatter and more informative than ever. Quickly find in-depth info on NKK's entire switch line. All 38 families categorized by size and actuator type. Precision proportioned dimensional drawings make switches simple to design-in. Key features, sizes, ratings, washability and other info, plus application suggestions enable you to pinpoint the particular switch you need in seconds. The industry's most logical ordering system saves you time and eliminates errors. Get your expanded & updated Big Cat Switch Catalog now.

BIG CAT. CALL 602/991-0942. ASK FOR EEM EXTENSION.



SUPER-SUBMINIATURE PCB WASHABLES WITH STC CONTACT MECHANISM

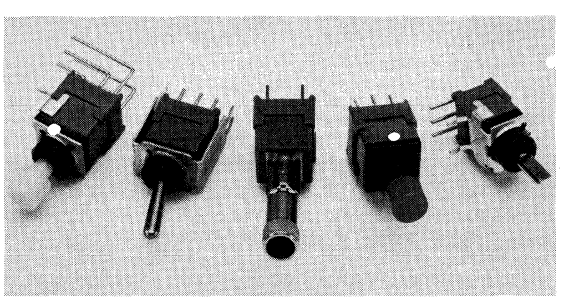
Choose from Series A toggles, rockers, pushbuttons, slides & indicator lights. Tiny PCB logic-level washables are ideal for space-restricted areas in computers, peripherals, communication systems, medical equipment, video systems and more. Totally sealed to allow time & money saving automated soldering and washing. Rated at 0.4VA max.@28V AC/DC max. Choose SPST, SPDT, DPDT & SP3T models in all circuit types with bracketed and unbracketed straight, right angle & vertical terminations for std. .100″ × .100″ spacing. Patented Sliding Twin Crossbar (STC) contact mechanism provides smoother actuation and world's most reliable logic level operation.

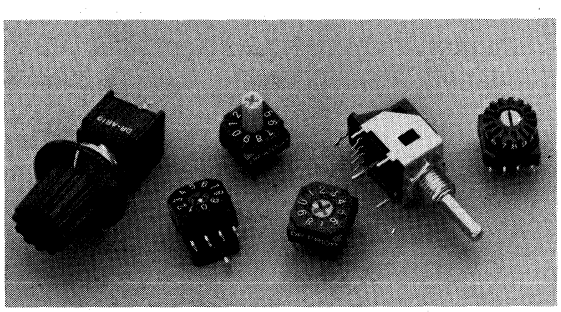
A SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.

ANTISTATIC PCB WASHABLE SUPER-SUBMINIATURE TOGGLES & PUSHBUTTONS

Super-subminiature logic-level models feature antistatic superstructure resin to prevent static electricity problems. Rated at 0.4VA max.@28V AC/DC max. SPDT, DPDT & SP3T models, 6 circuit varieties, plus standard and long-length bracketed or unbracketed straight, right angle and vertical terminations with std. .100″ × .100″ spacing. Antistatic, washability and ultra-reliable patented STC contact mechanism (to 100,000 minimum mechanical actuations) allow Series B switches to be used in computers, peripherals, communications systems, medical equipment, home videos, cameras and more.

B SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.





COMPACT, LOW-PROFILE WASHABLE BINARY CODED DIP ROTARY SWITCHES

DR Series applications include digital setting of computer peripherals, presetting of computers, selection of input-output boards and more. Choose screwdriver, shaft or dial actuated types with highly visible legends for PC board use, or shaft actuated type for panel mounting. Compact dimensions and low profile permit high density mounting and close stacking of PC boards. Real or complement code setting is available with either decimal or hexadecimal positions. O-ring sealed actuator and self-wiping contacts assure reliability and continuity. Insert molded terminals seal out contaminants. Switching rating: 100mA/5V DC, non-switching rating: 100mA/50V DC.

DR SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.

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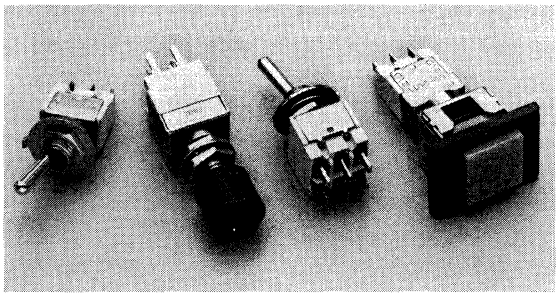


3 AMP RATED, SPACE & COST SAVING TOGGLES & PUSHBUTTONS

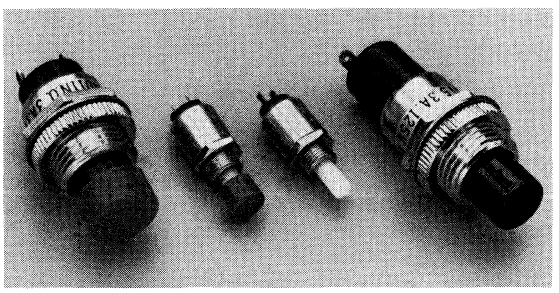
Subminiature Series E delivers big performance in lightweight, space-saving, economically priced toggles and pushbuttons. Ideal for miniaturized equipment. Rated 3A@125V AC (silver contacts), 0.4VA max.@28V AC/DC (gold contacts). 1500V dielectric strength. UL & CSA approvals. High-torque bushing protects contacts from damage. Stainless steel frame resists corrosion. Insulating barriers protect against crossover. Solder lug terminals. SPST, SPDT, DPST & DPDT versions. Series E toggles have slow-make, slow-break contact for AC and low-voltage DC operations. Choose from bushing & snap-in mounted Series EB pushbuttons, both with caps in a variety of colors.

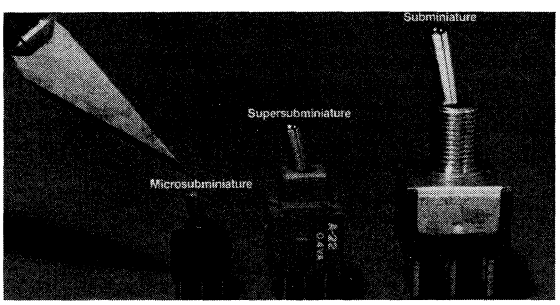
E & EB SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.

RUGGED & RELIABLE SUPER-SUBMINIATURE 3 AMP TO 0.4V AMP PUSHBUTTON DEVICES

Rugged SB panel-mounting pushbuttons provide reliable, low-cost 3A/125V AC (2A/30V DC) operation in communication equipment, machinery, security devices and more. Antijamming device protects contacts, increases switch life. Epoxy sealed solder lug terminals. UL & CSA approvals. Optional slip-on caps in 7 colors. Super-Subminiature momentary pushbutton FB models with .197″ dia. bushing, .819″ length are applicable for a wide range of miniaturized equipment. 500mA/125V AC and 0.4VA/28V AC/DC ratings. UL approvals. Guaranteed 50,000 operations.

SB & FB SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.





WORLD'S SMALLEST WASHABLE TOGGLES, ROCKERS, PUSHBUTTONS, PLUS STC CONTACTS

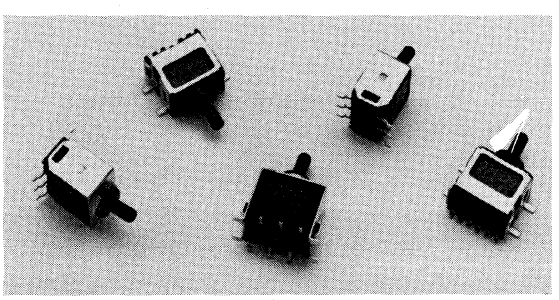
Micro-subminiature size (⅓ volume of super-subminiatures) & 0.25 gram weight enable these toggles, rockers, pushbuttons & indicators to improve reliability in numerous miniaturized applications — particularly hand held equipment. Totally sealed body allows time-saving wave soldering and washing. Molded-in terminals lock out contaminants. Patented gold-plated Sliding Twin Crossbar (STC) contacts make G series the most reliable of its type (guaranteed min. 100,000 mechanical actuations). Straight, right angle & vertical terminals for std. .100″ × .100″ PC board spacing. Colored rockers and snap-on caps available. SPDT & DPDT models.

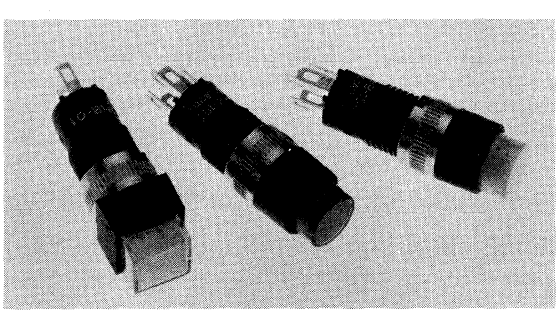
G SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.

MICRO-SUBMINIATURE WASHABLE SURFACE MOUNT SWITCHES WITH STC CONTACTS

No smaller surface mount toggles, none more reliable. Order 500-device tape reel or 50-piece stick tube. Choice of SM-straight (bracketed or unbracketed) or SM right angle terminals. NKK's patented Sliding Twin Crossbar (STC) contact mechanism permits a guaranteed 50,000 min. actuations and allows these Series G3 switches to be used in miniaturized applications. Superior heat-resistant resin in the switch body permits vapor phase reflow soldering. Totally sealed construction allows safe automated washing. G3 switches are rated at 0.4VA max.@28V AC/DC max. SPDT & DPDT types in a wide variety of circuits.

G3 SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.





ULTRA-SMALL LED PUSHBUTTON SWITCHES SAVE PANEL SPACE, INCREASE RELIABILITY

Super-subminiature HB models (¼th the size of standard lighted device) save substantial space, increase product reliability and enhance panel appearance. .315″ body dia. fits common size panel cutout. Switch takes up less than 1″ behind the panel. Round or square caps with full face and square-cap spot illumination provide high visibility and allow easy front panel relamping. Latch down feature on maintained circuits provides visible, audible and tactile feedback to the operator. Dual, sliding contacts with self-cleaning action increase contact stability and minimize contact bounce. SPDT device rated at 0.1A max.@30V AC/DC max. UL approvals. Non-lighted models available.

HB SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.

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nkk switches

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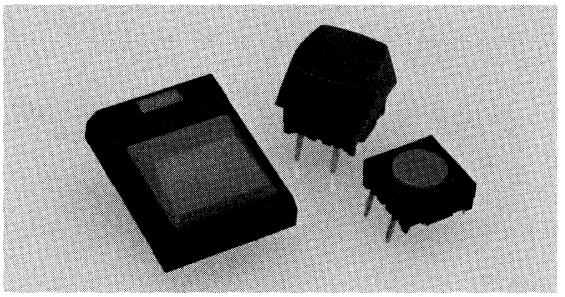
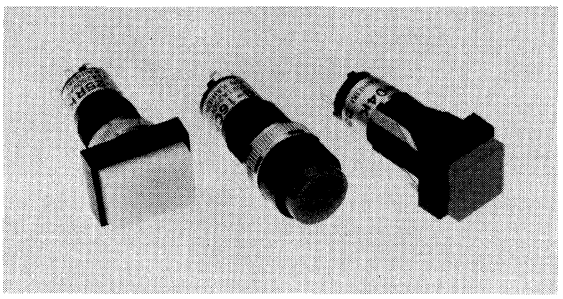
5,000,000 ACTUATIONS FROM LOW PROFILE KEYPAD ILLUMINATED AND NON-ILLUMINATED SWITCHES

Get unsurpassed reliability and versatility with 50mA/24V DC rated JB & JF keypad switches. JF models feature illuminated and non-illuminated actuators (both an integral part of the switch) in several colors. Low 5.7mm profile enhances product looks and functionality. Light touch (350gf max.) contact mechanism provides crisp, tactile and audible feedback. Short stroke and 180gf on low profile JB illuminated and non-illuminated models permit light touch, rapid operation with a min. 5,000,000 actuations. Copper alloy dome contact gives crisp tactile feedback. SPST contacts with strapped terminals allow X-Y coding simplify external circuit arrangement.

JF & JB SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.





VERSATILE, COMPACT 1 AMP & LOGIC-LEVEL LIGHTED PUSHBUTTON SWITCHES

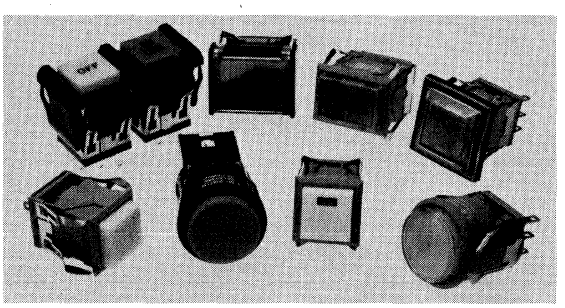
Miniature KB switches offer incredible flexibility. Front panel, bushing or snap-in mounting, plus optional adapters for straight or right angle PC board mounting. High visibility full-face or spot illumination with numerous color variations, square, rectangular or round caps that can be inscribed. Incandescent, LED or neon lamps with easy front panel relamping. Choose SPDT, DPDT in maintained or momentary circuits. 1A@125/250V AC or 30V DC operation with silver contacts, 0.4VA max. at 28V AC/DC max. with gold contacts. Audible and tactile circuit status feedback. Snap-action mechanism and molded-in terminals increase reliability (min. 100,000 mechanical operations).

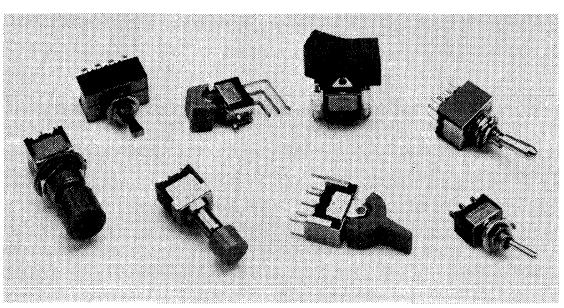
KB SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.

HIGH-RELIABILITY 3 AMP LIGHTED MODELS, NUMEROUS OPTIONS, INCLUDING PANEL SEALED TYPE

Choose SPDT, DPDT LB models with 3A/125V AC (UL & CSA approved) or 0.4VA ratings, both with maintained or momentary circuits. Special panel-sealed model is oil, dust and watertight to meet IP65 of IEC 529 standards. Choose spot illuminated round or square actuators with single or bicolor LEDs that change easily from the front panel. Front panel snap-in mounting stainless steel clips provide secure mounting in wide range of panel thicknesses. Snap-action contact increases sensitivity of actuator and life of switch (up to 1 million mechanical operations). Combo solder lug & .110" quick connect terminals epoxy sealed. Optional PC adaptor, splash/dust covers, bezels & more.

LB SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.





LARGEST AVAILABLE SELECTION OF 6 AMP TOGGLE, ROCKER & PUSHBUTTON SUBMINIATURES

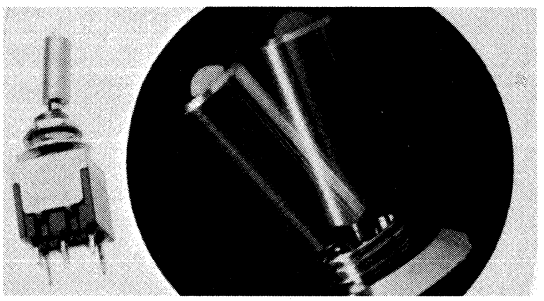
Literally thousands of toggles, rockers and pushbuttons with 6A/125V AC, 3A/250V AC and 0.4VA/28V max. ratings. Choose single through 4 poles and nine circuits. Toggles in short, long, bat, flatted, column, locking and color-tipped styles. Numerous rocker and paddle configurations and colors. Momentary and alternate action pushbuttons. Terminals include solder lug, wirewrap, quick connect, straight, right angle and vertical PC. Threaded, smooth, and splashproof bushings. Applications covering everything from farm equipment to sophisticated computer and telecommunications. Majority of switches UL & CSA approved.

M SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.

UNIQUE! ACTUATOR LED TIP CHANGES COLOR WHEN POSITION IS CHANGED

Toggle, rocker or paddle of M2100 SPDT & DPDT switch features high visibility LED that changes color with position of actuator. Switch applications include instrumentation, test equipment, audio and video control panels, private aircraft, telecommunications and more. 6A/125V AC, 3A/30V DC and logic level ratings. 1500V case to contact dielectric strength. Antijamming device protects contacts from damage due to excessive actuation force. Molded-in, epoxy sealed terminals lock out contaminants. Choose bushing, snap-in or flat frame mounting, plus solder lug, quick connect or PC terminal options.

M2100 SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.



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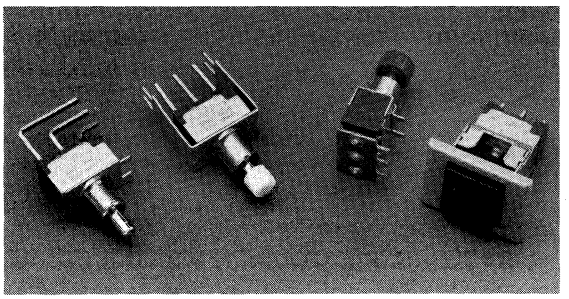
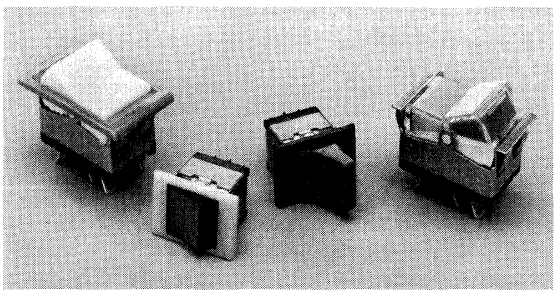
SUBMINIATURE 3 AMP LIGHT TOUCH MOMENTARY PUSHBUTTONS WITH SNAP-ACTING CONTACTS

Rugged, reliable MB2400 models feature high torque bushings, stainless steel frame, external insulating barriers, 1500V dielectric strength, plus epoxy sealed terminals to lock out contaminants. A light touch, short travel, snap-acting contact mechanism insures an extremely smooth feel and provides audible feedback to the operator. Up to 200,000 mechanical actuations guaranteed. Choose SPDT or DPDT models with momentary circuits rated 3A/125V AC or 0.4VA/28V AC/DC max., 7 bushing types, plus solder lug, straight PC or 3 lengths of wirewrap terminations. All models are UL and CSA approved.
MB2400 SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.



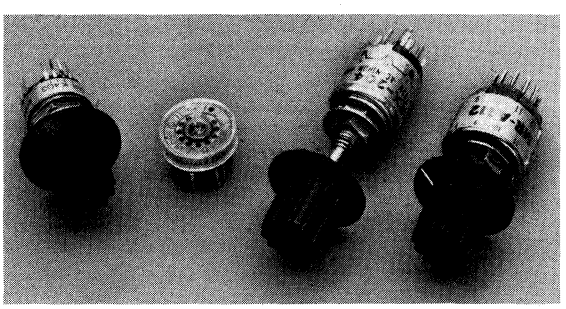


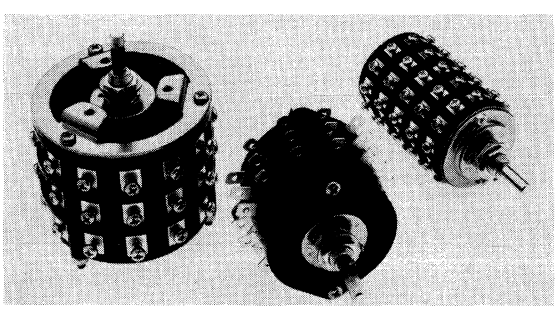
HIGH VISIBILITY 5 AMP TO 20 AMP ILLUMINATED ROCKERS

MLW models are industry's first miniature snap-in lighted rocker switches. Wide range of industrial applications. Rockers and paddles offered in 8 colors. SPDT, DPDT, SP3T models in 6 circuits. Neon, LED or 5 incandescent voltages. Design, spot illuminated and solid color caps. Standard size 10A/125V AC snap-in LW models feature partitioned rocker construction and dual lamps for distinctive illumination. Numerous colored rocker filters and lamp covers. DPDT models in maintained & momentary circuits. Incandescent or neon lamps. Screw-in panel mounting 20A/110V AC LW models also offered. These SPST devices have double break contacts and come with assembled neon lamp and resistor.
LW & MLW SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.

HALF-INCH DIA. MINIATURE LOGIC LEVEL TO 10 AMP ROTARY DEVICES

Wide variety of miniature shaft-actuated (black polyacetal knob supplied) rotaries for PC board or panel mounting. Panel depths range from .323" to .681". Choose single, double and four poles. Contact ratings from 0.4VA max.@28V AC/DC max. up to UL approved 10A/125V AC. Select 30°, 45°, 60° or 120° indexing and adjustable stop settings as well as continuous rotation. All MR switches have molded-in terminals. Some have an interior housing seal for washability, plus the added protection of a shaft rubber O-ring. Models for splashproof operations are also offered. Most switches feature self cleaning contacts. Wide range application potential.
MR SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.



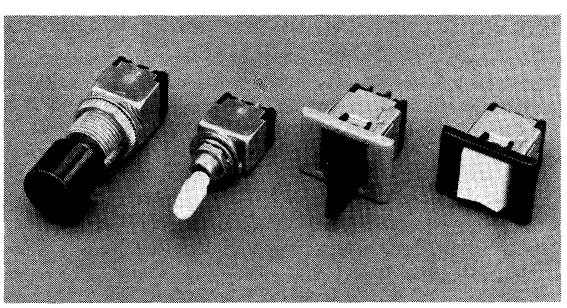


STANDARD SIZE THROUGH HIGH CAPACITY 30 AMP ROTARY SWITCH DEVICES

Nonshorting TS models have 1 through 5 poles, 2 through 11 positions and are rated at 6A/125V AC with resistive load. Devices have a 10mm dia. bushing, screw terminals & a choice of flatted or knurled shafts. Shorting or nonshorting HS rotaries have 1 through 6 poles, 2 through 11 positions. Rated at 6A/125V AC and 12A/125V AC, resistive or inductive load. Mount with 10mm bushing. Round smooth, round knurled or flatted shaft with solder lug/.250" quick connect terminals. Nonshorting PS rotary has 1 through 5 poles, 2 through 11 positions. Rated at 30A/125,250V AC with res. load or 10A/125V AC with inductive load. 10mm dia. bushing, round knurled or flatted shafts & screw terminals.
HS,PS,TS SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.

5 AMP TO 10 AMP MINIATURE TOGGLE, ROCKER AND PUSHBUTTON SWITCHES

Heavy duty, panel mounting switches used for test equipment, aircraft, medical instruments, farm machinery, heavy equipment, remote control and more. S Series 10A/125V AC toggles and 5A/125V AC SB pushbuttons available in one through four poles. 5A/125V AC PW rocker SPDT & DPDT models feature positive detent mechanism for well defined actuation with audible click. High torque collar prevents rotation or separation from case during mounting. Heavy gauge one-piece metal case for max. durability. Antijamming cross-pinned construction prevents damage to contacts from shock. Built to endure severe environments. Solder lug terminals secured in heavy, molded phenolic base.
S,SB,PW MINIATURES. CALL 602/991-0942. ASK FOR EEM EXTENSION.



NKK SWITCHES. 14415 N. Scottsdale Road, Scottsdale, AZ 85260

nkk switches

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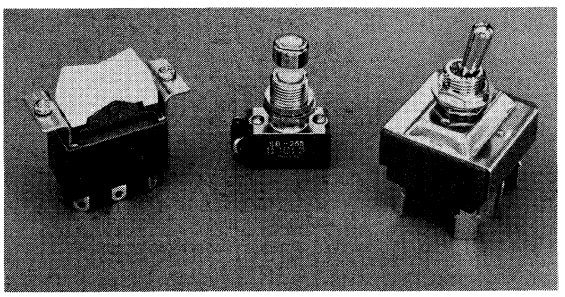
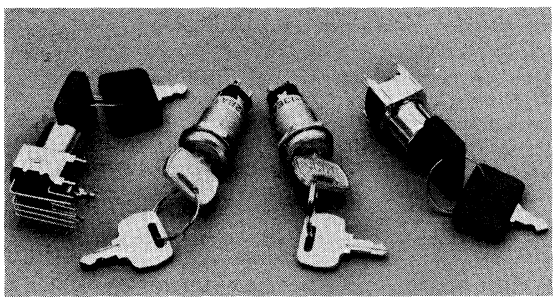
RUGGED, STD. SIZE TOGGLES, ROCKERS AND PUSHBUTTONS TO 25 AMP RATINGS



Bushing mounted S Series toggle available in 1 through 4 poles with 6 circuits and ratings of 3A through 25A/125V AC with res. load. Solder lug, screw & quick-connect terminals. Special splashproof bushing also offered. SB pushbutton models available in 1 & 2 poles with momentary or alternate action circuits. Rated 3A through 15A/125V AC with res. load. Bushing mounted with solder lug terminals. SW rockers offer 1 & 2 poles with 4 circuits and are rated at 3A through 20A/125V AC with res. load. Designed for flush panel mount. Solder lug terminals.

S,SB & SW STD. SIZE. CALL 602/991-0942. ASK FOR EEM EXTENSION.

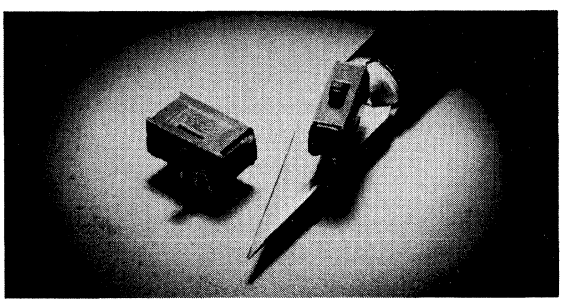


COMPACT BUSHING OR PC MOUNTABLE KEYLOCK SWITCHES SAVE SPACE BEHIND PANEL

SK Series switches meet a wide variety of applications including: cash register access keys, electronic security boxes, computer peripheral devices, small programmable controllers and more. Detent mechanism provides crisp, positive action. Self-wiping contacts assure reliability. Dust resistant interior protects contacts. UL/CSA approved bushing mounted SPDT devices have 1500V dielectric strength and are rated at 3A/125V AC. Short .945″ length behind panel saves space. PCB versions have sealed body to allow automated soldering. Disposable boot allows safe washing. They are rated at 0.4VA@28V AC/DC and available in 3 poles. Choose straight or right angle terminals.

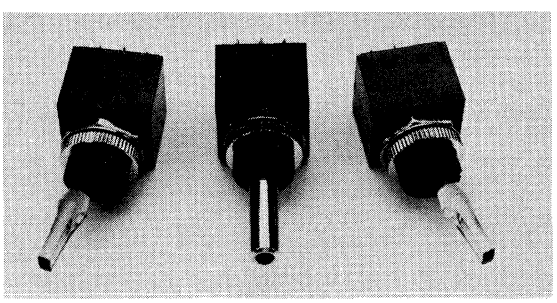
SK SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.

EXCLUSIVE! LIGHTED MICRO-SUBMINIATURE LOGIC LEVEL PCB SLIDE SWITCHES



Unique SS Series slide switches feature tiny LED in tip of actuator to indicate position at a glance. Ultra compact size permits very high density mounting. Designed to increase reliability and save space in small appliances, games, calculators, portable medical devices, telecommunications, hand-held devices and more. SPDT & DPDT versions rated at 0.1A@30V DC. Non-illuminated .257″ × .402″ models also offered. Choice of top or side actuation increases board design flexibility. High contact reliability and smooth actuation result from sliding twin contact mechanism with self-cleaning action. Insert molded terminals lock out contaminants, fit std. .100″ × .100″ PC board.

SS SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.

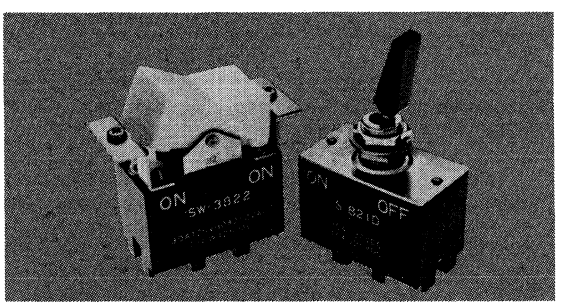


SPLASHPROOF FULLY ILLUMINATED OR LED TIPPED 6 AMP TOGGLES

Fully illuminated polycarbonate toggle version emits red, green or yellow light throughout entire length of toggle. LED tipped toggle type emits strong, concentrated light at the very end of the lever. Both TL Series devices are clearly visible in low light environments. Ideal for audio/video consoles, instrumentation, telecommunications and more. Single pole and double pole with solder lug terminals and 6A/125V AC rating, plus UL & CSA approval. An interior sealing ring above the toggle joint prevents dust or liquid entry. Panel sealed models with optional rubber washer meet IP65 of IEC529 standards.

TL SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.

RUGGED, HIGH AC/DC CAPACITY TOGGLES & ROCKERS TO 50 AMP RATINGS



S Series toggles are rated at 30A/125V AC res. load & 50A/125V AC. Choose 2 & 3 pole models with up to 3 maintained circuits. Bushing mounted with screw terminals. SW Rockers are available in 2 & 3 poles models with 3 maintained circuit options. They are rated at 30A/125V AC. Flanges allow secure flush panel mounting. All models have screw terminals. S & SW toggle & rocker switches are also designed for high capacity DC applications. They are rated at 15A/125V DC resistive load & 5A/125V DC inductive load. NKK high capacity toggles & rockers have demonstrated superior durability & reliability in a wide range of demanding applications.

S, SW HIGH CAP. CALL 602/991-0942. ASK FOR EEM EXTENSION.

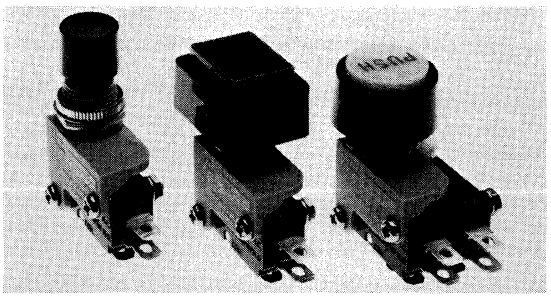
NKK SWITCHES. 14415 N. Scottsdale Road, Scottsdale, AZ 85260

NKK backs you with quick delivery and competitive prices on just about every type switch you'd expect from a leading manufacturer, plus many you won't find anywhere else. The first washable super-subminiatures; the world's smallest washable toggles, rockers and pushbuttons; LED toggle tips that change color; LEDs in tips of tiny slide switches — all are NKK "firsts." NKK matches innovation with quality. NKK's patented, award winning STC (Sliding Twin Crossbar) contact system is unequalled in the world for logic-level reliability. From the tiniest washables to 50 Amp powerhouses, you get premium quality and reliability without paying a premium price.

OVER 35 YEARS OF EXCELLENCE

nkk switches

For fast service and/or a free Big Cat Switch Catalog, contact: NKK Switches, 14415 N. Scottsdale Road, Scottsdale, AZ 85260. Phone 602/991-0942. FAX 602/998-1435.

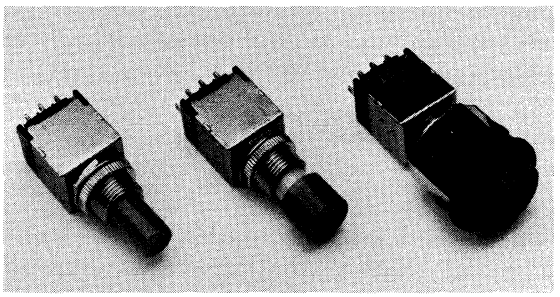


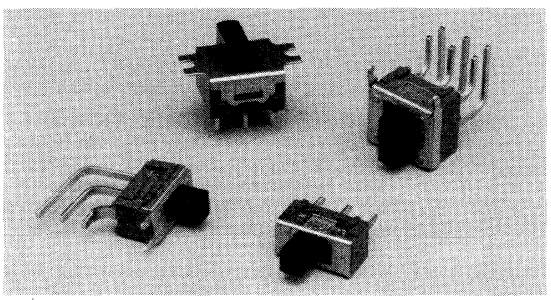
SNAP ACTING PUSHBUTTON IMPROVES PANEL LOOKS & RELIABILITY

Rugged, attractive SCB pushbuttons feature a specially designed snap acting contact mechanism that substantially increases operational efficiency and longevity. The long life version is rated at 10A@⅓ HP@125V AC resistive and tested to provide 5,000,000 min. mechanical actuations. The high capacity model is rated at 15A@½HP@125V AC resistive and will provide a min. 1,000,000 mechanical actuations. Both have UL, CSA & other international approvals. SCBs mount with a 12mm dia. bushing and offer solder lug, screw, plus .187" & .250" quick connect terminals. Rectangular and round shrouds and caps are available in a variety of colors to enhance front panel appearance.
SCB SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.

LIGHTED STD. SIZE POWER RATED PANEL MOUNT PUSHBUTTONS

The durability, option flexibility and power handling capability of illuminated DLB switches make them ideal for a wide range of applications. Control panels, communications, computer peripherals and transportation are just a few examples. Bushing & snap-in mounted DPDT models with ratings from 5A/125V AC, 3A/30V DC and 0.4VA max.@28V AC/DC max. 1500V case to contact dielectric strength. Solder lug & PC terminals. Patented detent switching mechanism for positive actuation indication. Heavy gauge steel case to protect mechanism and increase durability. 6V, 14V, 28V incandescent lamps or 110V neon, plus LED for spot illumination. Huge variety of cap styles & colors.
DLB SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.



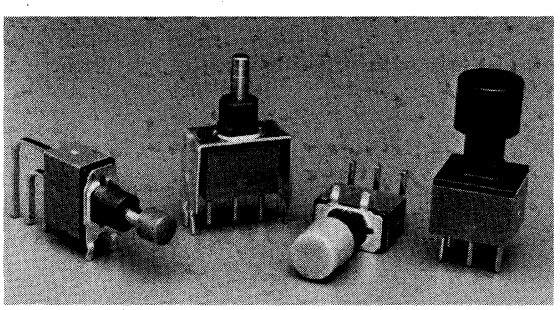


UNIQUE! 6A SUBMINIATURE SLIDE SWITCHES FEATURE LED LIGHTED TIP

MS Series subminiatures feature LED at the top of switch actuator. This unique positioning increases visibility from all vantage points. Crisp, clean actuation of the switch's high-reliability contact mechanism insures long life operation. Compact .500" × .469" dimensions makes these switches ideal for high-density, side-by-side mounting in numerous consumer and industrial applications. SPDT & DPDT with ratings of 6A/125V AC, plus 0.4V max.@28V AC/DC for dry circuit use. Non-illuminated versions available with the same ratings. Choose solder lug, straight, right angle & vertical terminations. Epoxy sealed terminals lock out contaminants.
MS SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.

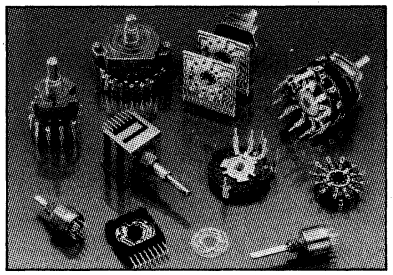
HUGE SELECTION OF WASHABLE SUBMINIATURE TOGGLES, ROCKERS & PUSHBUTTONS

The extensive family of washable, high reliability M2 subminiature toggles, rockers and pushbuttons is designed to cover a wide range of application needs. Choose 6A/125V AC down to logic level ratings, many with UL & CSA approvals. SPDT & DPDT models are available with numerous PCB terminal types, choice of toggle actuators, plus rockers/paddles and snap-on pushbutton caps in several sizes and colors. A rubber O-ring built into switch bushing provides the seal that allows time and money-saving automated wave soldering and washing. Epoxy sealed terminals lock out contaminants. Antijamming design increases switch life by protecting against contact damage.
M2T SERIES. CALL 602/991-0942. ASK FOR EEM EXTENSION.



NKK SWITCHES. 14415 N. Scottsdale Road, Scottsdale, AZ 85260

OAK Switches and Solenoids

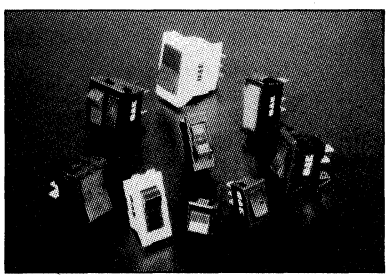


Rotary Switches

Oak rotary switches come in a variety of standard sizes and can be custom engineered to meet any design parameters. Most are qualified to MIL-S-3786 and many feature Oak's patented Unidex® detent system with dual-wiping self-cleaning contacts. Oak's complete line of rotary switches includes:

- Compact 1" "Acorn"
- Series 500 1/2" diameter single section
- Series 850 square, sealed contact programmable
- Economical 1" diameter "Monodex"
- Ultra-compact Series One-Half Inch multisection
- Economical Series 1300 plastic construction
- Economical printed circuit rotary switches
- Two, three and four position lever switches
- Power appliance switches

Request catalog F-1050.



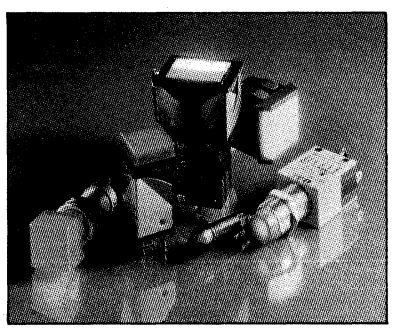
Rocker Switches

Available in an assortment of styles and colors, Oak rocker switches meet a wide range of design requirements. They are aesthetically pleasing and will complement the front panel styling of your product.

Choose from mini, single and double pole, lighted, non-lighted or LED varieties. Matching indicators are also available. Buttons come in six standard colors and nine profiles. Choose from flat, low and high "V", scalloped and contoured profile styles. Quick connect terminations are standard while PC board, solder tab, wire leads and screw terminations are also available.

Oak rockers will retrofit most existing switches and are U.L., CSA and VDE approved. All are competitively priced and many are stock items available for immediate delivery.

Request catalog F-1151.



Lighted Pushbutton Switches

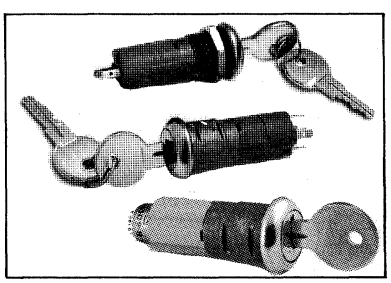
Oak Optolite™ lighted pushbutton switches and indicators come in a choice of eleven styles and nine custom colors with custom legends and various mounting options. A wide range of electrical ratings and contact configurations is available in both alternate (push-on-push-off) and momentary operation with up to 10 million duty cycles. These switches meet the military specifications for MIL-L-3661 and MIL-L-7961.

Choose from a selection of U.L. and CSA approved Optolite™ switches:

- Presslites - flexible friction cap; water tight, splashproof and E.M.I. suppressed; low profile
- Marcoflex - compact 650 series
- Indicators - subminiature, miniature, press-to-test, neon, general purpose
- Lamps - little and big QT
- Panel lights
- Series 150 - momentary pushbutton

Oak Optolite™ switches are competitively priced and many are stock items available for immediate delivery.

Request catalog IPI-1060.

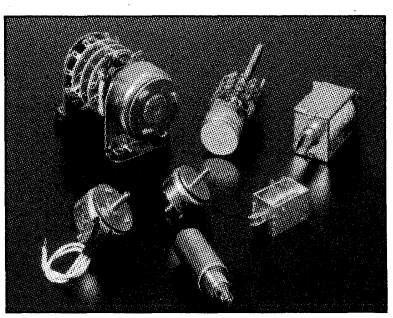


Keylock Security Switches

Oak anti-static keylock switches provide up to 20kV static protection for sensitive electronic circuitry. The compact size at 3/4" diameter is especially made for high density packaging. Available in single pole only, the keylock's operating life is tested up to 10,000 cycles.

The Series 500 keylock combines a high security switch with the versatility of the Series 500 rotary switching options. Available with up to six tumblers, it is explosion-proof and has a solid detent feel. Switching comes in one pole with up to 12 positions and two pole with up to 6 positions.

Oak Types A and F rotary keylocks are designed for applications combining maximum security with low-power switching. These tamper-proof keylocks are available in cylindrical and flat key styles with panel or durable bracket mounting. A range of standard key pull locations is available.



Solenoids

Whether rotary or linear, Oak has a solenoid for virtually any application. Rotary solenoids are available in eight basic types with 12, 18, 20 or 24 positions. They can be provided in either right or left hand with strokes from 25 degrees to 75 degrees.

Oak linear solenoids include flat pack, tubular or box frame styles. Flat pack: cover forces up to 85 lbs., push or pull strokes up to 0.400" with speeds as fast as two milliseconds. Box frame: pull ranges from 1 oz. to 4.5 lb. (AC) and 1 oz. to 20 lb. (DC). Tubular: pull, push or spring return with holding force ranges from 18 oz. to 16 lb. intermittent duty.

Also available are rotary solenoid selectors mating rotary solenoids with Oak's custom switch sections.

Request catalog F-1160 and F-1161.

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P.O. Box 517 • Crystal Lake, IL 60014
Phone: 815/459-5000

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SWITCHES

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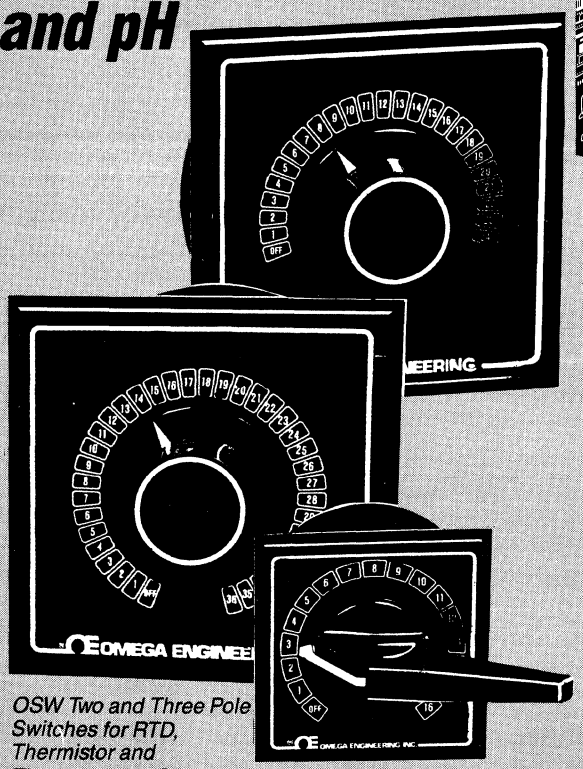
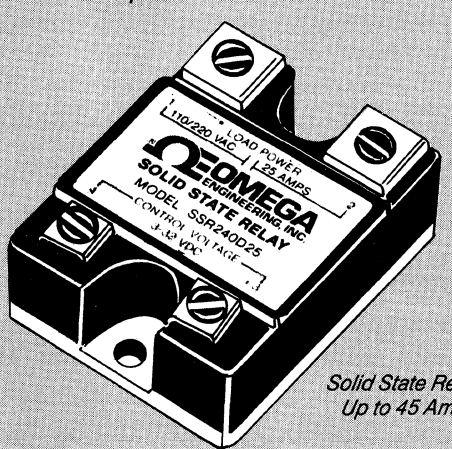


OSW Two and Three Pole Switches for RTD, Thermistor and Thermocouple Connections



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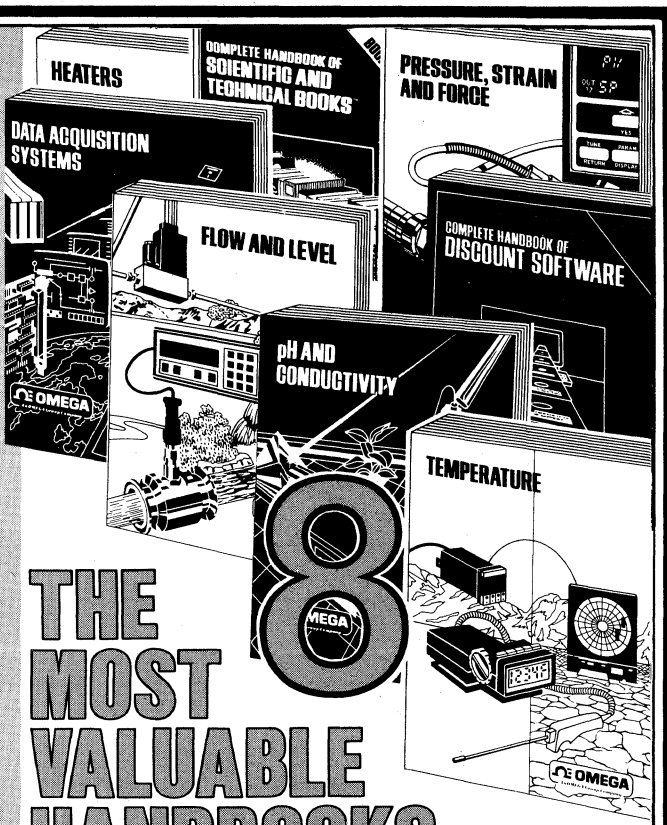

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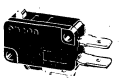
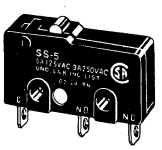
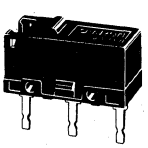
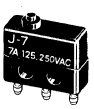
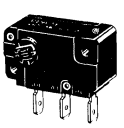
OMRON Basic Snap Action Switches

	General-Purpose Basic Switches			Miniature Basic Switches
Model (Dimensions in inches)	**Z**	**X**	**A**	**V**
				
	1.94″L x 1.5″H x 0.69″W	1.94″L x 1.95″H x 0.69″W	1.94″L x 1.11″H x 0.69″W	1.49″L x 0.74″H x 0.41″W
Features	Best selling switch offers high precision and more than 40 stock actuator styles.	Direct current switch with built-in magnetic blowout and 13 stock actuator styles.	High-capacity switch handles loads with large in-rush currents; 11 actuator styles.	General-purpose and low-force types break a wide range of loads, 7 stock actuator styles. High contact force types also available.
Rated Current	15 A (480 VAC)	10 A (125 VDC)	20 A (480 VAC)	0.1 to 21 A (125 VAC)
Operating Force (OF) Range (with pin plunger type)	8.8 to 12.3 oz.	18.0 oz.	14.1 to 22.0 oz.	0.9 to 14.1 oz.
Mechanical Service Life (operations)	20,000,000	1,000,000	5,000,000	10-50,000,000
Approval Standards	UL, CSA, SEV	UL, CSA, SEV	UL, CSA, SEV	UL, CSA, VDE, SEMKO

	Subminiature Basic Switches				Low-Torque Basic Switches
Model (Dimensions in inches)	**SS**	**D2F**	**J**	**D2MQ**	**D2MC**
					
	0.78″L x 0.40″H x 0.25″W	0.50″L x 0.26″H x 0.22″W	0.50″L x 0.35″H x 0.20″W	0.32″L x 0.50″H x 0.11″W	1.22″L x 1.09″H x 0.72″W
Features	Economical, long-life basic switch offers 3 operating forces, 5 popular actuator styles.	Small, lightweight switch available in low-force and microvoltage versions. New self-supporting and right angle terminals now available.	Ultra-small size, yet capable of switching large capacity loads.	Extremely small switch ideal for equipment miniaturization.	Highly reliable rotary-action type for low torque operation; high capacity and micro-load versions.
Rated Current	0.1 to 10.1 A (125 VAC)	0.1 to 3 A (125 VAC)	7 A (125 VAC)	.05 to 0.5 A (30 VDC)	.5 to 5 A (125 VAC)
Operating Force (OF) Range (with pin plunger type)	0.9, 1.8 or 5.3 oz.	0.9 to 5.3 oz.	4.9 oz.	4.2 oz.	0.07 oz.-in.
Mechanical Service Life (operations)	30,000,000	300,000	10,000,000	30,000	10,000,000
Approval Standards	UL, CSA, SEMKO	UL, CSA	UL, CSA	—	UL, CSA

Specifications subject to change without notice.

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One East Commerce Drive
Schaumburg, IL 60173
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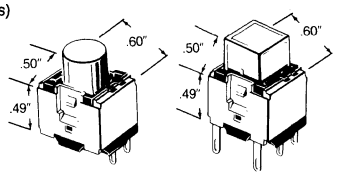
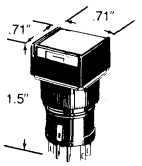
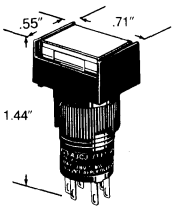
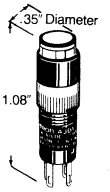
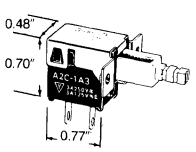
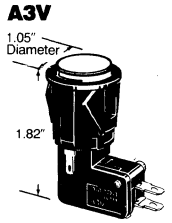
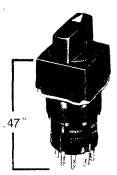
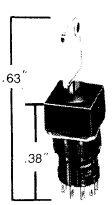
OMRON Pushbutton Switches

Model (Dimensions in inches)		A3A	A3B	A3C	A3D
					
Features		Compact pushbutton switch covers power to signal switching.	Round, square or rectangular LPB-.63 in. dia.	Round, square or rectangular LPB-.47 in. dia.	Round, square or rectangular LPB-.35 in. dia.
Mounting		Flange mount PCB direct mount	Retainer, Snap-in	Retainer	Retainer
Action	Momentary	○	○	○	○
	Alternate	○	○	○	○
Indication Type/Screen Pattern		Non-lighted type LED Spot-illumination type. LED Surface-illumination type. Mechanical-indication type.	LED or Lamp Full surface illumination	LED or Lamp Full surface illumination	LED Full surface illumination
Control Output		High capacity type SPST-NO, 125 VAC 6A. (Resistive load). General-purpose type DPDT, 125 VAC 3A (Resistive load). Microload type SPST-NO, 30 VDC 0.1A. (Resistive load).	General Purpose SPST-NO, 125 VAC 0.5A. Microload SPST-NO, 125 VAC 0.1A.	General Purpose SPST-NO, 125 VAC 0.5A. Microload SPST-NO, 125 VAC 0.1A.	Microload SPST, 30 VDC 0.1A.
Indication Unit		—	○	○	○

Model (Dimensions in inches)		A2C	A3V	A3B-S	A3B-K
					
Features		Miniature power switch with short 0.05″ keystroke.	Round, pushbutton with built-in basic switch.	Selector switch in broad variety of shapes and configurations that require only 22 mm mounting depth.	Keyed switch in broad variety of shapes and configurations that require only 22 mm mounting depth.
Mounting		Flange mount	Snap-in	Nut mounting.	Nut mounting.
Action	Momentary	○	○	○	○
	Alternate	○	○	○	○
Indication Type/Screen Pattern		Non-lighted type	LED or Lamp Full surface illumination	None	None
Control Output		SPST-NO, DPST-NO; 250 VAC, 3A; 250 VAC, 5A (resistive load).	High capacity SPDT, 250 VAC 15A.	SPST-NO + SPST-NO. DPST-NO + DPST-NC.	SPST-NO + SPST-NC. DPST-NO + DPST-NC.
Indication Unit		—	—	—	—

NOTE: ○ denotes availability.

Specifications subject to change without notice.

OMRON® Responsive Innovation

OMRON ELECTRONICS, INC.
One East Commerce Drive
Schaumburg, IL 60173
TWX 910-291-0426

Call Omron toll free:
1-800-62-OMRON

MINIGLOSSARY TIMERS

Accuracy
The variation of unit performance, i.e., time delay, voltage trip point, etc., over the specified conditions of ambient temperature, input voltage range, and time between operations.

Adjustability
The changing of a unit set point, within the specified range of unit operation, by means of internal or external adjustment mechanism (i.e., changing time delay with potentiometer).

Contact Rating
The electrical power-handling capability of relay contacts under specified environmental conditions and for a prescribed number of operations.

Delayed Interval Timing Function
Input voltage is applied continuously. The timing cycle is started by momentarily actuating the control circuit. The functions of separate Delay-On-Operate and interval type timers are combined in one package providing a single OFF-ON-OFF output cycles

Also called: single shot.

Delay-On-Operate Timing Function
Application of the input voltage starts the time delay. At completion of the time delay, the relay contacts transfer.

Also called: Delay-On-Make, On-Delay, Delay Relay, Delay-On-Pickup.

Delay-On-Release Timing Function
Input voltage must be supplied continuously to timer. Actuation of control circuit causes relay contacts to transfer immediately. Time delay starts when control circuit is released. The relay remains energized for the duration of the time delay—then de-energizes.

Also called: Delay-On-Break, Off-Delay, Delay-On-Dropout, Delay-On-Energization.

Frequency Sensor
A device that monitors a predetermined overfrequency and/or underfrequecy condition, and changes output state when these conditions exist.

Hysteresis
The difference between the response of a unit or system to an increasing and a decreasing signal (example: a voltage sensor).

Interval Timer Timing Function
Application of input voltage causes relay contacts to transfer and time delay to begin. At completion of the time delay, the relay contacts return to de-energized state.

Also called: Delay Interval, One Shot.

Output Control
The switching device, either solid-state or electromechanical, used in the unit to control the load connected to the output terminal(s).

Phase Sensor
A device that monitors for proper phase rotation in 3-phase systems.

Programmability
Ability to modify function, time delay or input voltage of a timer.

Recovery Timer

(Delay-On-Operate/Interval Timer)
The minimum time that input voltage must be interrupted *prior* to time-out to insure a successive timing cycle within the specified limits.

(Delay-On-Release)
The minimum duration of time that control circuit must be re-actuated to insure a new timing cycle when the control circuit is released.

Recycle Time

(Delay-On-Operate or Interval Timer)
The minimum time that input voltage must be interrupted after the timing cycle is completed to assure a successive timing cycle within the repeatability specified.

(Delay-On-Release)
The minimum duration of time that control circuit must be actuated to insure a successive timing cycle within the repeatability specified when the control circuit is released.

Repeat Cycle Timer Timing Function
Application of power automatically initiates continuous off-on cycling of the output relay.
Also called: flasher, intervalometer

Reset Time
The time required for the contacts to return to normal position when power is removed.

Reverse Polarity Protection
Blocking circuitry arrangement within the timer to prevent damage or output actuation if reverse polarity input voltage is applied.

Tolerance
The difference between specified and actual timing or sense point (factory setup tolerance).

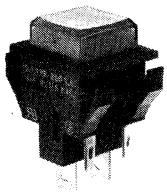
Transient Protection
Prevents damage to unit if positive or negative transients are applied to the unit. Insures proper operation of the unit during and after transient occurrence. Max. transients are usually specified as to amplitude and duration, i.e., 1000V for 1 second.

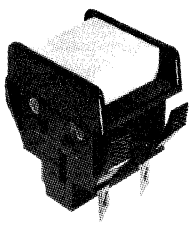
Trip Point
The predetermined point at which a sensing device is set to change the output state.

Voltage Sensor
A device that monitors for a predetermined overvoltage and/or undervoltage condition, and changes output state when these conditions exist.

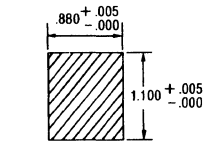
OSLO CONTROLS

TYPE S Lighted & Non-lighted Pushbutton Switches

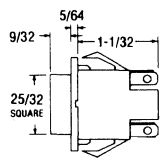




ALL DIMENSIONS IN INCHES



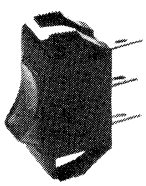
PANEL CUT OUT
PANEL THICKNESS 1/32" – 3/16"



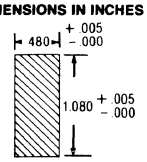
FEATURES
- Snap-in panel mounting with options in:
- Lighted or non-lighted styles
- Five different lamp voltages
- LED, incandescent or neon lamps
- Single pole and double pole circuit arrangements
- Momentary or alternating actions
- Multiple color combinations
- Custom legends

SPECIFICATIONS
- 10 amps 125/250VAC 1/4 HP 125VAC UL, CSA
- Mechanical life 100,000 operations

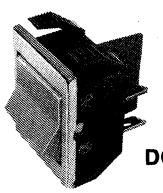
TYPE R and CR Lighted & Non-lighted Rocker Switches



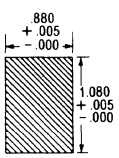
ALL DIMENSIONS IN INCHES



PANEL CUT OUT
PANEL THICKNESS 1/32" – 3/16"



TYPE RT
DOUBLE-POLE

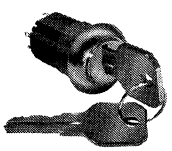


PANEL CUT OUT
PANEL THICKNESS 1/32" – 3/16"

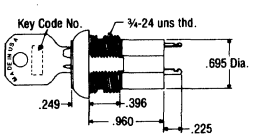
FEATURES
- Snap-in panel mounting with options in:
- Lighted or non-lighted styles
- Five different lamp voltages
- LED, incandescent or neon lamps
- Single pole and double pole circuit arrangements
- Maintained or momentary actions, 2 or 3 position
- Custom legends

SPECIFICATIONS
- 20 amps 125/250VAC 3/4 HP, 125/250VAC UL, CSA
- High inrush capability
- 14 amp @ 28 VDC UL

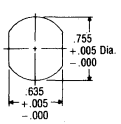
TYPE K Low-cost Keylock Switches

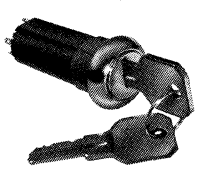


STANDARD
STYLE

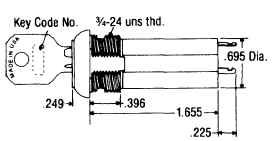


PANEL
MOUNTING





ANTISTATIC
STYLE



ALL DIMENSIONS IN INCHES

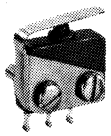
FEATURES
- Key operated protection with options in:
- Standard compact style or anti-static version for static discharge protection
- Various key operate & removable positions
- Single pole and double pole circuit arrangements
- Stainless steel or chrome lock finishes
- PC mount quick connect or solder terminal styles

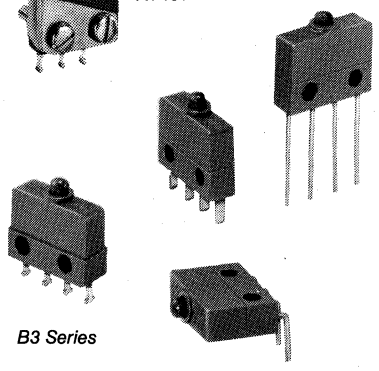
SPECIFICATIONS
- 4 amps @ 125VAC or 28VDC
- 2 amps @ 250VAC
- 5 TUMBLER LOCK MECHANISM UL, CSA

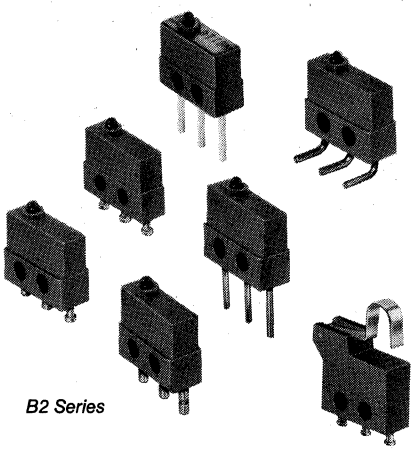
OSLO CONTROLS 328 Industrial Avenue, Cheshire, Connecticut 06410 • Tel.: (203) 272-2794 • FAX (203) 272-3492

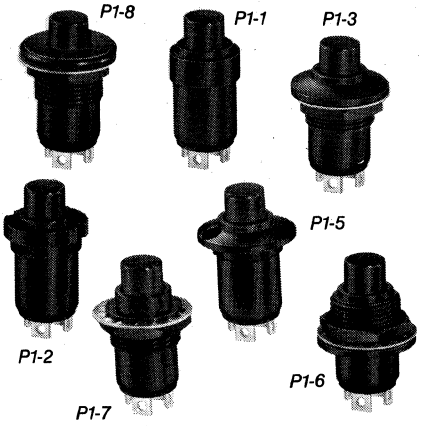
OTTO CONTROLS

OTTO® Means


A1-101


B3 Series


B2 Series



Double-break Basics

Subminiature snap-action military and commercial switches available in .200" (MIL-S-8805/76) and .156" (MIL-S-8805/101) wide versions. Choice of pc pins, solder turret, wire-wrap and right angle pc terminals; 5 or 6 ounce operating force; X, Y, Z, & C contact forms and gold plated or flashed silver contacts. Complete line of auxiliary actuators available and described below as P4 series.

Standard Characteristics:

Contact Rating: 7 amperes, resistive.
Contact Resistance: .025 ohms, max.
Tip Point Repeatability: Within .005"
Operating Force: 5 oz. +3, -2
Release Force: 1.5 oz. min.
Movement Differential: .018" ± .008"
Overtravel: .006" min.
Mechanical Life: 1 million cycles
Electrical Life: 50,000 cycles @ full load
Body Size: .510"L x .350"H x either .200" or .156"W.
Terminals: Turret & PC, .125"L; Wire-wrap, .500"L.

Single-break Basics

Subminiature snap-action military and commercial switches available in .200" (MIL-S-8805/4), .156" (MIL-S-8805/109) and MIL-S-8805/106 (hi-temp) versions. Choice of 3 lengths of pc pins, single or double turret, wire-wrap and right angle pc terminals; 4, 5 or 6 ounce operating force and gold plated or flashed silver contacts. In addition to integral lever actuator models, there is a complete line of auxiliary actuators available and described below as P4 series.

Standard Characteristics:

Contact Rating: 7 amperes, resistive.
Contact Resistance: .025 ohms, max.
Tip point Repeatability: Within .005"
Operating Force: 5 oz. +3, -2
Release Force: 1.5 oz. min.
Movement Differential: .018" ± .008"
Overtravel: .006" in.
Mechanical Life: 50,000 cycles
Electrical Life: 25,000 cycles @ full load
Body Size: .510"L x .350"H x either .200" or .156"W.
Terminals: Turrets, .090 & .225"L; PC, .090, .125" & .270"L; Wire-wrap, .300"L.

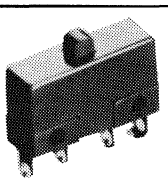
Sealed Military Pushbuttons

Featuring patented rolling sleeve principle, The P1 series offers moisture proof and dust tight sealing. Water proof to 3 feet of pressure is available on special order. There is a choice of 7 bezel/button styles with 9 button colors, all featuring positive tactile feed-back.

Standard Characteristics:

Contact Rating: 10 amperes, resistive.
Contact Resistance: .015 ohms, max.
Tip point Repeatability: Within .001"
Operating Force: 4 lbs.
Release Force: 1 lb. min.
Overtravel: .012" min.
Mechanical Life: 250K cycles, NO/NC; 50K NC/5-Term.
Electrical Life: 25,000 cycles @ full load
Button Size: .375"Dia. x .250" from bezel.
Button Material: Nylon in 9 colors.
Back of panel depth: 1.1 inch max.
Case Material: Aluminum

New! *B5 Series*



Big 10 amps capacity! High contact pressure. Available in military & commercial grades.

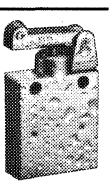
Standard Characteristics/Ratings

Operating Force: 5 oz. +3,-2, Standard.
Release Force: 2 oz. minimum
Movement Differential: .020 +.005 in.
Pretravel: .050 in. maximum.
Operate Point: .406 +.010 in.
Overtravel: .012 in. minimum
Maximum Force on Button: 25 Lbs.
Electrical Life, at full load: 100,000 cycles
Mechanical Life: 1,000,000 cycles.

ELECTRICAL:

Circuitry	Load	Sea Level @28 VDC	70,000 Ft. @28 VDC	125/250 VAC 60Hz.
SPST-NO	RES.	10.0A	10.0A	10.1A
SPST-NC	IND.*	7.5 A	3.5 A	5.0 A
Dbl.Break	LAMP	4.0 A	--	3.0 A

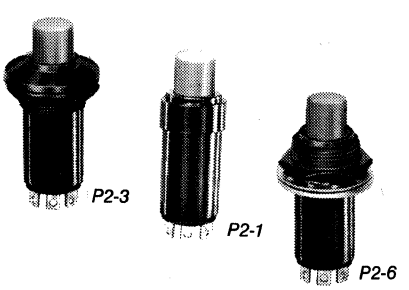
New! *P6-3 Series*



Subminiature Environment-free sealed switch with choice of lever, roller and plunger. Features B5 series switch.

Standard Characteristics/Ratings

Operating Force: 2.5 Lbs. maximum.
Release Force: .5 Lbs. minimum
Movement Differential: .020 +.010 in.
Pretravel: .050 in. maximum.
Operate Point: .406 +.010 in.
Overtravel: .012 in. minimum
Strength of Actuator: 25 Lbs., typ.
Electrical Life, at full load: 50,000 cycles
Mechanical Life: 50,000 cycles.
ELECTRICAL: See B5 series.



twostep™ Sequential Contact Action

Ideal for "Off-High-Low", "Off-Slow-Fast", "Stop-Fine-Course" and other 3 mode applications. Each level operates an independent set of SPDT circuits rated 5 amps. Six contact arrangements are offered to satisfy most circuit requirements. Also available as DPDT single detent. Moistureproof construction. 25,000 mechanical cycle life. Make-before-break contact option available.

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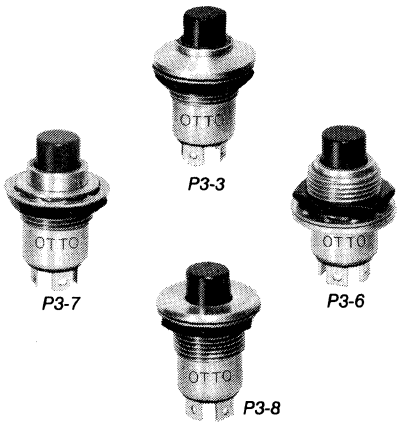
Precision Switches

OTTO CONTROLS

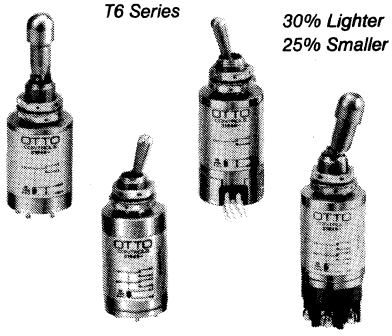


Sealed Pushbuttons

The P3 series is the commercial version of the P1 series and also features OTTO's patented rolling sleeve principle for effective moisture proof and dust tight sealing. Water proof to 3 feet of pressure is available on special order. There is a choice of 4 bezel/button styles with 9 button colors, all featuring positive tactile feed-back.

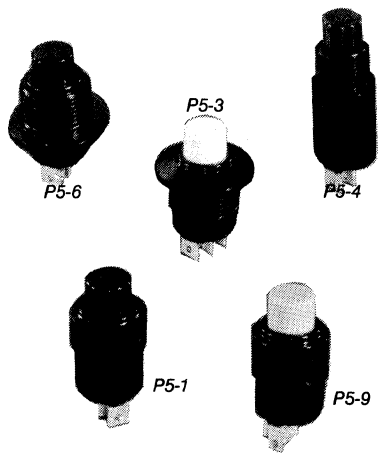
Standard Characteristics:

Contact Rating: 10 amperes, resistive.
Contact Resistance: .025 ohms, max.
Tip point Repeatability: Within .001″
Operating Force: 4 lbs. ± 1 lb.
Release Force: 1 lb. min.
Overtravel: .012″ min.
Mechanical Life: 50,000 cycles
Electrical Life: 25,000 cycles @ full load
Button Size: .375″Dia. x .250″ from bezel.
Button Material: Nylon in 9 colors.
Back of panel depth: 1.1 inch max.
Case Material: Aluminum, clear anodized



Environment-free Sealed Solenoid Held Toggles

Exclusive one piece, all stainless steel housing saves weight and back of panel space. Coil is self-shielding and will not emit stray magnetic fields. Positive tactile feedback. Sealed against immersion and corrosive atmosphere. Qualified to MIL-S-5594.

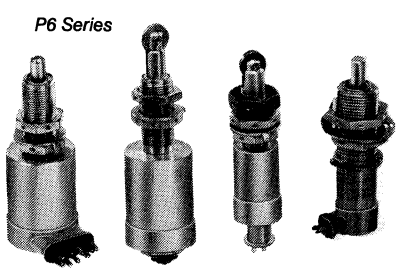


Alternate (Push Push) Action

The P5 series offers the alternate action switch function matching the panel appearance of the momentary action P1 and P3 series. Now you can design panels with both functions and still have a uniform appearance. The button returns to the original position after each actuation. Offered in moisture and dust tight sealed construction in addition to unsealed.

Standard Characteristics:

Contact Rating: 5 amperes, resistive.
Contact Resistance: .025 ohms, max.
Dust Tight: Per MIL-S-8805, Symbol 2.
Operating Force: 4 lbs. ± 1 lb.
Release Force: 1 lb. min.
Overtravel: .012″ in.
Total Travel: .180″ max.
Mechanical Life: 50,000 cycles
Electrical Life: 25,000 cycles @ full load
Button Size: .375″Dia. x .250″ from bezel.
Button Material: Nylon in 9 colors.
Back of panel depth: 1.1 inch max.
Case Material: Aluminum, anodized



Environment-free Sealed Plunger Switches

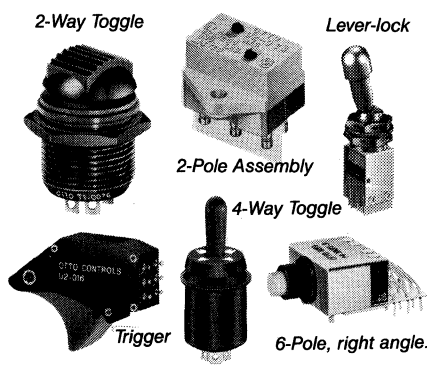
Sealed against immersion and corrosive atmospheres. Rugged mechanically and electrically. Employs OTTO's B2 and B3 basic switches. Complies with MIL-S-8805/104. One piece housing is sealed at the plunger with ring seals and at the base with a resilient header. Fourteen models.

Sealed Sub-Subminiature Pushbuttons

The P7 series incorporates all of the environmental characteristics of the P1 and P3 pushbuttons but in a sub-subminiature package. It also features OTTO's patented rolling sleeve principle for effective moisture proof and dust tight sealing. Water proof to 3 feet of pressure is available on special order. There is a choice of 7 bezel/button styles with 9 button colors, all featuring positive tactile feed-back.

Standard Characteristics:

Contact Rating: 5 amperes, resistive.
Contact Resistance: .025 ohms, max.
Tip point Repeatability: Within .001″
Operating Force: 1.7 lbs ± .5 lb.
Release Force: .5 lb. min.
Overtravel: .012″ min.
Mechanical Life: 50,000 cycles
Electrical Life: 25,000 cycles @ full load
Button Size: .190″Dia. x .125″ from bezel.
Button Material: Nylon in 9 colors.
Back of panel depth: .375 inch max.
Case Material: Aluminum, anodized



Special Purpose Designs

Panel sealed, waterproof and unsealed momentary, maintained or multi-level with detent action pushbuttons, toggles with multiple positions and gangs, lever-lock action, 2-way (toggle/pushbutton) and other actions.

2 East Main Street • Carpentersville, Illinois 60110 • Phone: 312/428-7171 • FAX 312/428-1956

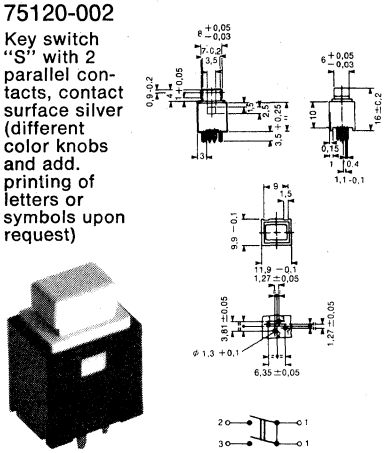
Preh Electronic Industries, Inc.
470 East Main Street, Lake Zurich, IL 60047-2578 U.S.A.
Phone (312) 438-4000 • Telex 297-112 PEI UR • FAX 312-438-5522

SWITCHES

KEY SWITCHES

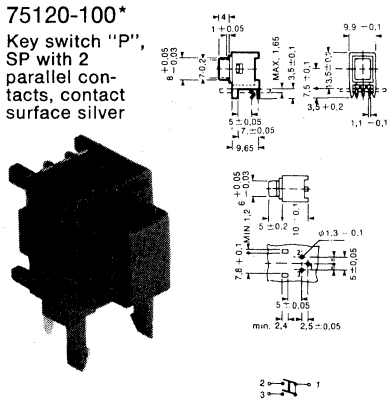
75120-002

Key switch "S" with 2 parallel contacts, contact surface silver (different color knobs and add. printing of letters or symbols upon request)



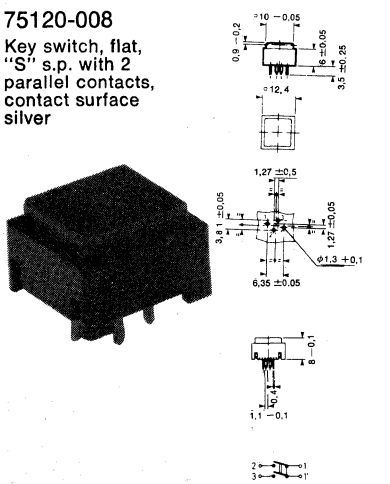
75120-100*

Key switch "P", SP with 2 parallel contacts, contact surface silver



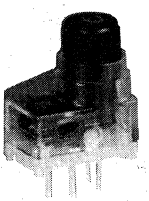
75120-008

Key switch, flat, "S" s.p. with 2 parallel contacts, contact surface silver



75121-000 (NEW)

Key switch w/LED
SPST



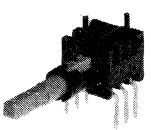
Switch Rating	0.025 A, 30 V DC or AC
Contact Resistance	≤150 mOhms contact surface silver ≤200 mOhms contact surface gold
Bounce	≤0.2 msec.
Typical Life	>200,000 switching cycles
Stroke	$0.9_{-0.2}$ mm
Actuating Force	1.4 ±0.2N
End Stop Force	>50 N
Flammability	UL 94 V −1

PUSH-PUSH SWITCHES

70052-032

MINIATURE KEY SWITCH "P"

DPDT, for p.c. mounting
Special knobs upon request



70052-034

As above, but different shaft
Knobs in different colors available

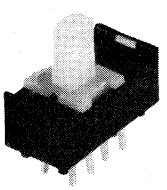
TECHNICAL DATA

Part No.	Switch rating	Contact resistance	Operational force (stroke)	Life
70052-032	0,5 A 12 V	≤20 mOhm	<4 N (3.5 mm)	10.000
70052-034	0,05A 250 V			

4-POSITION SLIDE SWITCH

74650-013*

Slide switch SP, 4 switching positions, "S"



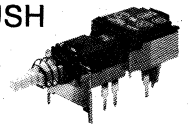
SPECIFICATIONS

Switch Rating	100 mA 30 V DC
Dielectric Strength	500 V AC
Insulation Resistance	>100 MΩ
Contact Resistance	≤100 mΩ
Life	≥1,000 cycles
Operational Force	1 N to 5 N
Contact Force	ca. 0.4 N

(different colors of knobs and add. printing of letters or symbols upon request)
Contact surface gold upon request

ME-5 SERIES POWER SWITCHES "SOFT TOUCH" PUSH-PUSH

70060-003
70060-014
70060-200
70060-208



Preh combines superior quality & wide flexibility in offering the ME-5 series power switches (DPST). This complete line is available in printed circuit or solder terminals. Optional SPST auxiliary switches (1A/24V, AC/DC) available. Accessories such as a dust cover, fuse holder, etc. also available on request.

Approvals:

VDE, UL, CSA, N,

D, S, SEV, BSI

TECHNICAL DATA

Part No.	Power rating	Contact resistance	Operational force (stroke)
70060-003	2,5/100 A 250 V (IEC 65)	<50 mOhm (<30)	≤6 N (3,5/5.7 mm)
70060-014	2,5/100 A 250 V (IEC 65)	<50 mOhm (<30)	≤6 N
70060-200	4/100 A 250 V (IEC) 65)	<50 mOhm (<30)	≤6 N
70060-208	4/100 A 250 V (IEC) 65)	<50 mOhm (<30)	≤6 N

70053-006

Minature push-push switch DPDT. Available in optional 90° degree P.C. mount.

TECHNICAL DATA

Part No.	Switch rating	Contact resistance	Operational force (stroke)	Life
70053-006	2,4 A 10 V	≤40 mOhm	<5 N (4,0/2,5)	10.000

***DETAILED CATALOG AVAILABLE UPON REQUEST**

PRES:AIR:TROL®
PRES:AIR:TROL CORPORATION
1009 W. Boston Post Road, Mamaroneck, NY 10543
914•698-2026 FAX: 914•698-9456 Telex: 5106000212
800•431-2625 (OUTSIDE NY)

PRESSURE AND VACUUM SWITCHES

• AND •

SHOCK-PROOF SWITCHES

(Shock-Proof • Water-Proof • Explosion-Proof)

PRESSURE & VACUUM SWITCHES

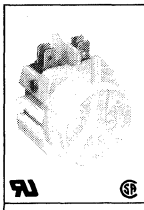


FIGURE R
RADIAL SPOUT
SIZE: 2¼″×2¼″
MOUNT: USE
#4 SELF TAP
SCREWS

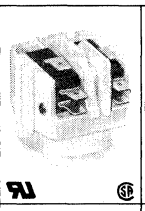


FIGURE C
CENTER SPOUT
SIZE: 2¼″×2¼″
MOUNT: USE
#4 SELF TAP
SCREWS

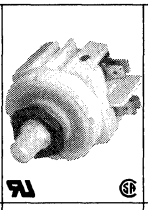


FIGURE M
1/8 NPT
SIZE: 2¼″×2¼″
MOUNT: USE
9/16-18 NUT

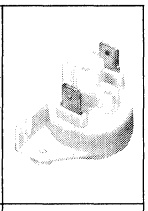


FIGURE D
DIFF. SWITCH
SIZE: 1⅝″×
1⅛″×1″
MOUNT: USE
(2) 1/8 SCREWS

NOTE:
1. Above sizes Do Not Include Inlet.
2. Special Micros available on request.
3. Fig. R, C & D Connect to 1/8″ ID Tube.
4. Other Spout and Mounting Configurations Available.
5. Micro Switches Accept STD .250″ Slide On Terminal.
6. Approx. Repeat Accuracy ± 3% At Constant Temp.
7. Consult Factory For Special Requirements.

LOW COST PRESSURE SWITCHES

SPDT	DPDT	ADJUSTABLE RANGE	MAX 250VAC RATING	APPROVAL	FIG # STD	FIG # SPECIAL
PR10103A	—	1.5-7 INCH H_2O	3A	UL, CSA	R	M,C
PR10306A	—	5-35 INCH H_2O	5A	UL, CSA	R	M,C
PR10510A	PR20510A	20-50 INCH H_2O	10A	UL, CSA	R	M,C
PM11120A	PM21120A	1-4 PSI	21A	UL, CSA	M	R,C
PM11130A	PM21130A	2.5-6 PSI	21A	UL, CSA	M	R,C
PM11140A	PM21140A	4-11 PSI	21A	UL, CSA	M	R,C
PM11150A	PM21150A	9-18 PSI	21A	UL, CSA	M	R,C
PM11160A	PM21160A	15-28 PSI	21A	UL, CSA	M	R,C
PM11170A	PM21170A	25-40 PSI	21A	UL, CSA	M	R,C
PM11180A	PM21180A	35-65 PSI	21A	UL, CSA	M	R,C
PM11190A	PM21190A	50-100 PSI	21A	UL, CSA	M	R,C
PM11195A	PM21195A	75-125 PSI	21A	UL, CSA	M	R,C

LOW COST VACUUM SWITCHES

VR10103A	—	2.5-7 INCH H_2O	3A	UL, CSA	R	M,C
VR10306A	—	6-16 INCH H_2O	5A	UL, CSA	R	M,C
VR10510A	VR20510A	13-25 INCH H_2O	10A	UL, CSA	R	M,C
VR10515A	VR20515A	20-40 INCH H_2O	10A	UL, CSA	R	M,C
VR11120A	VR21120A	35-80 INCH H_2O	21A	UL, CSA	R	M,C
VR11130A	VR21130A	75-150 INCH H_2O	21A	UL, CSA	R	M,C
VR11140A	VR21140A	135-250 INCH H_2O	21A	UL, CSA	R	M,C

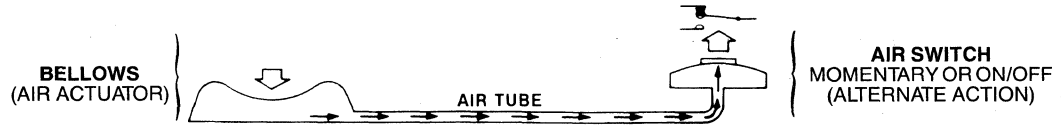
DIFFERENTIAL PRESSURE SWITCH (Pressure or Vacuum)

D1000A	—	.5-15 INCH H_2O	.5A	—	D
D1001A	—	5-30 INCH H_2O	.5A	—	D

NOTE: Differential switch may be set for normally open or closed contacts for pressure or vacuum operation.

SHOCK PROOF, WATER PROOF, EXPLOSION PROOF SWITCH

INSTEAD OF A SWITCH CONNECTED BY CABLE TO THE EQUIPMENT OR APPLIANCE, AN AIR BELLOWS IS JOINED BY TUBING TO AN AIR SWITCH CONTAINED WITHIN THE EQUIPMENT OR APPLIANCE. **AIR SWITCHES ARE AVAILABLE IN MOMENTARY, ALTERNATE ACTION, OR SEQUENCING ACTIONS.**

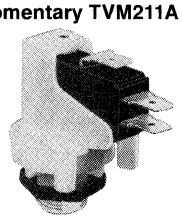


Air Switches

1. 2HP@240VAC
   1HP@ 120VAC
   21 AMP@ 240VAC
2. Other mounting choices
3. Acetel plastic body and mechanism ensures high mechanical stability and minimum moisture absorption.
4. Other switch ratings available.

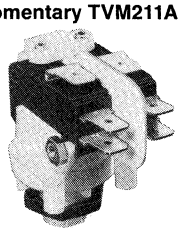
FILE #E80254 FILE #LR69099-1

ON/OFF TVA211A
Momentary TVM211A



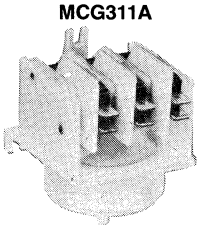
"Tinytrol™ Single"
SPDT

ON/OFF TVA211A
Momentary TVM211A



"Tinytrol Double"
DPDT
US PATENT
4,783,580

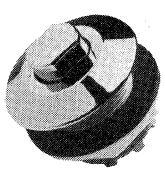
4-Function
MCG311A



"Magictrol"™
Sequencing

Air Actuators (Bellows)

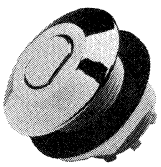
The air actuators in any of the various forms, are not affected by water, dirt, dust or flammable gases. Only a few of the many actuators available are shown here. Standard electrical footswitches are also available.



B225A

B513A

B318A



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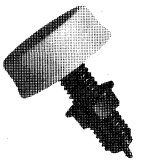

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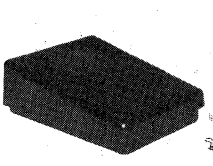


B621A

PRESS BOX
(AIR SWITCH
IN A
JUNCTION BOX)

ALLIED CONTROLS/RUNDEL PRODUCTS

100 RELAY ROAD, PLANTSVILLE, CT 06479
203-621-6771 FAX: 203-621-4932

H33 Pushbuttons, Pilot Lights, and Selector Switches

H33 1 13/64" Pushbuttons
Round Momentary Operators[1]

Type of Unit	Cap Color	Operator & Cap Cat. No.	Operator & Cap List Price	Operator with NO Contact Cat. No.	Operator with NO Contact List Price	Operator with NC Contact Cat. No.	Operator with NC Contact List Price	Operator with 1NO-1NC Contacts Cat. No.	Operator with 1NO-1NC Contacts List Price	Operator with 2NO Contacts Cat. No.	Operator with 2NO Contacts List Price	Operator with 2NC Contacts Cat. No.	Operator with 2NC Contacts List Price
	Green	H33FSG0	$10.80	H33FSG1	$16.80	H33FSG2	$16.80	H33FSG3	$22.80	H33FSG4	$22.80	H33FSG5	$22.80
	Black	H33FSK0	10.80	H33FSK1	16.80	H33FSK2	16.80	H33FSK3	22.80	H33FSK4	22.80	H33FSK5	22.80
	Red	H33FSR0	10.80	H33FSR1	16.80	H33FSR2	16.80	H33FSR3	22.80	H33FSR4	22.80	H33FSR5	22.80
	Green	H33FHG0	10.80	H33FHG1	16.80	H33FHG2	16.80	H33FHG3	22.80	H33FHG4	22.80	H33FHG5	22.80
	Black	H33FHK0	10.80	H33FHK1	16.80	H33FHK2	16.80	H33FHK3	22.80	H33FHK4	22.80	H33FHK5	22.80
	Red	H33FHR0	10.80	H33FHR1	16.80	H33FHR2	16.80	H33FHR3	22.80	H33FHR4	22.80	H33FHR5	22.80
	Green	H33FFG0	10.80	H33FFG1	16.80	H33FFG2	16.80	H33FFG3	22.80	H33FFG4	22.80	H33FFG5	22.80
	Black	H33FFK0	10.80	H33FFk1	16.80	H33FFK2	16.80	H33FFK3	22.80	H33FFK4	22.80	H33FFK5	22.80
	Red	H33FFR0	10.80	H33FFR1	16.80	H33FFR2	16.80	H33FFR3	22.80	H33FFR4	22.80	H33FFR5	22.80
	Green	H33ESG0	10.80	H33ESG1	16.80	H33ESG2	16.80	H33ESG3	22.80	H33ESG4	22.80	H33ESG5	22.80
	Black	H33ESK0	10.80	H33ESK1	16.80	H33ESK2	16.80	H33ESK3	22.80	H33ESK4	22.80	H33ESK5	22.80
	Red	H33ESR0	10.80	H33ESR1	16.80	H33ESR2	16.80	H33ESR3	22.80	H33ESR4	22.80	H33ESR5	22.80
	Green	H33EHG0	10.80	H33EHG1	16.80	H33EHG2	16.80	H33EHG3	22.80	H33EHG4	22.80	H33EHG5	22.80
	Black	H33EHK0	10.80	H33EHK1	16.80	H33EHK2	16.80	H33EHK3	22.80	H33EHK4	22.80	H33EHK5	22.80
	Red	H33EKR0	10.80	H33EHR1	16.80	H33EHR2	16.80	H33EHR3	22.80	H33EHR4	22.80	H33EHR5	22.80
	Green	H33EFG0	10.80	H33EFG1	16.80	H33EFG2	16.80	H33EFG3	22.80	H33EFG4	22.80	H33EFG5	22.80
	Black	H33EFK0	10.80	H33EFK1	16.80	H33EFK2	16.80	H33EFK3	22.80	H33EFK4	22.80	H33EFK5	22.80
	Red	H33EFR0	10.80	H33EKR1	16.80	H33EKR2	16.80	H33EFR3	22.80	H33EFR4	22.80	H33EFR5	22.80

Momentary Operators with Mushroom Caps[1,2]

	Red	H33MSR0 $28.80	H33MSR1 $28.80	H33MSR2 $28.80	H33MSR3 $34.80	H33MSR4 $34.80	H33MSR5 $34.80
	Red	H33MFR0 38.80	H33MFR1 44.80	H33MFR2 44.80	H33MFR3 50.80	H33MFR4 50.80	H33MFR5 50.80
	Red	H33JSR0 22.80	H33JSR1 28.80	H33JSR2 28.80	H33JSR3 34.80	H33JSR4 34.80	H33JSR5 34.80
	Red	H33JFR0 44.80	H33JFR1 50.80	H33JFR2 50.80	H33JFR3 56.80	H33JFR4 56.80	H33JFR5 56.80
	Red	H33JDR0 46.80	H33JDR1 52.80	H33JDR2 52.80	H33JDR3 58.80	H33JDR4 58.80	H33JDR5 58.80

Maintained Pushbutton Operators[1]

	Green	H33MP1G0$27.20	H33MP1G1$33.20	H33MP1G2$33.20	H33MP1G3$39.20	H33MP1G4$39.20	H33MP1G5$39.20
	Black	H33MP1K0 27.20	H33MP1K1 33.20	H33MP1K2 33.20	H33MP1K3 39.20	H33MP1K4 39.20	H33MP1K5 39.20
	Red	H33MP1R0 27.20	H33MP1R1 33.20	H33MP1R2 33.20	H33MP1R3 39.20	H33MP1R4 39.20	H33MP1R5 39.20
	Red	H33MP3R0 38.80	H33MP3R1 44.80	H33MP3R2 44.80	H33MP3R3 50.80	H33MP3R4 50.80	H33MP3R5 50.80
	Red	H33MP2R0 38.80	H33MP2R1 44.80	H33MP2R2 44.80	H33MP2R3 50.80	H33MP2R4 50.80	H33MP2R5 50.80
	Red	H33PP3R0 34.80	H33PP3R1 40.80	H33PP3R2 40.80	H33PP3R3 46.80	H33PP3R4 46.80	H33PP3R5 46.80

Illuminated Momentary Pushbuttons[1]

Type Of Unit	Illumination	Operator with Lens, Lamp and Transformer (if indicated) Cat. No.	Operator with Lens, Lamp and Transformer (if indicated) List Price	Operator with NO Contact Cat. No.	Operator with NO Contact List Price	Operator with NC Contact Cat. No.	Operator with NC Contact List Price	Operator with 1NO-1NC Contacts Cat. No.	Operator with 1NO-1NC Contacts List Price	Operator with 2NO Contacts Cat. No.	Operator with 2NO Contacts List Price	Operator with 2NC Contacts Cat. No.	Operator with 2NC Contacts List Price
	6 Volt Lamp	H33PM1A0	$21.00	H33PM1A1	$27.00	H33PM1A2	$27.00	H33PM1A3	$33.00	H33PM1A4	$33.00	H33PM1A5	$33.00
	12 Volt Lamp	H33PM2A0	21.00	H33PM2A1	27.00	H33PM2A2	27.00	H33PM2A3	33.00	H33PM2A4	33.00	H33PM2A5	33.00
	24 Volt Lamp	H33PM3A0	22.60	H33PM3A1	28.60	H33PM3A2	28.60	H33PM3A3	34.60	H33PM3A4	34.60	H33PM3A5	34.60
	48 Volt Lamp	H33PM4A0	23.80	H33PM4A1	29.80	H33PM4A2	29.80	H33PM4A3	35.80	H33PM4A4	35.80	H33PM4A5	35.80
	60 Volt Lamp	H33PM5A0	23.80	H33PM5A1	29.80	H33PM5A2	29.80	H33PM5A3	35.80	H33PM5A4	35.80	H33PM5A5	35.80
	120 Volt Lamp	H33PM6A0	23.80	H33PM6A1	29.80	H33PM6A2	29.80	H33PM6A3	35.80	H33PM6A4	35.80	H33PM6A5	35.80
	120 Volt Trans. with 6 Volt Lamp	–	–	H33PM7A1	48.80	H33PM7A2	48.80	H33PM7A3	54.80	H33PM7A4	54.80	H33PM7A5	54.80
	240 Volt Trans. with 6 Volt Lamp			H33PM8A1	48.80	H33PM8A2	48.80	H33PM8A3	54.80	H33PM8A4	54.80	H33PM8A5	54.80
	480 Volt Trans. with 6 Volt Lamp	–	–	H33PM9A1	48.80	H33PM9A2	48.80	H33PM9A3	54.80	H33PM9A4	54.80	H33PM9A5	54.80

1 Legend plate is not included.
2 Mushroom caps can be ordered with two set screws, add suffix SSX to the Cat. No. Example: H33MSRDSSX.
3 Recommended use of AEM contact block when specifying NO block, and BLB contact block when specifying NC block.

H33 1 13/64" Illuminated Pushbuttons
Illuminated Momentary Pushbutton (Push-Pull, Spring Return to Center)[1]

Type Of Unit	Illumination	Operator only Cat. No.	Operator only List Price	Operator with NO Contact Cat. No.	Operator with NO Contact List Price	Operator with NC Contact Cat. No.	Operator with NC Contact List Price	Operator with 1NO-1NC Contacts Cat. No.	Operator with 1NO-1NC Contacts List Price	Operator with 2NO Contacts Cat. No.	Operator with 2NO Contacts List Price	Operator with 2NC Contacts Cat. No.	Operator with 2NC Contacts List Price
	6 Volt Lamp	H33LP1A0	$33.20	H33LP1A1	$39.20	H33LP1A2	$39.20	H33LP1A3	$45.20	H33LP1A4	$45.20	H33LP1A5	$45.20
	12 Volt Lamp	H33LP2A0	33.20	H33LP2A1	39.20	H33LP2A2	39.20	H33LP2A3	45.20	H33LP2A4	45.20	H33LP2A5	45.20
	24 Volt Lamp	H33LP3A0	34.80	H33LP3A1	40.80	H33LP3A2	40.80	H33LP3A3	46.80	H33LP3A4	46.80	H33LP3A5	46.80
	48 Volt Lamp	H33LP4A0	36.00	H33LP4A1	42.00	H33LP4A2	42.00	H33LP4A3	48.00	H33LP4A4	48.00	H33LP4A5	48.00
	60 Volt Lamp	H33LP5A0	36.00	H33LP5A1	42.00	H33LP5A2	42.00	H33LP5A3	48.00	H33LP5A4	48.00	H33LP5A5	48.00
	120 Volt Lamp	H33LP6A0	36.00	H33LP6A1	42.00	H33LP6A2	42.00	H33LP6A3	48.00	H33LP6A4	48.00	H33LP6A5	48.00
	120 Volt Trans. with 6 Volt Lamp	–	–	H33LP7A1	61.00	H33LP7A2	61.00	H33LP7A3	67.00	H33LP7A4	67.00	H33LP7A5	67.00
	240 Volt Trans. with 6 Volt Lamp			H33LP8A1	61.00	H33LP8A2	61.00	H33LP8A3	67.00	H33LP8A4	67.00	H33LP8A5	67.00
	480 Volt Trans. with 6 Volt Lamp	–	–	H33LP9A1	61.00	H33LP9A2	61.00	H33LP9A3	67.00	H33LP9A4	67.00	H33LP9A5	67.00

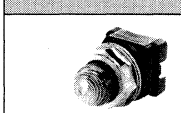
Illuminated Maintained Pushbuttons (Push-Pull)[1]

	6 Volt Lamp	H33PL1A0 $33.20	H33PL1A1 $39.20	H33PL1A2 $39.20	H33PL1A3 $45.20	H33PL1A4 $45.20	H33PL1A5 $45.20
	12 Volt Lamp	H33PL2A0 33.20	H33PL2A1 39.20	H33PL2A2 39.20	H33PL2A3 45.20	H33PL2A4 45.20	H33PL2A5 45.20
	24 Volt Lamp	H33PL3A0 34.80	H33PL3A1 40.80	H33PL3A2 40.80	H33PL3A3 46.80	H33PL3A4 46.80	H33PL3A5 46.80
	48 Volt Lamp	H33PL4A0 36.00	H33PL4A1 42.00	H33PL4A2 42.00	H33PL4A3 48.00	H33PL4A4 48.00	H33PL4A5 48.00
	60 Volt Lamp	H33PL5A0 36.00	H33PL5A1 42.00	H33PL5A2 42.00	H33PL5A3 48.00	H33PL5A4 48.00	H33PL5A5 48.00
	120 Volt Lamp	H33PL6A0 36.00	H33PL6A1 42.00	H33PL6A2 42.00	H33PL6A3 48.00	H33PL6A4 48.00	H33PL6A5 48.00
	120 Volt Trans. with 6 Volt Lamp	– –	H33PL7A1 61.00	H33PL7A2 61.00	H33PL7A3 67.00	H33PL7A4 67.00	H33PL7A5 67.00
	240 Volt Trans. with 6 Volt Lamp		H33PL8A1 61.00	H33PL8A2 61.00	H33PL8A3 67.00	H33PL8A4 67.00	H33PL8A5 67.00
	480 Volt Trans. with 6 Volt Lamp	– –	H33PL9A1 61.00	H33PL9A2 61.00	H33PL9A3 67.00	H33PL9A4 67.00	H33PL9A5 67.00

Illuminated Maintained Pushbuttons (Push-On; Push-Off)[1]

	6 Volt Lamp	H33ML1A0$37.00	H33ML1A1$43.00	H33ML1A2$43.00	H33ML1A3$49.00	H33ML1A4$49.00	H33ML1A5$49.00
	12 Volt Lamp	H33ML2A0 37.00	H33ML2A1 43.00	H33ML2A2 43.00	H33ML2A3 49.00	H33ML2A4 49.00	H33ML2A5 49.00
	24 Volt Lamp	H33ML3A0 38.60	H33ML3A1 44.60	H33ML3A2 44.60	H33ML3A3 50.60	H33ML3A4 50.60	H33ML3A5 50.60
	48 Volt Lamp	H33ML4A0 39.80	H33ML4A1 45.80	H33ML4A2 45.80	H33ML4A3 51.80	H33ML4A4 51.80	H33ML4A5 51.80
	60 Volt Lamp	H33ML5A0 39.80	H33ML5A1 45.80	H33ML5A2 45.80	H33ML5A3 51.80	H33ML5A4 51.80	H33ML5A5 51.80
	120 Volt Lamp	H33ML6A0 39.80	H33ML6A1 45.80	H33ML6A2 45.80	H33ML6A3 51.80	H33ML6A4 51.80	H33ML6A5 51.80
	120 Volt Trans. with 6 Volt Lamp	– –	H33ML7A1 64.80	H33ML7A2 64.80	H33ML7A3 70.80	H33ML7A4 70.80	H33ML7A5 70.80
	240 Volt Trans. with 6 Volt Lamp		H33ML8A1 64.80	H33ML8A2 64.80	H33ML8A3 70.80	H33ML8A4 70.80	H33ML8A5 70.80
	480 Volt Trans. with 6 Volt Lamp	– –	H33ML9A1 64.80	H33ML9A2 64.80	H33ML9A3 70.80	H33ML9A4 70.80	H33ML9A5 70.80

H33 1 13/64" Pilot Lights
Full Voltage and Transformer Pilot Lights

Type of Unit	Illumination	Pilot Light with Amber Lens Cat. No.	Pilot Light with Amber Lens List Price
	6 Volt Lamp	H33P1A	$22.00
	12 Volt Lamp	H33P2A	22.00
	24 Volt Lamp	H33P3A	23.60
	48 Volt Lamp	H33P4A	24.80
	60 Volt Lamp	H33P5A	24.80
	120 Volt Lamp	H33P6A	24.80
	120 Volt Transformer with 6 Volt Lamp	H33P7A	42.80
	240 Volt Transformer with 6 Volt Lamp	H33P8A	42.80
	480 Volt Transformer with 6 Volt Lamp	H33P9A	42.80

1 Legend plate is not included.
1A Price includes 1 N/O and 1 N/C contact and preformed jumpers necessary for operation.

Consult factory for Catalog Number Development ordering information.

ALLIED CONTROLS/RUNDEL PRODUCTS

100 RELAY ROAD, PLANTSVILLE, CT 06479
203-621-6771 FAX: 203-621-4932

H33/H36 Pushbuttons, Pilot Lights, and Selector Switches

H33 1 13/64" Pilot Lights

Push-to-Test Pilot Lights[1]

Type of Unit	Illumination	Pilot Light with Amber Lens Cat. No.	List Price
	6 Volt Lamp	H33PT1A3	$34.20
	12 Volt Lamp	H33PT2A3	34.20
	24 Volt Lamp	H33PT3A3	35.80
	48 Volt Lamp	H33PT4A3	37.00
	60 Volt Lamp	H33PT5A3	37.00
	120 Volt Lamp	H33PT6A3	37.00
	120 Volt Transformer with 6 Volt Lamp	H33PT7A3	54.80
	240 Volt Transformer with 6 Volt Lamp	H33PT8A3	54.80
	480 Volt Transformer with 6 Volt Lamp	H33PT9A3	54.80

Resistor Pilot Lights,

	120 Volt Lamp and Diode Block for Remote Test	H33PR0A	$44.80
	RB 120A with 120 Volt Lamp	H33PR1A	31.80
	RB 120B with 120 Volt Lamp	H33PR2A	31.80
	RB120/24A with 24 Volt Lamp	H33PR3A	34.60
	RB120/24B with 24 Volt Lamp	H33PR4A	34.60
	RB240/120A with 120 Volt Lamp	H33PR5A	35.80
	RB240/120B with 120 Volt Lamp	H33PR6A	35.80
	NRB120 with 120 Volt Neon Lamp	H33PR7A	29.80
	NRB240 with 120 Volt Neon Lamp	H33PR8A	29.80
	NRB480 with 120 Volt Neon Lamp	H33PR9A	29.80

H33 1 13/64" Selector Switches

Two Position Lever Operated Switches*[1]

Type of Unit	Operation	Cap Color	Operator Only Cat. No.	Operator Only List Price	Operator with Contact Blocks XO OX Cat. No.	Operator with Contact Blocks XO OX List Price	Operator with Contact Blocks XO OX XO OX Cat. No.	Operator with Contact Blocks XO OX XO OX List Price
	Manual	Green	H33SW12MGL0	$14.80	H33SW12MGL3	$26.80	H33SW12MGL6	$38.80
		Black	H33SW12MKL0	14.80	H33SW21MKL3	26.80	H33SW12MKL6	38.80
		Red	H33SW12MRL0	22.80	H33SW12MRL3	34.80	H33SW12MRL6	46.80
	Spring Return Right to Left	Green	H33SW12SRGL0	22.80	H33SW12SRGL3	34.80	H33SW12SRGL6	46.80
		Black	H33SW12SRKL0	22.80	H33SW12SRKL3	34.80	H33SW12SRKL6	46.80
		Red	H33SW12SRRL0	22.80	H33SW12SRRL3	34.80	H33SW12SRRL6	46.80

Three Position Lever Operated Selector Switches*[1]

Type of Unit	Operation	Cap Color	Operator Only Cat. No.	Operator Only List Price	Operator with Contact Blocks XOO OOX Cat. No.	Operator with Contact Blocks XOO OOX List Price	Operator with Contact Blocks XOO OXO OOX Cat. No.	Operator with Contact Blocks XOO OXO OOX List Price
	Manual, Single Rod Action	Green	H33SW13MGL0	$14.80	H33SW13MGL3	$26.80	H33SW13MGL7	$38.80
		Black	H33SW13MKL0	14.80	H33SW13MKL3	26.80	H33SW13MKL7	38.80
		Red	H33SW13MRL0	14.80	H33SW13MRL3	26.80	H33SW13MRL7	38.80
	Manual, Twin Rod Independent Action	Green	H33SW23MGL0	14.80	H33SW23MGL3	26.80	H33SW23MGl7	36.80
		Black	H33SW23MKL0	14.80	H33SW23MKL3	26.80	H33SW23MKL7	36.80
		Red	H33SW23MRL0	14.80	H33SW23MRL3	26.80	H33SW23MRL7	36.80
	Spring Return Left to Center,	Green	H33SW13SLGL0	22.80	H33SW13SLGL3	34.80	H33SW13SLGL7	46.80
		Black	H33SW13SLKL0	22.80	H33SW13SLKL3	34.80	H33SW13SLKL7	46.80
		Red	H33SW13SLRL0	22.80	H33SW13SLRL3	34.80	H33SW13SLRL7	46.80
	Spring Return Right to Center	Green	H33SW13SRGL0	22.80	H33SW13SRGL3	34.80	H33SW13SRGL7	46.80
		Black	H33SW13SRKL0	22.80	H33SW13SRKL3	34.80	H33SW13SRKL7	46.80
		Red	H33SW13SRRL0	22.80	H33SW13SRRL3	34.80	H33SW13SRRL7	46.80
	Spring Return Both Sides to Center	Green	H33SW23SCGL0	22.80	H33SW23SCGL3	34.80	H33SW23SCGL7	46.80
		Black	H33SW23SCKL0	22.80	H33SW23SCKL3	34.80	H33SW23SCKL7	46.80
		Red	H33SW23SCRL0	22.80	H33SW23SCRL3	34.80	H33SW23SCRL7	46.80

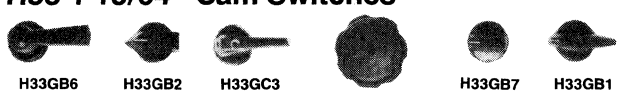
1. Legend plate is not included
2. Price includes 1 N/O & 1 N/C contact and preformed jumpers necessary for operation

H33 1 13/64" Selector Switches

Four Position Lever Operated Switches*[1]

Type of Unit	Operation	Cap Color	Operator Only Cat. No.	Operator Only List Price	Operator with Contacts XOOO OXOO OOXO OOOX Cat. No.	Operator with Contacts XOOO OXOO OOXO OOOX List Price
	Manual	Black	H33SW24MKL0	$14.80	H33SW24MKL6	$38.80
		Green	H33SW24MGL0	14.80	H33SW24MGL6	38.80
		Red	H33SW24MRL0	14.80	H33SW24MRL6	38.80

H33 1 13/64" Cam Switches



H33GB6 H33GB2 H33GC3 H33GB5 H33GB7 H33GB1

HOW TO ORDER

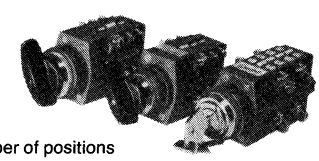
1. Unit Operator

Quantity	Class	(Operator)
_____	H___SS3	Maintained
_____	H___SS3	Spring Return to Center
_____	H___KSS3	Key Lock Maintained
_____	H___KSS3	Key Lock Spring Return

H33GC4

2. Select position angle.

Cam Angle	Maximum Positions
30° _____	up to 12 positions
45° _____	up to 8 positions
60° _____	up to 6 positions
90° _____	up to 4 positions



3. Specify Cam Angle / Specify number of positions
_____ (write in number) _____ (write in number)
4. Handles: Choose from seven handles and levers
Indicate handle number _____
5. Indicate nameplate legend and associated switch position. See legend plate section.

Pricing Information		
Cat. No.	Description	List Price 2
H33SS3	Standard maintained operator	$60.00
H33SS3-3SR	Standard operator 3 position spring return to center	$60.00
H33KSS3	Key lock maintained operator (includes 2 keys)	$80.00
H33KSS3-3SR	Key lock operator 3 position spring return to center	$80.00
–	Price per contact	$10.00
–	Engraved nameplate (show marking required)	$8.50
–	600V applications require spacers. Refer to local sales office.	–

H36 Monolever, Reset Operator

Monolever Operator Oiltight & Watertight

Available in 2, 3 or 4 position (plus center) either maintained, spring returned or a combination of both. The monolever uses a special DPDT contact block with 10 Amp 600 V rating.

	Operators	Center Position Plus	List Price 3
	H36M1-2M	2 Position Manual Return	$71.00
	H36M1-3M	3 Position Manual Return	79.00
	H36M1-4M	4 Position Manual Return	87.00
	H36M1-2SR	2 Position Spring Return	71.00
	H36M1-3SR	3 Position Spring Return	79.00
	H36M1-4SR	4 Position Spring Return	87.00
	Contact Blocks-for use with Monolever Operator		**List Price**
	H36M01A1D	1 N/O Contact & Dummy	$ 8.00
	H36M0BA	2 N/O Contacts	12.00
	H36M01B1D	1 N/C Contacts & Dummy	8.00
	H36M02B	2 N/C Contacts	12.00
	H36M0C	1 N/O & N/C Contact	12.00

NEMA 1 Reset Operator

Standard length 4", measured from front of panel. Adjustable ± 1/4 inch. To make oiltight and watertight use H33SA1 boot. Other lengths available on special order. 3

	Color	Assembled Cat. No.	List Price 5	As Components
	Red	H36RS-11-AR21-15 4	$7.00	
	Green	-AG21	7.00	
	Black	-AB21	7.00	Reset without color cap order H36RS-11 @ $6.80 list
	Yellow	-AY21	7.00	
	Blue	-ABL21	7.00	Replacement color caps, see H33 components section for extended color caps.
	Brown	-ABR21	7.00	
	Orange	-AO21	7.00	
	White	-AW21	7.00	
	Grey	-AGR21	7.00	

1 Legend plate is not included.
2 Price includes handle
3 Includes operator only. Contact blocks not included.
4 Red & black reset buttons furnished with engraved "reset" legend.
5 For lengths longer than 4", add 20¢ list per inch.

***Illuminated Switches Available Upon Request**

610 East Tenth Street
Oakland, CA 94606
FAX: (415) 452-3620

BRILL ELECTRONICS

1220 Olympic Boulevard
Santa Monica, CA 90404
Tel: (213) 452-8002

(415) 834-5888

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- Decibel Products

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- Calif. Chassis

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- E.F. Johnson
- Mallory
- Sprague

CIRCUIT BREAKERS
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- Potter Brumfield
- Waber Electric

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- Kulka
- Manhattan
- Paladin
- Panduit
- Pomona
- Superior
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- Stemco

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- U.S.D.

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- Superior
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- Waber

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- Allied Controls
- American Zettler
- Aromat
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- Coto
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- Guardian
- ITT
- Line Electric
- Magnecraft
- Master Electronics
- Midtex
- Omron
- Potter & Brumfield
- Sigma
- Struthers-Dunn
- Theta-J

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- Bourns
- Clarostat
- Mallory
- Ohmite

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- Semitronics

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- C & K
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- Magnum
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- Siemen
- USD
- Vernitron-Beau
- Weidmuller

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- Fluke
- Simpson Electric
- Triplett

TIMERS
- Agastat
- Amperite
- Industrial Timer
- Magnecraft
- Master Electronics
- Midtex
- Omron
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- SSAC

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- Helper Winch

TRANSFORMERS
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- Jeffersons
- Microtran
- Sola
- Stancor
- Thordarson
- Triad
- U.T.C.

TUBES
- Eimac
- G.E.
- National
- Raytheon
- R.C.A.
- Varian (Klystrons)

TUBING
- Alpha
- Electrovert
- Heli-Tube
- Panduit

WIRE & CABLE
- Alpha
- Belden
- Cablewave
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Switchcraft
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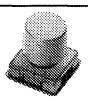
EECO®

SCHURTER
P.O. Box 750158 • 1016 Clegg Court • Petaluma, CA 94975-0158 • 707-778-6311 • FAX 707-778-6401

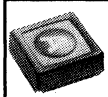
SWITCHES

PUSHBUTTONS - Snap Dome

MTG ½"
Base switch designed for use under custom membrane overlay.

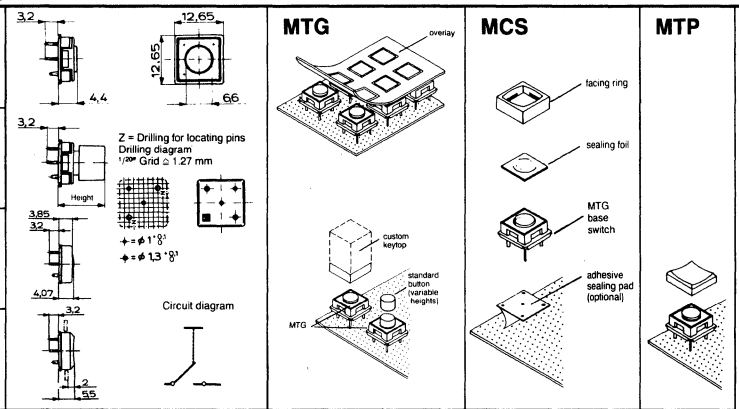


MTG ½"
Base switch with button.



MCS ½"
Base switch with sealing foil and facing ring.

MTP ½"
Base switch with keycap.

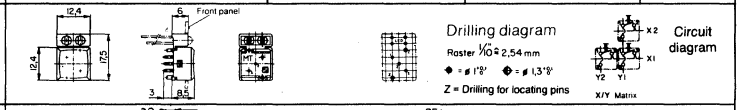


The snap dome is gold plated steel guaranteed for 10^6 operations.

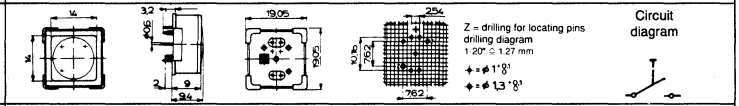
The actuating style, color and legend inscription can be selected from a number of basic components.

The switches can be supplied with an IEC rating of sealing protection class IP40 or IP65.

MT
Key switch with or without LED's.

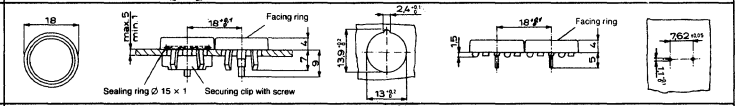


MTG, MCS, MTL ¾"
Key switch unlighted or backlighted with two LED's. MTL is indicator only.

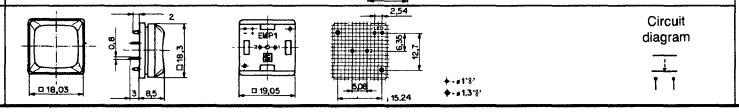


Contacts are available with gold or silver plating.

MCS ¾"
Key switch unlighted with extreme low profile for panel or pcb mounting.

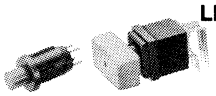


EMP-1
Key switch with or without LED.

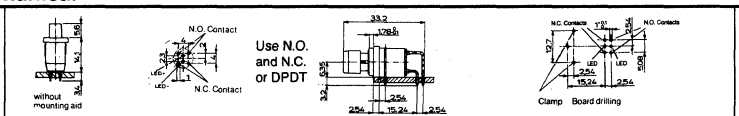


Adhesive sealing pads for wave-soldering and washing are available for most models.

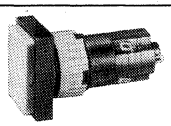
PUSHBUTTONS - Electromechanical



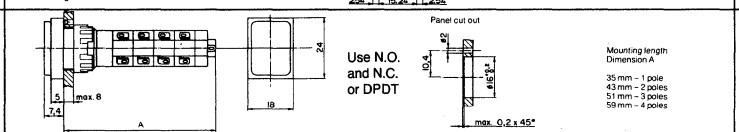
LDS/LDT



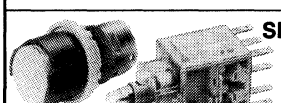
Miniature pushbutton with or without TI LED or mechanical indicator for panel or pcb mounting. Available with solder terminals and various button shapes and colors.



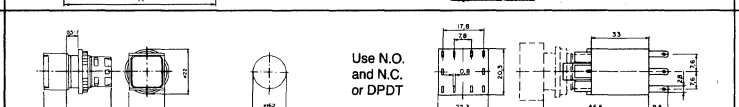
EMF



Pushbutton accepts TI¾ LED neon or incandescent lamps. Available in round, square or rectangular. Also with gold contacts, various lense colors and legend inscriptions. AF is matching indicator.



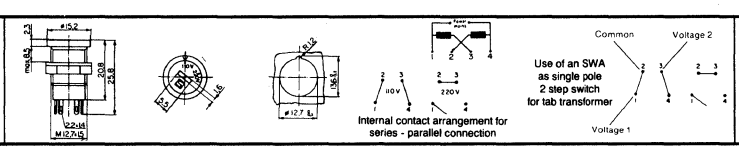
SBE



Heavy-duty push button with mechanical contact black accepts T5 LED, neon or incandescent lamps. Available in round, square, or rectangular. Various lense colors and legend inscriptions. AF is matching indicator.

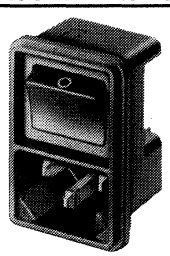
ROTARY - Voltage Selector

SWA

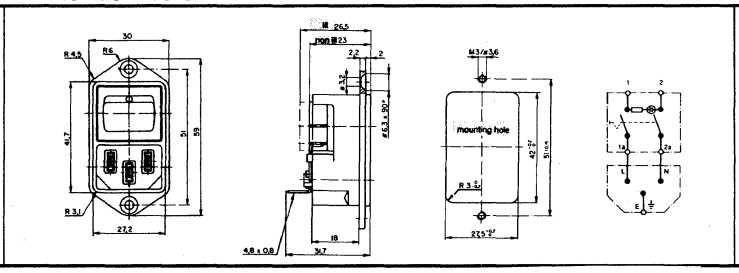


Selector switch for international voltages. Part number 033.4501 for panel mounting and 033.4601 for pcb mounting. Reference full-line catalog for 3 and 6 position models.

ROCKER - AC Power On/Off with Inlet Connector



KEB



DPST line switch internally wired to AC connector for chassis or snap-in mounting. Available unlighted or with 110V or 220V red or green lighted switch. Reference EEM section 2100 for more Schurter power entry modules. Reference section 2700 for units with filters.

Shallco

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PRECISION ELECTRONIC COMPONENTS
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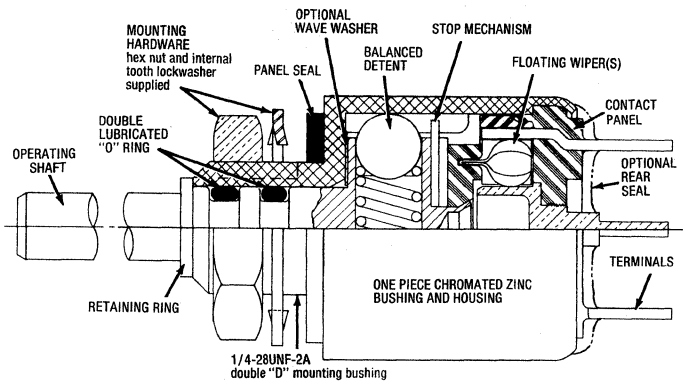
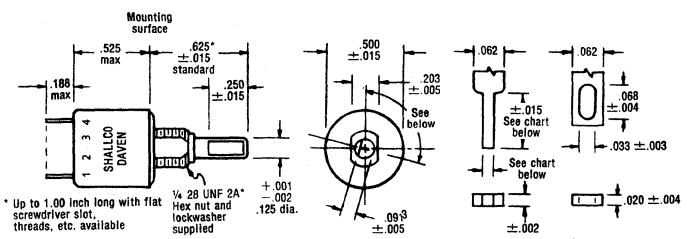
½ INCH SUBMINIATURE ROTARY "C" SWITCH

The Shallco subminiature ½ in. diameter "C" Series combines time proven (over 30 years) internal construction i.e., rotor, stator, wiper, with a cost effective die cast operating shaft and housing.
The Shallco "C" Series switches are designed to satisfy the most demanding industrial and commercial instrumentation requirements.
Shallco offers a unique ½ inch, 3 pole, 4 position, 30° switch and a greater selection of 36°, 45° and 60° switches than any other manufacturer.
The most cost effective switch combines the die cast shaft and housing. However, brass and stainless steel shafts are available and provide the flexibility needed to meet your exact requirements without over specifying. No other manufacturers offers this service.
Our nationwide network of representatives (see EEM yellow pages) is ready to respond to your requirements in an expeditious manner.



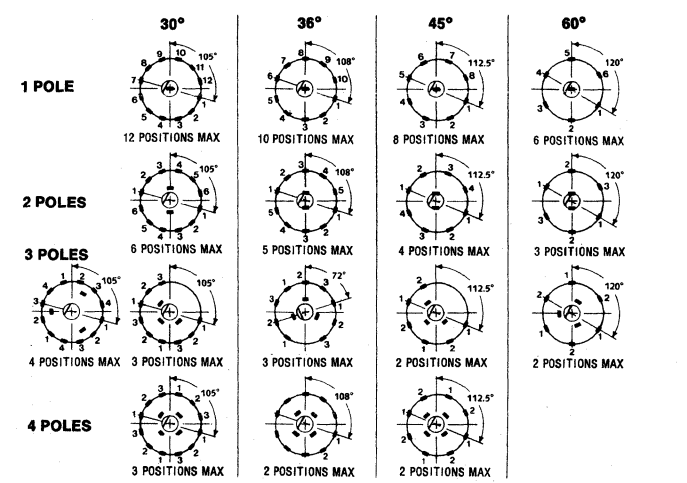
Daven Internal Construction Design — Proven Reliability Since 1951

DIMENSIONS



SCHEMATICS

All one pole commons are either .028 dia. pin for P/C terminals or .065 dia. turret for solder lug terminals. All switches are supplied with the maximum complement of terminals.



SPECIFICATIONS

MATERIALS:

Bushing and housing (1 pc.): Chromate coated zinc die cast

Operating shaft: Chromate coated zinc die cast; optional brass or stainless steel

Contacts/Terminals: Gold-plated

Contact panel: Molded Thermoset plastic

Detent: Balanced system with two balls and spring

Wiper: Floating (rosebud) beryllium copper, gold plated

Seals: Shaft and bushing: double lubricated "O" ring. Panel: flat gasket - standard "O" ring - optional. Rear terminal seal: optional (see above)

Rotational torque: 10 inch ounces min.

Stop torque: 7.5 inch lb. min.

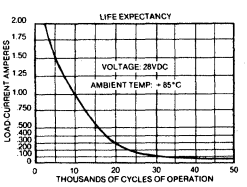
ELECTRICAL:

Contact Resistance: 20 milliohms max. thru life; 10 milliohms max. initial; see life curve

Insulation Resistance: 10,000 megohms minimum thru life; 50,000 megohms initial (as measured between mutually insulated parts)

Voltage breakdown (DWV): 600 Vac between mutually insulated parts

Life: 25,000 cycles minimum at .200 amp, 28 Vdc (resistive load) at +85°C



ENVIRONMENTAL:

Shock: MIL-STD-202 type "M" and "H" (medium and high shock)

Vibration: MIL-STD-202, method 204, test condition 3, grade 3 and also MIL-STD-810, method 514 procedure II, part 3, curve AF for X, Y and Z axis

Operating temperature range: −65°C to +85°C

Storage temperature range: (Non-operating exposure) −65°C to +125°C

General: Switches will meet or exceed the requirements of MIL-S-3786/20, thermal shock (−65°C to +125°C), salt spray, explosion, construction "E" and "F", stop strength, bushing strength (15 lb.), terminal strength, shaft and panel seals, sand and dust.

HOW TO SPECIFY

*Poles	Terminals	Indexing	Series	Contacts
1	P=PC	30°	"C"	"M" Shorting
2	S=Solder Lug	36°	Zinc	
3		45°	Housing	"B" Non-shorting
4		60°		

†Positions	Stops	Shaft Length, fms	Flat Length	Shaft Material
02	"F" Fixed	16ths of inch	16ths of inch	Z=Zinc
to		10=.625 Standard	04=.250 Standard	B=Brass
12	"R" Continuous Rotation	16=1.000 max.		S=Steel

† See schematics

fms = from mounting surface
1004 is standard. Shaft lengths up to 1.00" max. and various flat locations are optional.

Example: 1P36CB10R1004Z
1 pole, PC, 36°, C series, Non-shorting, 10 positions, continuous rotation, .625 long shaft (includes bushing), .250 long flat opposite position #1, chromate coated zinc operating shaft

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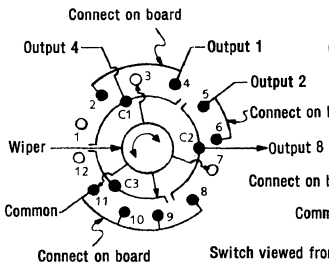
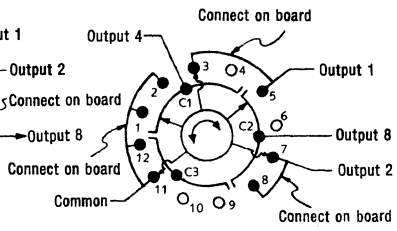
½ INCH BINARY CODED ROTARY SWITCHES

Schematics

Binary Coded Decimal Series 126



Complement Binary Coded Decimal Series 127



Switch viewed from shaft end.

• = terminals provided
o = terminals removed

Wiper shown with switch in position #1. Shaft flat diametrically opposite position #1.

Factory fixed stops available to limit rotation.
All switching is non-shorting.

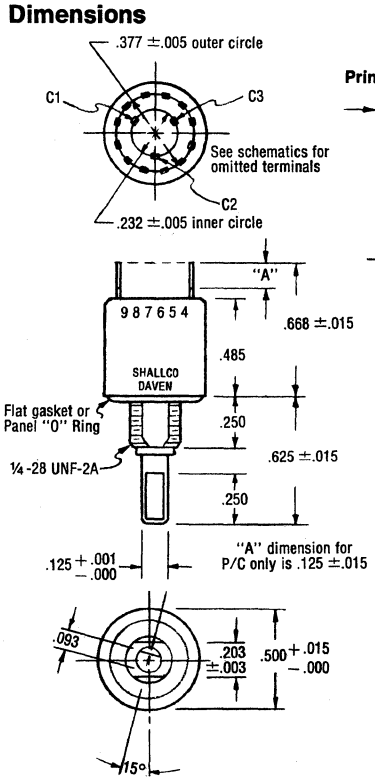
BCD

Switch Position	Common made to output: 1	2	4	8	BCD Output
1					0
2	•				1
3		•			2
4	•	•			3
5			•		4
6	•		•		5
7		•	•		6
8	•	•	•		7
9				•	8
10	•			•	9
11		•		•	10
12	•	•		•	11

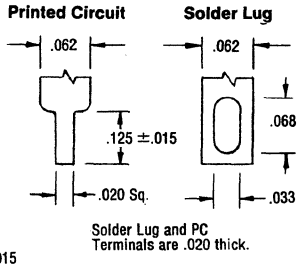
Complement BCD

Switch Position	Common made to output: 1	2	4	8	BCD Output
1	•	•	•	•	0
2			•	•	1
3	•		•	•	2
4			•	•	3
5	•	•		•	4
6		•		•	5
7	•			•	6
8				•	7
9	•	•	•		8
10		•	•		9
11	•		•		10
12			•		11

Dimensions



Terminals



SPECIFICATIONS

MATERIALS:

Bushing and housing (1 pc.): Stainless steel, nickel plated brass or chromate coated zinc die cast

Operating shaft: Stainless steel, brass or chromate coated zinc die cast

Contacts: Copper alloy with plated gold over nickel

Detent: Balance double balls of brass. Spring is steel

Shaft & panel seals: Double "O" ring shaft seal is standard. Flat gasket panel seal is standard. "O" ring panel seal is optional

Contact panel: Diallyl phthalate per MIL-M-14

ELECTRICAL:

Life: Up to 25,000 cycles with a resistive load of .200 Amps, 28 volts DC max.

Contact Resistance: 20 milliohms initial; 100 milliohms after life

Insulation Resistance: 50,000 megohms initial; 10,000 megohms after life

Voltage breakdown (DMV): 500 VAC between mutually insulated parts

MECHANICAL:

Stop torque: 7.5 pound inches minimum

Rotation torque: 8 to 24 ounce inches at room temperature

Optional seal: Can be sealed to withstand total immersion in FC 40/43 for 30 seconds @ +85°C

Long Life: To insure prolonged use or storage life, the contacts of the ½" binary coded switch are constructed with gold plating over silver. Shafts are available in lengths up to 1.00 inch (fms) in brass, stainless steel or zinc die cast to meet your specific requirements. Dougle "O" ring shaft seals are standard.

Compatible: Series 126 is available with up to 12 positions fixed stop, or continuous rotation, binary coded decimal (BCD) with 30° indexing. Its complement, the Series 127, is also furnished with up to 12 positions BCD. Both P/C and standard solder terminals are available.

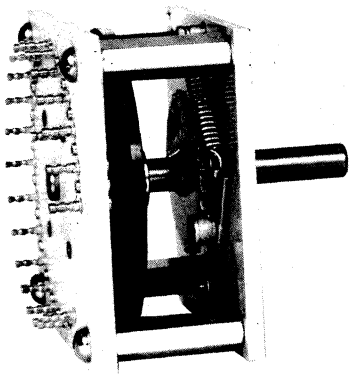
PART NUMBER CODING

PART NUMBERING SYSTEM

126 or 127 ■ ■ - ■ ■ - ■ - ■ ■ - ■

- Series: 126 or 127
- Case material: S = Stainless steel; B = Brass; Z = Die cast zinc
- Shaft material: S = Stainless steel; B = Brass; Z = Die cast zinc
- Number of positions: 2 through 12; Add "CR" for continuous rotation
- Type of terminals: P = P.C.; S = Solder lug
- Shaft length from mounting surface: 5 through 16 in 1/16" increments
- Flat length: 0 through 8 in 1/16" increments

Shallco ROTARY SWITCHES SERIES C, D, AND E

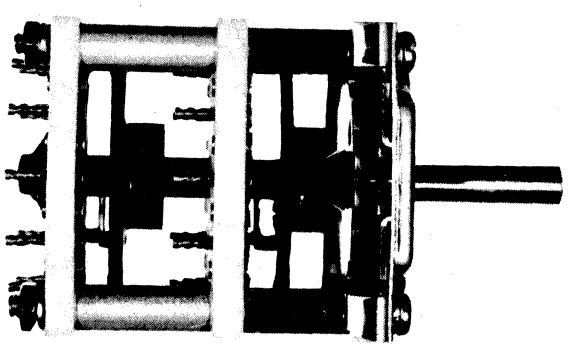


SPECIFICATIONS

GENERAL:
Meets or surpasses requirements of MIL-S-3786

ELECTRICAL:
Current carrying capacity—10 amps.
Current switching capacity—up to 2 amps.
Contact resistance—Initial—.005 ohms max.
Contact resistance—After Life—.010 ohms max.
Insulation resistance—50,000 megohms
Dielectric withstanding voltage—1500V rms
Dielectric withstanding voltage after life—1000V rms

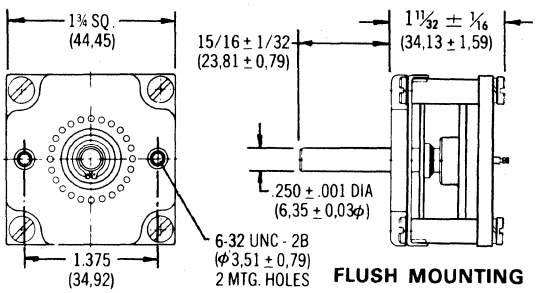
MECHANICAL:
Rotational life—50,000 cycles* min.@.250 amps.@85° C
Stop torque—50 In. Lbs.
Type construction—Open frame
Stops—Factory set to desired position.
Optional features—⅜-32 UNEF-2A bushing mount with anti-rotation pin. Shaft and front panel "O" ring seals. Spring return feature.
Concentric shafts available
Progressive shorting available
*One cycle = one full cw plus one full ccw rotation.



FEATURES OF SHALLCO 1¾, 2¼, 2¾ SQUARE SERIES C, D, E SINGLE DECK SWITCH MULTI DECKS AVAILABLE

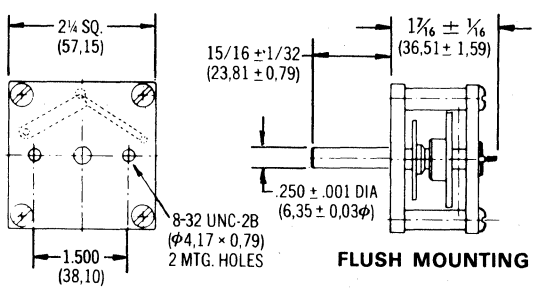
- Meets or surpasses requirements of MIL-S-3786
- Available in one pole 2-48 position through four pole 2-15 position. See ordering information
- High current carrying capacity
- Low contact resistance

SERIES C



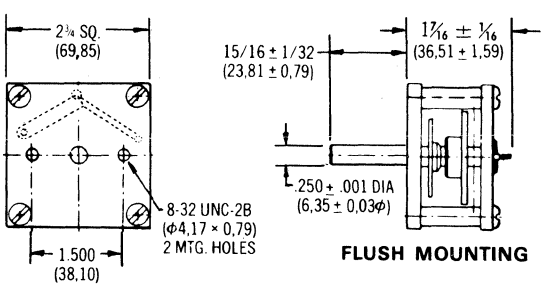
FOR ADDITIONAL DECKS ADD. 29/32 (23,02) PER DECK

SERIES D



FOR ADDITIONAL DECKS ADD 1 1/16 (26,99) PER DECK

SERIES E



FOR ADDITIONAL DECKS ADD 1 1/16 (26,99) PER DECK.

REQUEST CATALOG IO FOR COMPLETE INFORMATION

NUMBERS IN ( ) ARE METRIC EQUIVALENT (MILLIMETERS)

USE ORDER FORM

SHALLCO INC. / SMITHFIELD IND. PARK / P.O. BOX 1089 / SMITHFIELD, N.C. 27577 / (919) 934-3135

SHALLCO ORDERING INFORMATION

SHORTING				NON-SHORTING		
SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE	NUMBER OF POLES	SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE
111-CM	15°	24*	one	111-CB	30°	12**
112-CM	11¼°	32*		112-CB	22½°	16**
121-CM	15°	11	two	121-CB	30°	6
122-CM	11¼°	15		122-CB	22½°	8
131-CM	15°	5	three	131-CB	30°	3
132-CM	11¼°	7		132-CB	22½°	4
141-CM	15°	5	four	141-CB	30°	3
142-CM	11¼°	7		142-CB	22½°	4

*Maximum number of positions may be used with continuous rotation only.
**Normally supplied as continuous rotation; stops available on request.

SHORTING				NON-SHORTING		
SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE	NUMBER OF POLES	SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE
111-DM	15°	24*	one	111-DB	30°	12*
112-DM	11¼°	32		112-DB	22½°	16*
113-DM	7½°	48		113-DB	15°	24*
121-DM	15°	24*	two	121-DB	30°	12*
122-DM	11¼°	32		122-DB	22½°	16*
123-DM	7½°	23		123-DB	15°	12
141-DM	15°	11	four	141-DB	30°	6
142-DM	11¼°	15		142-DB	22½°	8
143-DM	7½°	11		143-DB	15°	6

*Normally supplied as continuous rotation; stops available on request.

SHORTING				NON-SHORTING		
SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE	NUMBER OF POLES	SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE
111-EM	15°	24*	one	111-EB	30°	12*
112-EM	11¼°	32		112-EB	22½°	16*
113-EM	7½°	48		113-EB	15°	24*
121-EM	15°	24*	two	121-EB	30°	12*
122-EM	11¼°	32		122-EB	22½°	16*
123-EM	7½°	48		123-EB	15°	24*
141-EM	15°	11	four	141-EB	30°	6
142-EM	11¼°	15		142-EB	22½°	8
143-EM	7½°	23		143-EB	15°	12
161-EM	15°	7	six	161-EB	30°	4
162-EM	11¼°	9		162-EB	22½°	5
163-EM	7½°	15		163-EB	15°	8
181-EM	15°	5	eight	181-EB	30°	3
182-EM	11¼°	7		182-EB	22½°	4
183-EM	7½°	11		183-EB	15°	6

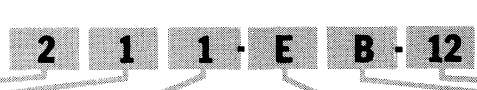
*Normally supplied as continuous rotation; stops available on request.

(Order Form to order Series C, D, E)

Order by using a six-place "shorthand" description

Example: 211—EB—12

Rotary Selector Switch, two decks, 1 pole per deck, 30° of spacing between positions, E series, non-shorting, 12 positions.



PLACE 1	PLACE 2	PLACE 3	PLACE 4	PLACE 5	PLACE 6
indicates number of decks:* 1 = One Deck 2 = Two Decks 3 = Three Decks, etc.	indicates number of poles per deck: 1 = One Pole 2 = Two Poles 3 = Three Poles 4 = Four Poles	indicates degrees of spacing between positions: Shorting 1 = 15° 2 = 11¼° 3 = 7½° Non-Shorting 1 = 30° 2 = 22½° 3 = 15°	indicates series of switch: C = C Series D = D Series E = E Series	indicates Shorting or Non-Shorting: M = Shorting (make before break) B = Non-Shorting (break before make)	indicates number of positions per pole: 2 = Two positions 3 = Three positions 4 = Four Positions, etc.

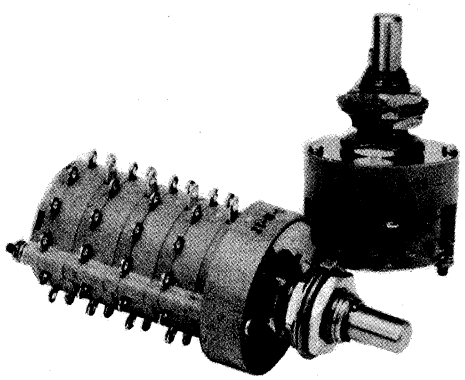
Request catalog 10 for more detailed information and additional switch types.

Shallco

SHALLCO, INC.
PRECISION ELECTRONIC COMPONENTS
SMITHFIELD INDUSTRIAL PARK • P.O. BOX 1089 • SMITHFIELD, N.C. 27577 • 919/934-3135

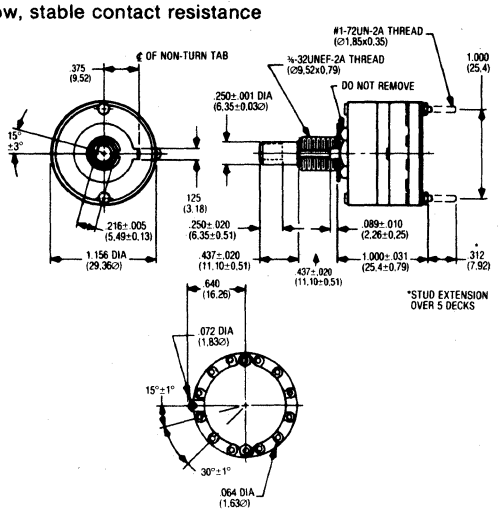
series **J**

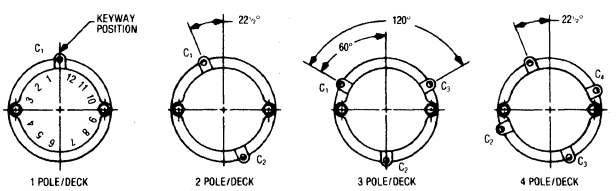
ROTARY SELECTOR SWITCHES



FEATURES OF SHALLCO ONE INCH SERIES J SINGLE OR MULTIDECK SWITCH

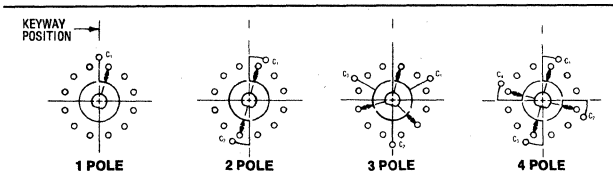
- Designed to meet requirements of MIL-S-3786
- Closed construction
- Smooth, positive detent
- Low, stable contact resistance



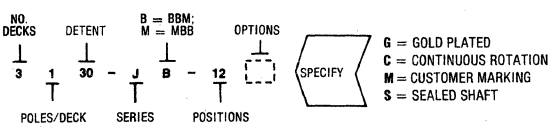


SHORTING				NON-SHORTING		
CODE	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE	NUMBER OF POLES	CODE	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE
1130-JM	30°	12	ONE	1130-JB	30°	12
1230-JM		6	TWO	1230-JB		6
1330-JM		4	THREE	1330-JB		4
1430-JM		3	FOUR	1430-JB		3

SINGLE DECK SHOWN. FOR MULTI-DECK, INCREASE FIRST DIGIT OF ABOVE CODES.



(VIEWED FROM SHAFT END AND SHOWN IN POSITION 1, EXTREME CCW POS.)



SPECIFICATIONS

GENERAL:

Designed to meet the requirements of MIL-S-3786/SR04

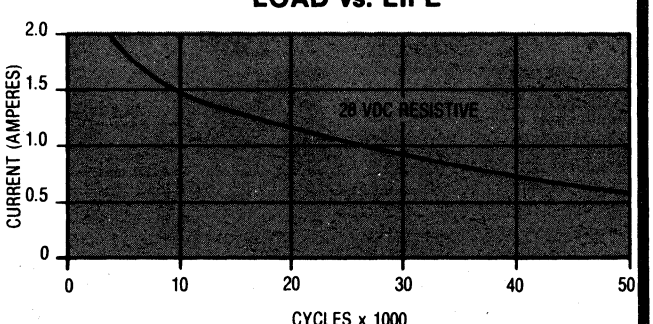
ELECTRICAL:

Current carrying capacity - 10 amperes
Current switching capacity - 1 ampere (28 VDC, Resistive)
Contact resistance - Initial - 5 milliohms maximum
Contact resistance - After Life - 20 milliohms maximum
Insulation resistance - 50,000 megohms
Voltage breakdown - 1000 VAC
Voltage breakdown - After Life - 500 VAC minimum

MECHANICAL:

Rotational life - 50,000 cycles
Stop torque - 15 pound-inches minimum
Construction - Enclosed
Stops - Factory set
Torque - 8 to 120 ounce-inches (dependent on decks, poles/deck)
Shaft flat - Opposite moving contact, see diagrams

LOAD vs. LIFE



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Your design deserves Shogyo quality and reliability.
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Shogyo Service . . . comprehensive, responsive and fast
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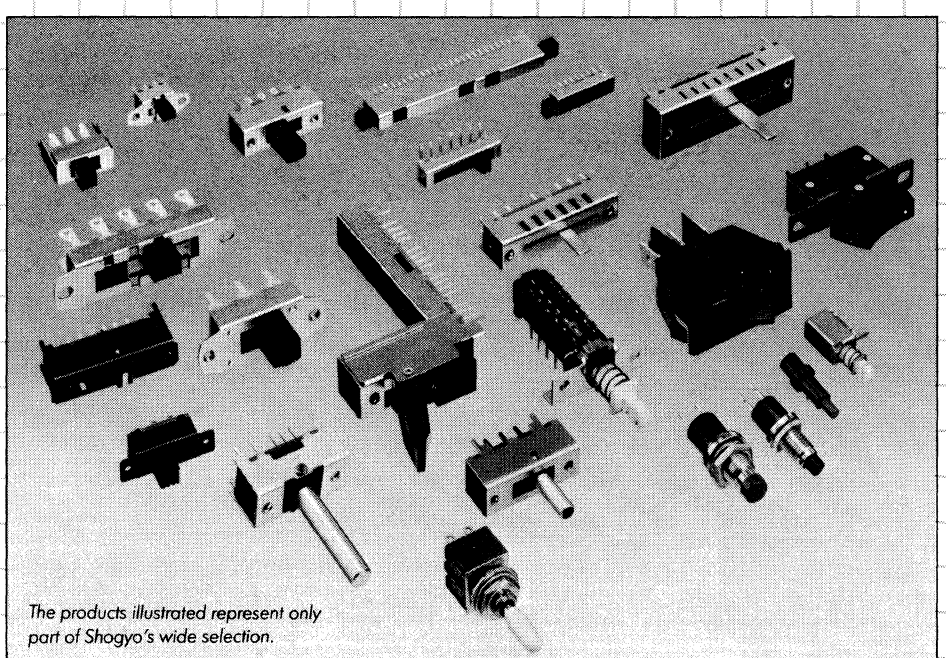
and . . .
Shogyo Selection . . . with complete custom design capabilities

Including a diverse offering of:
- *Slide switches*
- *Toggle switches*
- *Power switches*
- *Push button switches*
- *Lever action switches*
- *Push-slide switches*
- *Leaf switches*
- *Rotary-slide switches*

And featuring:
- *PC or solder mount*
- *An extensive variety of sizes, pin types, pole and position quantities, ratings, contact and insulation resistances, and withstand voltages*
- *Electrical/mechanical endurances up to 30,000 cycles*
- *Silver plated contacts*



The products illustrated represent only part of Shogyo's wide selection.

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For complete product listings and specifications, request our free catalog.

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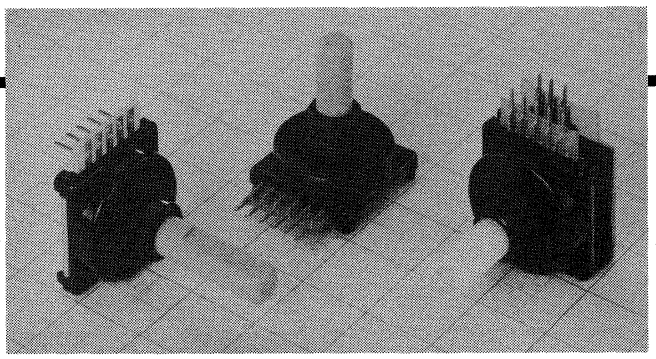
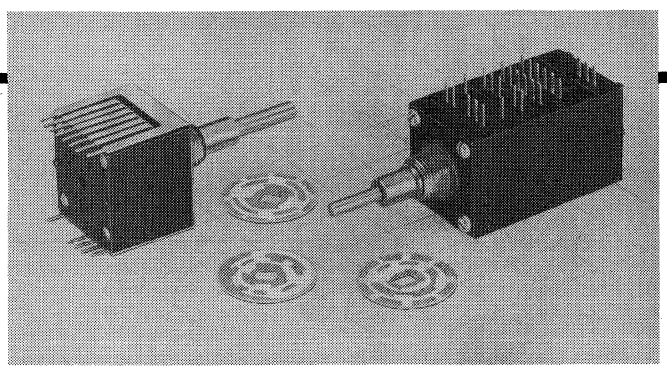
- Detented or non-detented versions
- All quadrature two bit codes



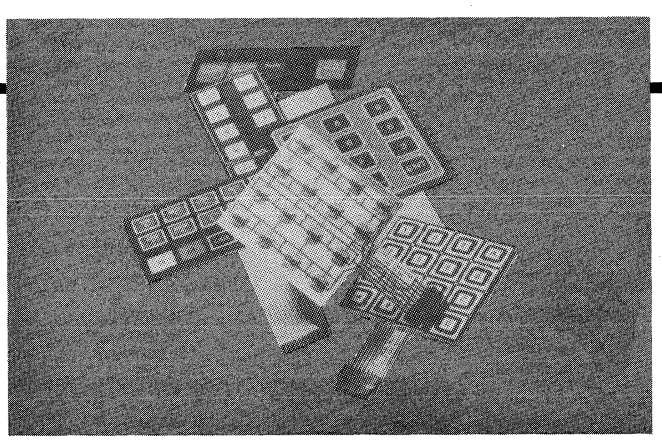
Encoder
LCE



MM P/REL
Rotary Switches

- Just .865″ square
- Indexing angles: 60°, 45°, 36°, 30°, 22.5°, 20°, 18°, 15°, 12.8°, 11.25°, 10°
- Programmable to customer truth table
- Enclosed, wave solderable construction
- 60,000 cycles

- Flexible or PC board construction
- X-Y or Common Bus Configuration
- ESB, EMI, RFI shielding
- Non-tactile or tactile feedback
- Embossed overlays available
- New! Shorting contact feature



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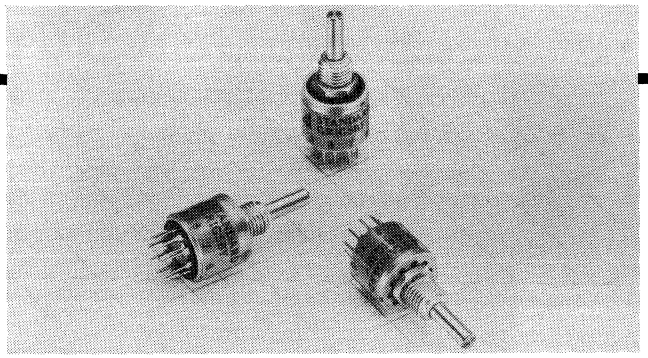
Custom Assembly



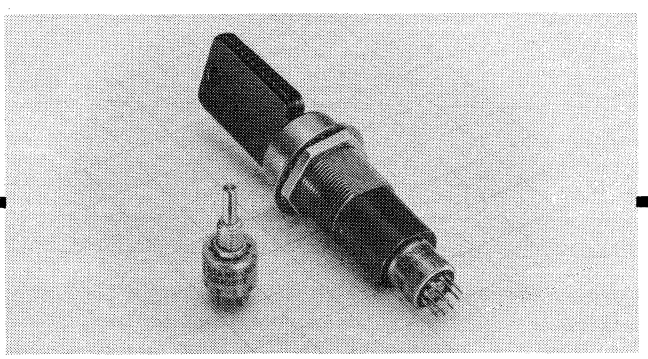
Now at an affordable price!

- Just .500″ diameter
- Constructed to meet rigid military specs
- Sealed or unsealed versions
- Fixed or adjustable stops available
- 4 Indexing angles available

SG Series SD
Rotary Switches

- Long life
- No moving contacts
- Low power consumption
- With or without pushbutton
- TTL compatibility
- 16, 24 or 32 positions
- Custom designs available

Optical Encoders



- Utilizes new 1/2″ SD rotary switch
- Anti-static discharge protection available
- Number of security levels offered
- Various circuits variations available
- Choice of angles of throw

SG Series SDL
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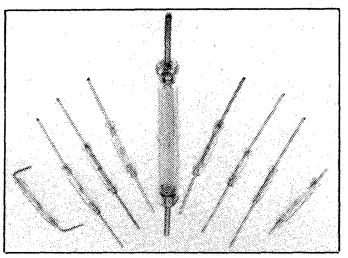
Setting Performance Standards Throughout the World . . .



- ☐ Tested to 1 billion operations
- ☐ Totally automated production
- ☐ Highest quality, based on computerized SPC, yielding unmatched uniformity.
- ☐ Custom cutting and forming for difficult applications
- ☐ Several standard contact materials for a broad range of applications

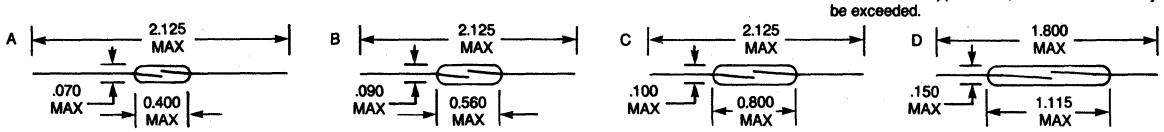
Switch Specifications:

Switch Type	Switch Size	Lead Dia. (inches typ.)	Contact Material	Power Rating (VA max.) See note 3	Switching Current (amps max.)	Carry Current (amps max.)	Switching Voltage (volts DC max.)	Switching Voltage (volts AC rms max.)	Breakdown Voltage (volts DC min.)	Contact Resistance (milliohms max.)	Insulation Resistance (ohms min.)	Operate Time including Bounce (ms typ.)	Resonant Freq. (kHz min.)	Pull-in Range (ampere-turns)	Typical Drop-Out for 20 AT Pull-in	Typical Drop-Out for 40AT Pull-in	Vibration 10-2000 Hz (G's max.)
GR400	A	0.018	Rhodium	5	0.5	1.0	50	50	150	150	10^{12}	0.5	4.5	10-40	14	22	50
GR560	B	0.022	Rhodium	10	0.5	1.0	100	125	250	100	10^{12}	0.6	3.0	9-50	14	28	50
GK560	B	0.022	Gold-Nickel Alloy	10	0.5	1.0	100	125	250	150	10^{12}	0.6	3.0	9-70	10	15	50
GHG560	B	0.022	Amalgam	10	0.5	1.0	100	125	250	75	10^{12}	0.4	3.0	10-40	10	17	50
PR560	B	0.022	Rhodium	10	0.5	1.0	200	250	600	100	10^{12}	0.6	3.0	15-60	14	28	50
TS560	B	0.022	Noble Metal	5	0.5	1.0	50	125	200	250	10^{9}	1.0	3.0	10-100	N/A	N/A	30
GR100	C	0.022	Rhodium	10	1.0	2.0	200	250	350	100	10^{12}	0.8	2.2	9-60	12	22	40
PR100	C	0.022	Rhodium	10	1.0	2.0	250	350	1000	100	10^{12}	0.8	2.2	20-60	12	22	40
GR100F	C	0.022	Rhodium/ Copper	10	1.0	2.0	200	250	350	75	10^{12}	0.8	2.2	15-50	17	32	40
TS100	C	0.022	Noble Metal	5	1.0	2.0	100	125	300	250	10^{9}	1.0	2.2	10-100	N/A	N/A	40
GK126	C	0.026	Gold-Nickel Alloy	25	1.5	2.5	200	250	350	150	10^{12}	1.0	2.5	15-80	10	20	30
GHG126	C	0.026	Amalgam	15	1.5	2.5	200	250	350	75	10^{12}	0.8	2.5	20-60	10	20	30
PR150	D	0.026	Rhodium	30	1.5	3.0	250	400	1000	100	10^{12}	1.5	1.2	20-60	10	20	30

1) Contact resistance measurements are made at 10mA from a 1 volt source with 50% overdrive.

2) Storage temperature - 50°C to +155°C
Operate temperature - 40°C to +125°C

3) Consult factory for specific application assistance when using switches at or near maximum rated load. In some applications, maximum loads may be exceeded.



Contact Materials — Dry Circuit & Power Switching

Rhodium

Industry standard — recommended for general purpose applications. Low resistance, high melting point metal provides millions of trouble-free operations at low and medium loads.

Gold-Nickel Alloy

Specially developed plating and post assembly conditioning makes this alloy particularly resistant to hostile transients encountered in telecommunication circuits. Suitable for medium and high power loads.

Mercury Amalgam

Precision controlled mercury amalgam ensures contact resistance stability at low level switching over hundreds of millions of operations as required in automatic test equipment and instrumentation applications.

Detail application assistance for custom forming and proximity applications.

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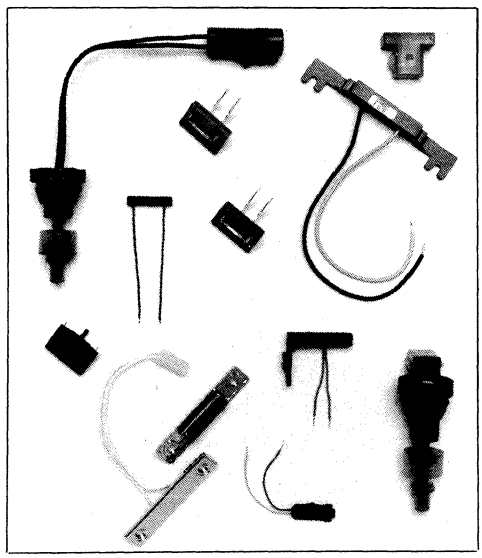
EEM 1988

For Manufacturers' sales office, see yellow pages

Standex Electronics

CUSTOM MAGNETIC SENSORS



Standex Electronics designs and builds magnetic proximity sensors for a wide range of markets and applications. The basic sensing element for most applications is the hermetically sealed reed switch. Other technologies are used as the application dictates.

- ☐ Hi-Rel Switching — hermetically sealed contacts — billions of operations switching low level loads
- ☐ No External Power Required
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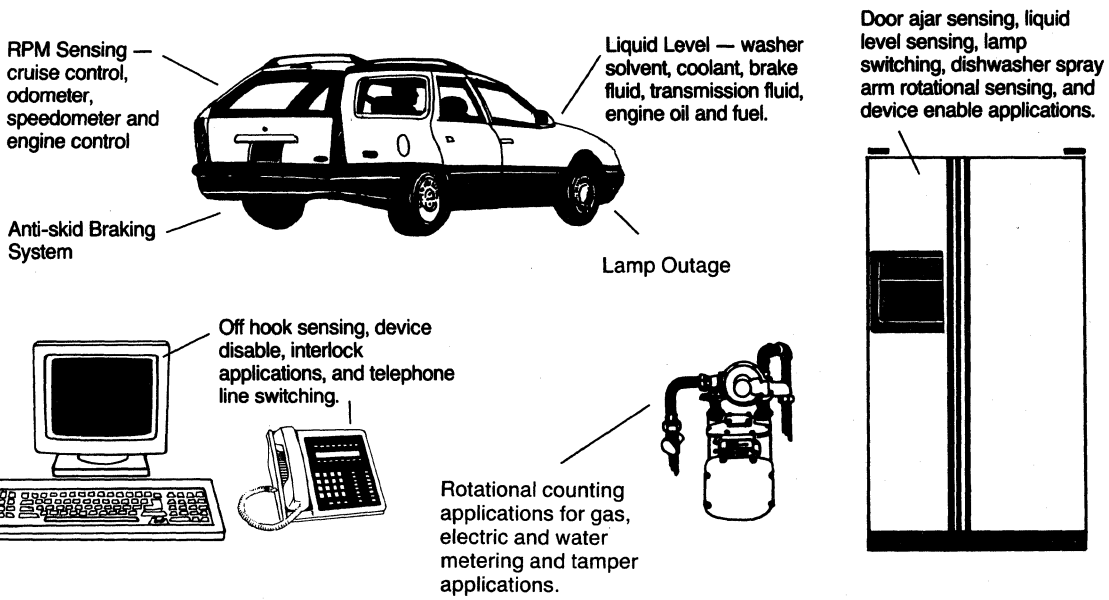

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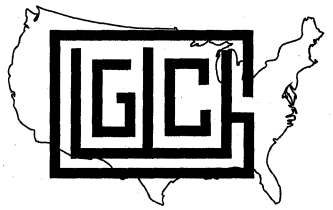
The world's best known companies are turning to Standex Electronics for magnetic proximity sensors.

Standex magnetic proximity sensors are used by companies such as General Electric, Ford, Digital Equipment Corp., IBM, and Northern Telecom. Call us and find out why.

EEM 1989



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- Gaynor
- Licon/ITW
- Marquardt
- MEC
- New England Controls
- Omron
- Oslo Controls
- Pollak
- RCL/ITW
- SoLiCo/Taiko
- Switchcraft
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TERMINAL BLOCKS
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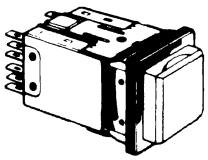
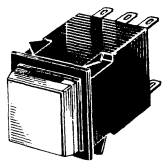
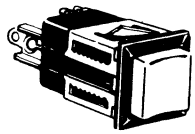


SERIES PL —
"Push-Lite" SWITCH



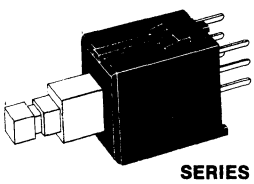
SERIES BXL —
"Box Switch" SWITCH



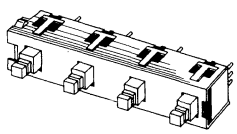
SERIES US & LUS —
"Uniswitch" SWITCHES

Standard and miniature non-illuminated or illuminated switches offer broad switching capabilities in minimal mounting space. All switches are easy to mount and are available with a variety of actuator colors, circuitry, terminal styles and mechanical functions. Current ranges from 250 mA to 8 A.

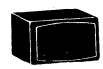
IBS MINIATURE PUSHBUTTON SWITCHES



SERIES 98000R



Type I



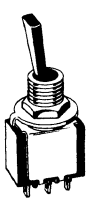
Type II

Series 98000R IBS miniature pushbutton switches can be gang mounted on common frames, up to 12 stations long with center-to-center spacing of 10 mm, 15 mm or 20 mm. Available with interlock, non-lock, momentary or push-lock/push-release mechanical functions. .130 in. (3.30 mm) x .130 in. (3.30 mm) square plungers accept a full line of industry standard pushbuttons. Switches are stocked without pushbuttons due to wide variety that can be used. Order pushbuttons separately. Switches have .157 in. (4 mm) long PC terminals for mtg. single- or double-sided PC boards up to .094 in. (2.39 mm) thick. Close stacking (centers) permit high density within minimum front panel space. Plunger travel: .144 in. (3.66 mm).

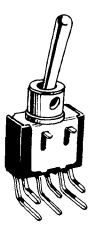
IBS PUSHBUTTONS

IBS pushbutton faces are concave for operator convenience with full legend capability. Can be mounted horizontally or vertically. Pushbutton dimensions: Type I — .388 in. (9.86 mm) W x .216 in. (5.49 mm) H x .425 in. (10.80 mm) D. Type II — .464 in. (11.79 mm) W x .288 in. (7.32 mm) H x .432 in. (10.97 mm) D. Pushbuttons must be ordered separately.

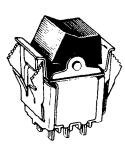
MULTI-SPEC® INTERNATIONALLY APPROVED SWITCHES



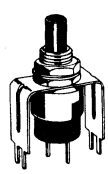
Series A
Miniature
Flat Toggle



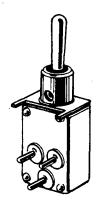
Series A
Miniature Toggle
Right Angle PC,
Horizontal Lever
Action



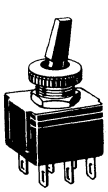
Series B
Miniature
Rocker



Series F
Subminiature
Pushbutton,
Straight PC



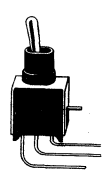
Series J
Miniature
Low Profile
Toggle



Series UL4600
High Current
Toggle

Series UL4700
Pushbutton

Series P
Rocket Power
Switch



Series M
Microminiature
Toggle

1-4 pole rocker, toggle and pushbutton switches offer a wide selection of standard and special features. In miniature, subminiature and microminiature sizes, they are designed for bushing, snap-in or PC board mounting. Terminal choices include solder lug, PC, wire-wrapping, quick-connect and sealed or unsealed. They have most European approvals. There's a selection of gold and silver contacts with ratings from 100 mA to 20 A.

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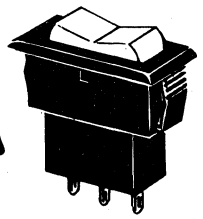
Switchcraft

A **Raytheon** Company

SERIES 50 MINIATURE ROCKER SWITCHES



(applied for) **(actual size)**

Rocker Color				Function[1]			
Black	Red	Gray	Blue	III	II	I	Circuit
503B2NN	503B2NR	503B2NG	503B2NBL	On	—	(On)	SPST
502B2NN	502B2NR	502B2NG	502B2NBL	On	—	On	SPST
506B2NN	506B2NR	506B2NG	506B2NBL	(On)	Off	(On)	SPDT
507B2NN	507B2NR	507B2NG	507B2NBL	On	Off	(On)	SPDT
504B2NN	504B2NR	504B2NG	504B2NBL	On	Off	ON	SPDT

[1]Parentheses = momentary function;
no parentheses = locking function.

Single pole miniature, instrument-grade rocker switches provide up to 4 A, 125 V switching and snap-in mounting for car phones, mobile radios, hand held instruments, and other applications. Switches have epoxy sealed solder lug terminals and offer a choice of 2- or 3-position (momentary and/or locking combinations) and four rocker colors. Dim.: .41 in. (10.3 mm) w. x .913 in. (23.2 mm) h. x .772 in. (19.6 mm) lg. Mounts in .35 in. (8.9 mm) x .734 in. (18.65 mm) in panels up to .118 in. (3 mm) thick max.

SERIES 100 — SINGLE POLE, 2- & 3-POSITION NON-ILLUMINATED ROCKER SWITCHES

UL, CSA and VDE approved switches have up to 8 A switching; 1A, 1C or 1K circuitry; solder or .187 in. quick connect terminals; locking action; and black or white housings and rockers. Additional approvals include: SEMKO (Sweden), DEMKO (Denmark), and NEMKO (Norway). Snaps into .75 in. (19 mm) x .51 in. (13 mm) panel openings from front. Matching indicator lights available; contact Switchcraft. Dim.: .744 in. long x .508 in. wide x .492 in. behind panel (excluding terminals).

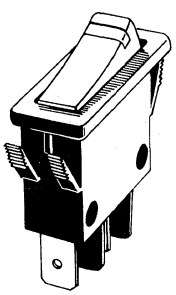
(Other European Approvals available)

Part No.	Circuitry	Terminals	Housing Color	Rocker Color	Current Rating
100B2NN	1A, ON-OFF	Solder Lug	Black	Black	1
100B2BB	1A, ON-OFF		White	White	1
102B2NN	1C, ON-ON		Black	Black	1
102B2BB	1C, ON-ON		White	White	1
104B2NN	1K, ON-OFF-ON		Black	Black	2
104B2BB	1K, ON-OFF-ON		White	White	2
100B98NN	1A, ON-OFF	Quick Connect	Black	Black	1
100B98BB	1A, ON-OFF		White	White	1
102B98NN	1C, ON-ON		Black	Black	1
102B98BB	1C, ON-ON		White	White	1
104B98NN	1K, ON-OFF-ON		Black	Black	2
104B98BB	1K, ON-OFF-ON		White	White	2

NOTES: [1] UL & CSA — 8 A, ¼ hp, 250 V AC; 8 A, 12 V DC non-inductive load.
[2] UL & CSA — 5 A, ⅓ hp, 250 V AC; 5 A, 12 V DC non-inductive load. VDE — 6 (4) A, 250 V AC.

SERIES 200 — SINGLE POLE, 2-POSITION, HIGH CURRENT, ILLUMINATED & NON-ILLUMINATED ROCKER SWITCHES

UL & VDE approved (CSA applied for) switches have up to 16 A switching; 1A or 1C circuitry; solder or .25 in. quick-connect terminals; locking action; matte black or white housings; red, amber, matte white, matte black & matte black/red rockers. Snaps into 1.181 (30 mm) x .433 in. (11 mm) panel openings from front. Inrush current: 200 A, 250 V AC, 10 ms. Matching indicator lights available; contact Switchcraft. Dim.: 1.17 in. long x .551 in. wide x 1.118 in. (quick connects) behind panels.



(Other European Approvals available)

NOTES: [1]UL, CSA & VDE approved — 16 A, 3/4 hp; 250 V AC; 12 A, 28 V DC non-inductive load. VDE approved — 16 (6) A, 250 V AC.

[2]UL & CSA approved — 16 A, 250 V AC.

SERIES 200—Locking Action

Part Number	Circuitry	Terminals	Housing Color	Rocker Color	Illum.	Current Ratings
200B2NN	1A, ON-OFF	Solder Lug	Matte Black	Matte Black	No	1
200B2NNR	1A, ON-OFF		Matte Black	Matte Black/Red		
200B5NN	1A, ON-OFF	Quick Connect	Matte Black	Matte Black		
200B5NNR	1A, ON-OFF		Matte Black	Matte Black/Red		
202B2NN	1C, ON-ON	Solder Lug	Matte Black	Matte Black		
202B2NB	1C, ON-ON		Matte White	Matte White		
202B5NN	1C, ON-ON	Quick Connect	Matte Black	Matte Black		
202B5NB	1C, ON-ON		Matte White	Matte White		
200NB2ANKR	1A, ON-OFF	Solder Lug	Matte Black	Red	Yes	2
200NB2ANKA	1A, ON-OFF		Matte Black	Amber		
200NB2ABKR	1A, ON-OFF		Matte White	Red		
200NB2ABKA	1A, ON-OFF		Matte White	Amber		
200NB5ANKR	1A, ON-OFF	Quick Connect	Matte Black	Red		
200NB5ANKA	1A, ON-OFF		Matte Black	Amber		
200NB5ABKR	1A, ON-OFF		Matte White	Red		
200NB5ABKA	1A, ON-OFF		Matte White	Amber		

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Switchcraft

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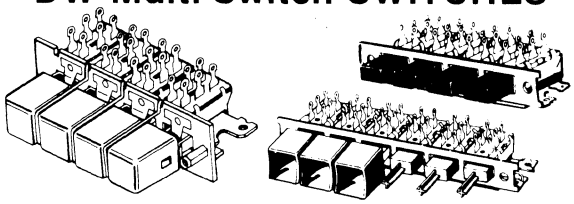
DW Multi-Switch SWITCHES



The DW (double-wipe) Multi-Switch switch is available up to 18 stations in a single row & ganged assemblies with interaction between rows. Max. switching per station is 4-C (4PDT). Each station utilizes specially designed switching modules with U-shaped, high reliable bifurcated contactors rated at 3 amps, A.C.; 0.5 amp, D.C., 125 V, non-inductive load. DW Multi-Switch switches are available in 5 series: 65000, 66000, 67000, 70000, and 71000. All provide four standard functions: **Interlock** — actuating a pushbutton automatically restores to normal the pushbutton previously actuated. **Lock-Out** — prevents operation of more than one pushbutton at a time. This feature is included on all interlock switches. **Non-Lock** — each pushbutton has momentary action. **All-Lock** — all pushbuttons, except release, lock when depressed. All pushbuttons restored to normal by actuating (momentary) release pushbutton. **Push-Lock/Push-Release** — pushbuttons lock when depressed and release when again depressed. **All Series** — pushbuttons on $^{3}/_{8}$" centers. DW Multi-Switch switches are available in single row assemblies with interlock and all-lock functions from one to twelve stations; with non-lock and push-lock/push-release functions up to 18 stations.

Series 65000—Non-illuminated, integral pushbutton.
Series 66000—Non-illuminated version of Series 67000.
Series 67000—Illuminated pushbuttons.
Series 70000, 71000—Non-illuminated, cross-rib plungers, accept up to 12 different styles of pushbuttons.

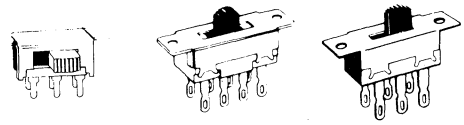
MOMENTARY Button Switch SWITCHES

Miniature pushbutton switches are enclosed in metal housing. Terminals: solder lug. Contacts: internal nickel silver, 250 mA, 30 W max., AC, non-inductive. **Series 903, 913:** behind panel mtg. **Series 923, 933:** front mount. All switches: bushing mount.

903 & 913

923 & 933

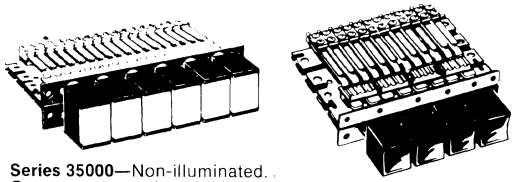
"Tini-Slide" SWITCHES



Miniature "**Tini-Slide**" switches are precision locking switches with unique lift/wipe/slide action and silver contacts. Ratings: 0.5 A, 125 V AC or DC, non-inductive. 2- and 3-position types. U.L. listed. Solder lugs or PC terminals. Crowned knobs.

Series 56000 — DPDT & DPTT **Series C63000 — 4PDT**
Series C62000 — Side Knobs

littel Multi-Switch SWITCHES



Series 35000—Non-illuminated. Compact, rugged multiple-station switches feature up to 6PDT per station in .6 square inch space. Excellent selection of contacts for low or high current switching. Plungers accept nine different Switchcraft pushbuttons. Mechanical functions are: interlock, all-lock, non-lock and push-lock/push-release. One to 18 stations; many legends are possible.

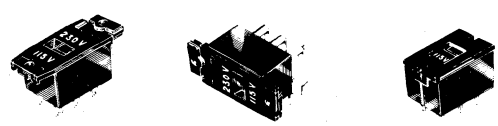
Series 36000—Non-illuminated companion series to Series 37000. All other basic functions and features are same as Series 35000.

Series 37000—Single lamp illumination at each station. All other basic functions and features are same as Series 35000.

Series 38000—Twin lamp illumination using low power, low heat lamps. All other basic functions and features same as Series 35000.

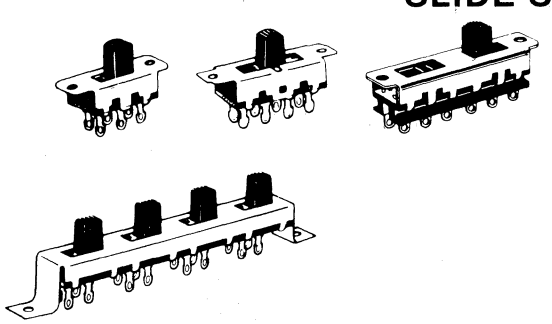
EUROPEAN LINE VOLTAGE SELECTOR SWITCHES

NEW! 10 A SWITCH



Durable slide switches provide quick and easy programming/ selection of 115 V or 230 V primary power in electrical/electronic equipment for international marketplace. UL, CSA and VDE (Verband Deutscher Elecktrotechniker) approved. Mountings are flange or PC (straight or right angle). DPDT, locking. Ratings: UL & CSA: 2A, 250 V AC & 4A, 125 V AC. VDE: 2 A, 250 V AC. Switches also designed to comply with CEE and IEC requirements. Legends: 115 V-230 V. New 10 A switch rated: 10.1 A, 125 V AC; 5 A, 250 V AC. Submitted to UL & CSA for listing.

SLIDE SWITCHES



Instrument quality Switchcraft slide switches have low cost, precision "double-wipe" contacts with "U"-shaped bifurcated contacts rated at 0.5 A DC, 3 A AC, 125 V, non-inductive. Solder lugs have $^{5}/_{64}$" dia. center holes and wrap-around notch. Various knob styles: crowned, rocker, flush. U.L. & C.S.A. listed types and heights. Up to 4 poles of switching with locking or momentary action.

Series 46000 — General purpose slide switches
Series 47000 — Tandem switches
Series 48000 — 4-gang slide switches

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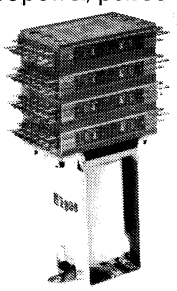
T-Bar THE SOURCE FOR MULTI-CONTACT RELAYS AND SWITCHES

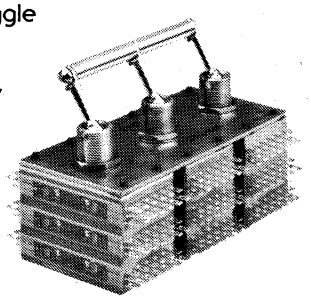
RELAYS

General purpose 800-series, with contact ratings to 5A, and 900-series with low-level to 1A ratings. Both available with 12, 24, 36, 48, and 52 poles in form A (N.O.), form B (N.C.), and form C (D.T.) and 60 poles, form A. Operation from continuous ac or dc power, pulsed power (latching), or solid-state logic. Environmentally sealed and hermetically sealed relays for aerospace, shipboard and ground support hostile environments are available.



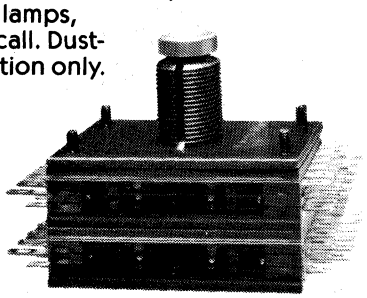
TOGGLE SWITCHES

Same 800-series and 900-series as relays. Available with 12 to 144 poles in form C, maintained action. Typical life in excess of 50,000 operations. Normally dust-tight, T-Bar toggle switches are also available in an environmentally sealed version.



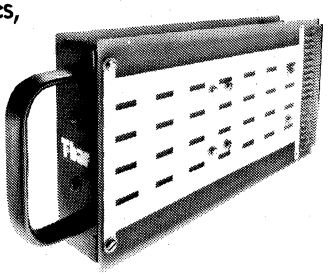
PUSHBUTTON SWITCHES

Momentary pushbutton switches, 800-series only are available with 12 to 36 poles, form C. Typical applications include press-to-test for control panel lamps, reset, and all-call. Dust-tight construction only.



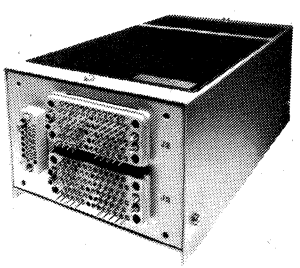
PLUGGABLE MODULES

Pluggable modules use standard T-Bar multi-contact relays in either a one relay configuration or two relays independently controlled with no common failure mode. Plugged into T-Bar printed circuit card cages, any desired switching configuration can be established by backplane wiring.



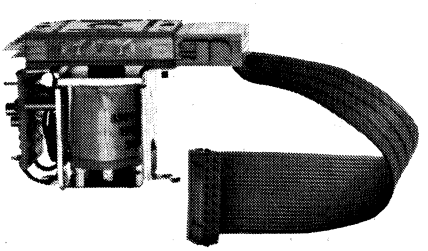
SELECTOR UNITS

Standard T-Bar relays, 800 or 900-series, are packaged as an automatic selector unit to random or sequential circuit selection and addressed through binary weighted coils. Available as Treeselect (all unaddressed lines remain open) or Norselect (all unaddressed lines connected to a bus), selector units can be provided with 16 to 128 positions.



CONNECTORS

T-Bar plug-on connectors are available for all relays and switches. Each connector provides wiring to one-half of a wafer deck (6 poles; A, B, or C). A 36-pole device, for example, requires 6 connectors. Two connector versions are available. One accommodates individual wiring with crimp-on connectors; the other is used to mass-terminate ribbon cable.



T-Bar INCORPORATED
a DATA SWITCH company

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Tech labs SINCE 1935

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- Hi-Pot 1500 V RMS Min.
- Contact Resistance less than .01 Ohm
- Low Thermal EMF
- Low Capacitance between Contacts
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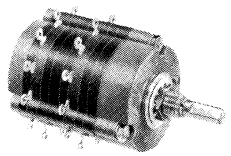
ROTARY SWITCHES

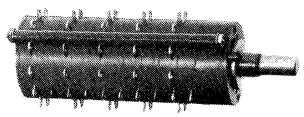
TYPE 2000



- Low Contact Resistance <1 Mili-Ohm
- Insulation Resistance >1 Million Meg-Ohms
- Sizes: 2$\frac{3}{32}$" Dia. x 1$\frac{1}{16}$" Depth/Deck
- SP or DP/Deck
- 6 or 12 Pos./Pole MBB
- Indexing: 30° or 60°
- Current Capacity: 5 Amps Continuous

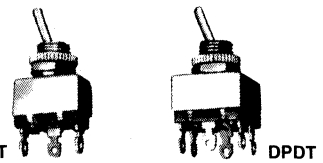
TYPE 3

UL LISTED



- Enclosed Molded Construction
- Size: 1$\frac{1}{4}$" Dia. x $\frac{1}{2}$" Depth/Deck
- SP or DP/Deck
- Up to 12 Pos./Pole BBM or MBB
- Indexing: 30°, 60° or 90°
- UL Listed: 3 Amp Resistive 120 VAC
  3 Amp Resistive 28 VDC

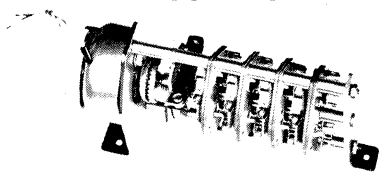
TOGGLE SWITCHES



- Meet or Exceed MIL-S3950, MS75028 & 029
- Size: $\frac{1}{4}$" × $\frac{1}{2}$" × $\frac{5}{16}$" for SP.ST
- Size: $\frac{1}{2}$" × $\frac{1}{2}$" × $\frac{5}{16}$" for DP.ST
- Contact Resistance: 10 Milli-Ohms
- $\frac{1}{4}$ – 40 Mtg. Bushing, $\frac{1}{4}$ or $\frac{3}{8}$ lg.
- Various Combinations of Bushings, Terminals, Handles and Housings Available.
- Contact Rating: 5 Amps @ 28 VDC
  5 Amps @ 125 VAC Inductive Load

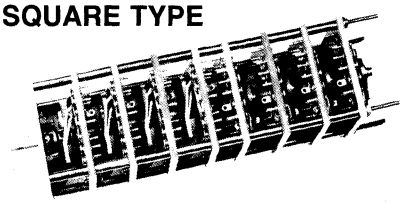
OPEN FRAME ROTARY SWITCHES

REMOTELY CONTROLLED



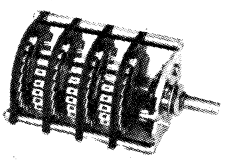
- Available as: Stepping Switch
  Motor Driven Solenoid Drives
  Motor and Geneva Drives
  Enercon AC Incremental Motor Drive
- Interrupters or Homing Decks Available.
- May be Remotely Controlled by MasterSlave Arrangement: Computer, External Pulse or Other AC or DC Operation.

SQUARE TYPE



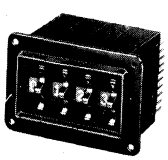
- 13 Styles Available
- Sizes: 1$\frac{5}{16}$" x 1$\frac{5}{16}$" up to 8" x 8" sq; 15 Decks max.
- 1 to 12 Poles/Deck
- Up to 150 Positions/Pole
- Current Capacity 15 Amps Continuous

TYPE 2



- Single Hole Bushing Mtg.
- Size: 1$\frac{3}{4}$" x 2$\frac{1}{4}$"; $\frac{3}{4}$" Depth/Deck
- 1 to 4 Poles/Deck
- Up to 24 Positions/Pole MBB
- Up to 12 Positions/Pole BBM
- Indexing: 15°, 30°, 45°, or 60°
- Current Capacity: 5 Amps Continuous

THUMBWHEEL SWITCHES



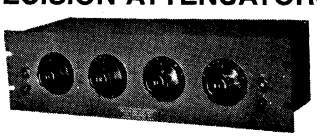
- Compact Modular Construction
- Size: $\frac{1}{2}$" Wide Modules
- Positive Detent 10, 11, 12 Positions
- Wide Range of Codes
- Various Terminations
- Kelvin Varly Voltage Divider
- Decade Transfer Drive Between Digits
- Capacitance Decades
- Precision Resistance Decades
- Current Capacity: 1 Amp. Continuous

Tech Labs will undertake special prototype design and manufacturing of your switch and attenuator requirements. We can also customize and supply completely pre-wired units.

Contact our factory for competitive quotations.

ATTENUATORS

PRECISION ATTENUATORS



TYPE 11T AND 11H PRECISION ATTENUATORS — DC to 10 MHz*
- Circuit: "T" or Balanced "H"
- Impedance: 50 to 600 ohms, as specified
- Resistor Accuracy: ±0.1% or better
- Accuracy: ±0.1 db to 200 KHz (overall) ±0.6 db to 2 MHz. Lower values of loss, essentially flat to 10 MHz

Type No.	Circuit	db Range	db/ Step	Dimensions
11-T	"T"	111	0.1	5¼"x19"5"
11-H	Bal. "H"	111	0.1	5¼"x19"x10"

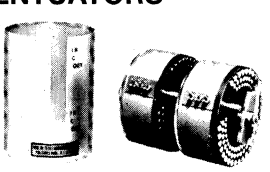
* On Low Impedance Units, Lower Losses Usable to 100 MHz.

TYPE 850T AND 850H FOR THE AUDIO RANGE
- Circuit: "T" or Balanced "H"
- Impedance: 600/600 ohms unless specified —Other values to order
- Range: 2 dial unit gives 93 db in 0.1 db steps: 3 dial unit gives 111 db in 0.1 db steps
- Terminals: Telephone type jacks for input and output — Solder terminals provided on rear for permanent connections: Insertion of plugs into jacks lifts rear connections
- Accuracy: Resistors adjusted to ±0.1% excepting low values of loss are ±.25%

FIXED ATTENUATORS

- Two basic models
- Standard circuits "T" and Bridged "H" — others available
- Octal plug-in base available
- Up to 80 db loss
- Many impedance available

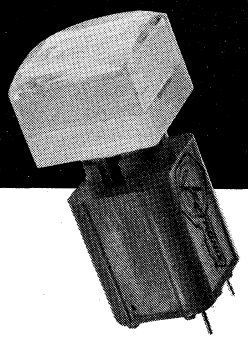
ROTARY/VARIABLE ATTENTUATORS



- Five basic models — 1$\frac{7}{16}$" to 3" dia.
- All circuit configurations
- Wide range of impedance
- Available with detents, tapers and cueing
- Aluminum anodized can
- Precious metal contacts
- Up to 45 steps
- Audio, video and RF

the SWITCH you'll LOVE to touch!

VEETRONIX™ KEYBOARD SWITCHES

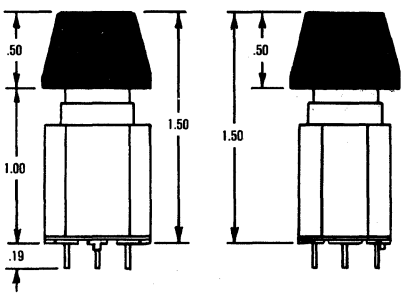


a Touch Above the Rest!

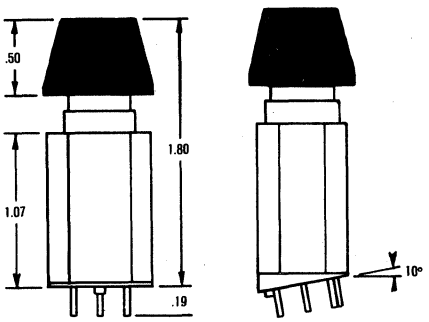
Hardly a day passes without someone calling to say,
"I Like The Touch of Your Switches."

Widely used by manufacturers of computer and video switching equipment, because of ***VEETRONIX'*** patented design, which combines POSITIVE ACTION with just the right touch. Not loose. Not stiff. Just right!

SHORT SERIES



LONG SERIES



SWITCH FORM	CIRCUIT DIAGRAM	SWITCHING
A	1, 6	Single Pole Single Throw Normally Open
B	1, 6	Single Pole Single Throw Normally Closed
AA	1, 6, 4, 3	Double Pole Single Throw Normally Open
BB	1, 6, 4, 3	Double Pole Single Throw Normally Closed
AB	1, 6, 4, 3	Double Pole Single Throw 1 Open/1 Closed (Break Before Make)
LAMP	L2, L5	Voltage And Amperage At Option

SPECIFICATIONS:

Max.Current (except special order)
Form A or AA: 500 milliamps (resistive)
others: 250 milliamps (resistive)

Max. Voltage
Form A or AA: 200 VDC (resistive)
others: 100 VDC (resistive)

Max. Power Loading
Form A or AA: 10 watts (resistive)
others: 7 watts (resistive)

Max. Initial Contact Resistance
100 milliohms

Min. Breakdown Voltage
250 VDC

Min. Insulation
100 milliohms

Min. Life (reed)
50 million cycles

Lamp
T-1 ¾ bi-pin; optional voltage 3-28

All Plastic Parts
premium engineering plastic

Contact Surfaces
Noble metal

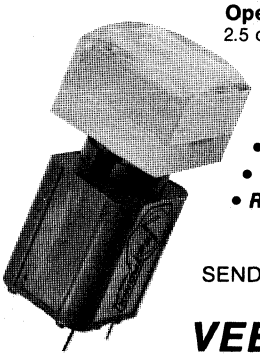
Terminals
0.025 Dia. nickel plated

Key Travel
.187" plus or minus .007"

Pre-Travel
Min. .050"

Min. Overtravel
.020"

Operating Force
2.5 oz. to 20 oz. = 0.7 oz.



- ***OPTIONAL ILLUMINATION!***
- ***HERMETICALLY SEALED CONTACTS!***
- ***CHOICE OF SWITCH FORMS!***
- ***BI-LEVEL & ALTERNATE ACTION!***
- ***REGULAR & LOW PROFILE UNITS!***

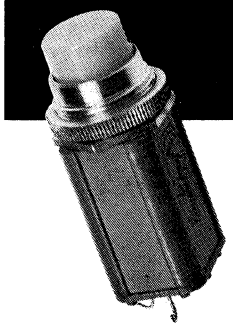
SEND YOUR SPECS FOR QUOTE
WRITE OR PHONE

VEETRONIX, INC.

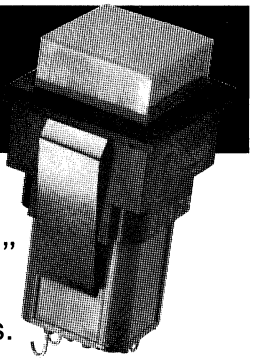
BOX 480 Lexington, NE 68850 (308) 324-4600
TWX: 910-960-4741 FAX: (308) 324-4985
Ask for Eddie Howerter

VEETRONIX™
THE KEY TO QUALITY

MADE IN U.S.A.



VEETRONIX™ PANEL SWITCHES



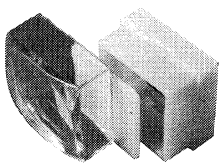
Available in a variety of configurations, these panel switches have the same "JUST-RIGHT-TOUCH" as our line of keyboard switches. In addition, we will build to your specifications at very competitive prices.

See specifications and table of contact forms on facing page.

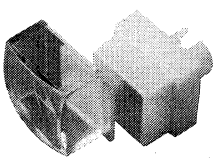
VEETRONIX™ KEYCAPS

VEETRONIX will provide just the right cap for your requirements, either from standard styles, or custom-made to your exact specifications. Our in-house tool and die shop permits the flexibility to meet your individual needs. We offer a wide choice of colors. Cap adapters permit use on either an illuminated or unilluminated switch. Relegendable styles available for 1-space and 2-space caps.

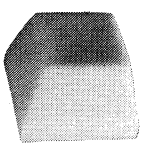
SOME REPRESENTATIVE CAPS AND ADAPTERS:



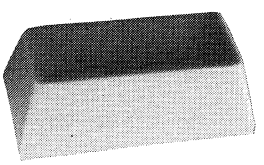
.720" SQUARE CONCAVE RELEGENDABLE CAP



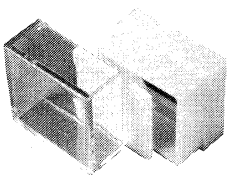
.600" SQUARE RELEGENDABLE CAP



V7001 1-SPACE CAP

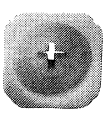


V7001 2-SPACE CAP



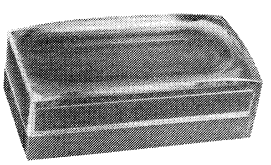
.720" SQUARE, FLAT-TOP RELEGENDABLE CAP

ADAPTER FOR ILLUMINATED SWITCHES



ADAPTER FOR NONILLUMINATED SWITCHES

V7002 1-SPACE CAP



V7002 2-SPACE CAP

CUSTOM MANUFACTURING:

VEETRONIX **can mold special plastic parts to meet your most exacting requirements, either from your mold or from one we design and build for you in our tool and die shop.** ***VEETRONIX*** **can also do custom assembly of electronic and electro-mechanical devices. Send specs for quote.**

VEETRONIX™

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VEETRONIX
P.O. Box 480
Lexington, NE 68850
MADE IN U.S.A.

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TWX: 910-960-4741
FAX: (308) 324-4985

KEYBOARDS/KEYPADS

Manufacturer	Starting EEM Page No.	Type						Features								
						Membrane										
		Key Switch	Mechanical (Hard Contact)	Capacitive	Hall Effect	Full Travel	Not Full Travel	Conductive Elastomers	Low Profile	Sealed Keyboard	Back Lighted	Illuminated Switch	Modular	Custom Legends & Symbols	Custom Capabilities	Custom Keypads
Amkey	B•1856			√					√	√		√		√	√	
Bergquist	B•1858						√		√	√	√	√		√	√	√
Cherry	B•1859	√	√			√			√					√	√	
Digitran	B•1860	√	√	√		√			√	√		√	√	√	√	√
Electronics Research Assoc.	B•1861	√	√			√	√	√	√	√	√	√	√	√	√	√
Flex-Key	B•1863		√			√	√	√	√	√	√	√	√	√	√	√
Grayhill	B•1864	√	√			√						√	√	√		√
Intaq Electrotouch	B•1866	√	√			√	√	√	√	√	√	√		√	√	√
Interswitch	B•1867		√						√	√			√			
Jayco	B•1868						√	√	√	√	√	√		√	√	√
Low Key Corp.	B•1870						√		√	√	√	√		√	√	√
Lucas Duralith	B•1873	√				√	√	√				√		√	√	√
LZR	B•1875	√	√											√		
Mechanical Enterprises, Inc.	B•1876	√	√						√					√		
Memtron Technologies	B•1878						√			√		√		√		
NMB Technologies	B•1879		√			√			√					√	√	
Oak Switch	B•1880					√	√	√	√	√	√	√		√	√	√
Orbit Instrument	B•1881	√	√						√		√			√	√	√
Preh Electronic	B•1882					√			√	√	√			√	√	√
George Risk Inds.	B•1883	√	√							√	√	√		√	√	√
Texas Instruments	B•1885		√					√	√	√				√	√	√

MINIGLOSSARY TIMERS

Accuracy
The variation of unit performance, i.e., time delay, voltage trip point, etc., over the specified conditions of ambient temperature, input voltage range, and time between operations.

Adjustability
The changing of a unit set point, within the specified range of unit operation, by means of internal or external adjustment mechanism (i.e., changing time delay with potentiometer).

Contact Rating
The electrical power-handling capability of relay contacts under specified environmental conditions and for a prescribed number of operations.

Delayed Interval Timing Function
Input voltage is applied continuously. The timing cycle is started by momentarily actuating the control circuit. The functions of separate Delay-On-Operate and interval type timers are combined in one package providing a single OFF-ON-OFF output cycles

Also called: single shot.

Delay-On-Operate Timing Function
Application of the input voltage starts the time delay. At completion of the time delay, the relay contacts transfer.

Also called: Delay-On-Make, On-Delay, Delay Relay, Delay-On-Pickup.

Delay-On-Release Timing Function
Input voltage must be supplied continuously to timer. Actuation of control circuit causes relay contacts to transfer immediately. Time delay starts when control circuit is released. The relay remains energized for the duration of the time delay—then de-energizes.

Also called: Delay-On-Break, Off-Delay, Delay-On-Dropout, Delay-On-Energization.

Frequency Sensor
A device that monitors a predetermined overfrequency and/or underfrequecy condition, and changes output state when these conditions exist.

Hysteresis
The difference between the response of a unit or system to an increasing and a decreasing signal (example: a voltage sensor).

Interval Timer Timing Function
Application of input voltage causes relay contacts to transfer and time delay to begin. At completion of the time delay, the relay contacts return to de-energized state.

Also called: Delay Interval, One Shot.

Output Control
The switching device, either solid-state or electromechanical, used in the unit to control the load connected to the output terminal(s).

Phase Sensor
A device that monitors for proper phase rotation in 3-phase systems.

Programmability
Ability to modify function, time delay or input voltage of a timer.

Recovery Timer

(Delay-On-Operate/Interval Timer)
The minimum time that input voltage must be interrupted *prior* to time-out to insure a successive timing cycle within the specified limits.

(Delay-On-Release)
The minimum duration of time that control circuit must be re-actuated to insure a new timing cycle when the control circuit is released.

Recycle Time

(Delay-On-Operate or Interval Timer)
The minimum time that input voltage must be interrupted after the timing cycle is completed to assure a successive timing cycle within the repeatability specified.

(Delay-On-Release)
The minimum duration of time that control circuit must be actuated to insure a successive timing cycle within the repeatability specified when the control circuit is released.

Repeat Cycle Timer Timing Function
Application of power automatically initiates continuous off-on cycling of the output relay.
Also called: flasher, intervalometer

Reset Time
The time required for the contacts to return to normal position when power is removed.

Reverse Polarity Protection
Blocking circuitry arrangement within the timer to prevent damage or output actuation if reverse polarity input voltage is applied.

Tolerance
The difference between specified and actual timing or sense point (factory setup tolerance).

Transient Protection
Prevents damage to unit if positive or negative transients are applied to the unit. Insures proper operation of the unit during and after transient occurrence. Max. transients are usually specified as to amplitude and duration, i.e., 1000V for 1 second.

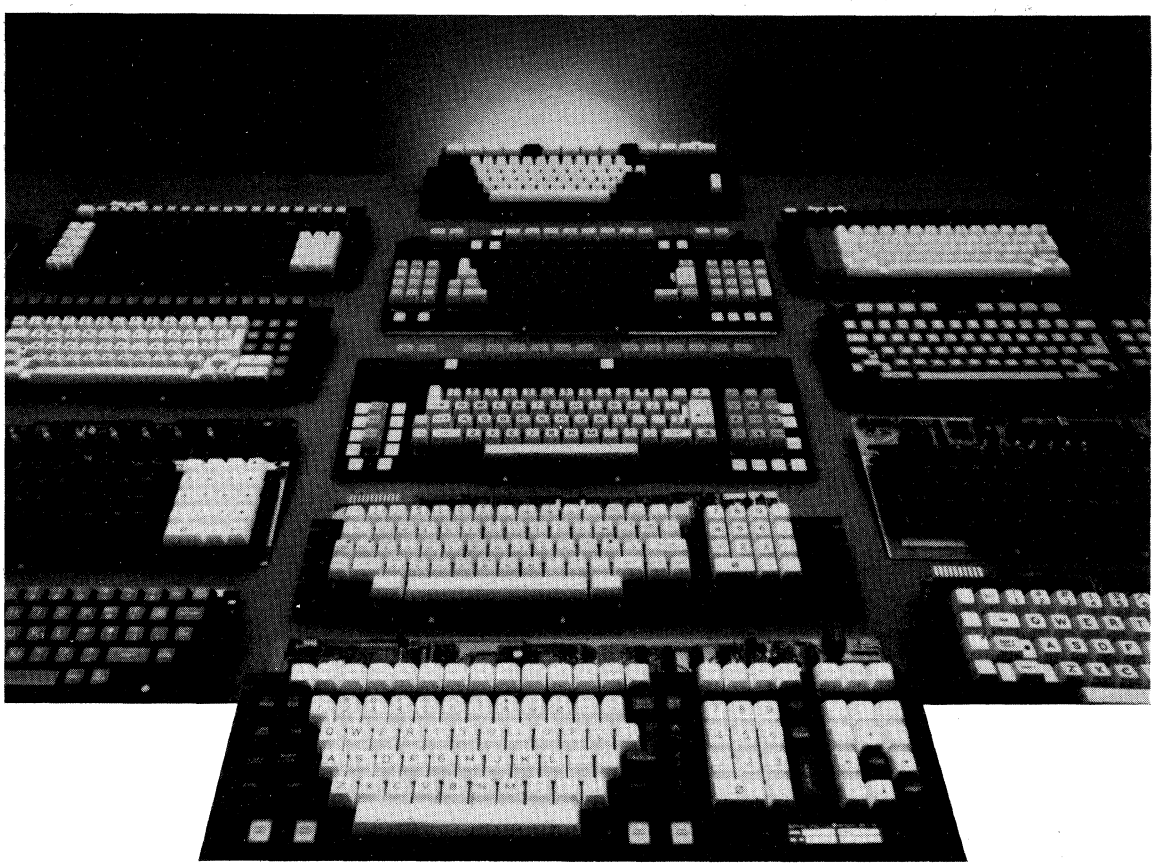
Trip Point
The predetermined point at which a sensing device is set to change the output state.

Voltage Sensor
A device that monitors for a predetermined overvoltage and/or undervoltage condition, and changes output state when these conditions exist.

Amkey 55 Chase Street, Methuen, MA 01844
(508) 975-5445 • FAX (508) 975-0357

Solid State Keyboards

Amkey delivers!



custom designed keyboard systems

To meet your commercial, industrial or military requirements, Amkey's engineering staff works closely with your design team to build a quality product. We build state-of-the-art keyboard systems for point of sale terminals, graphics displays, N/C equipment, medical and electronic weapons systems.

Amkey keyboards offer features like...

- Parallel or serial output—TTL or RS232, RS423, RS422, etc.
- Amkey's silent "No-Switch" snap in keyswitches
- Custom programs for special features include different baud rates, sequential codes and key functions
- Full travel DIN standard/sculptured/stepped/sloped keyboards
- Hardware options—clickers, beepers, LEDs, displays, lighted targets, trackballs, mice, joysticks, etc.
- Prompt delivery

AMKEY OFFERS CUSTOM, COMMERCIAL, INDUSTRIAL AND MILITARY KEYBOARD SYSTEMS FROM CONCEPT TO FIRST ARTICLES IN LESS THAN 16 WEEKS.

CALL OR WRITE AMKEY TODAY WITH YOUR REQUIREMENTS. AMKEY DELIVERS!

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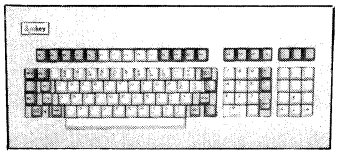
Solid State Keyboards

DIN-64

STANDARD FEATURES

- 19mm solid state switches to meet 30mm ergonomic requirements (DIN standard) with .150" total key travel
- Solid state capacitance technology
- MCS-48 series microcomputer controlled (8048,8035, etc.)
- Cursor control keys
- Amkey's patented phase-detector
- +5 volt operation
- Asynchronous serial TTL ASCII output
- Automatic-repeat enable/disable
- Power-up reset
- 4 Modes
- Two shot molded keytops with sculptured typing area and matte surface

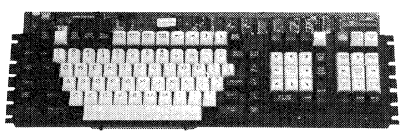
DIN 124



STANDARD FEATURES

- 19mm solid state switches to meet 30mm ergonomic requirements (DIN standard) with .150" total key travel
- Solid state capacitance technology
- Microcomputer controlled
- 20 function keys across top row for improved software capability
- Amkey's patented phase-detector
- Asynchronous serial ASCII output and input
- RS-232 9600 baud
- Automatic-repeat enable/disable
- 4-led display
- Power-up reset
- 4 Modes
- 3 user location homing bump keys
- Two shot molded keytops with sculptured typing area and matte surface

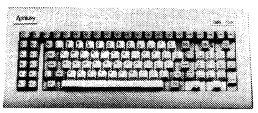
MPNK 114



STANDARD FEATURES

- Microprocessor controlled
- Single +5 VDC supply
- Eprom programmable
- Solid state circuitry
- N-key rollover
- Automatic repeat enable switch
- Two-shot molded key tops
- High reliability
- Rigid chassis mounting
- Low profile
- Rugged construction
- Low power requirement
- Sculptured typing area
- Shift lock and caps lock w/LED target in key
- Serial transmission at multiple baud rates

DIN 106-1



STANDARD FEATURES

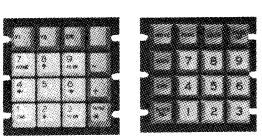
- 19mm solid state switches to meet 30mm ergonomic requirements (DIN standard) with .150" total key travel
- Solid state capacitance technology
- MCS-48 series microcomputer controlled (8048,8035, etc.)
- Full 21 function keys across top row for improved software capability
- Amkey's patented phase-detector
- +5 volt operation (12V option on longer cable)
- Asynchronous serial RS-422 ASCII output with jumper selectable 300, 2400, 4800, 9600 baud
- Automatic-repeat enable/disable
- Power-up reset and externally resettable
- Selectable serial logic
- 5 Modes
- 3 user location homing bump keys
- Two shot molded keytops with sculptured typing area and matte surface

MPNK 101

STANDARD FEATURES

- Microprocessor controlled
- Single +5 VDC supply
- Eprom programmable
- Solid state circuitry
- N-key rollover
- 5 modes
- Automatic repeat enable switch
- High reliability
- Sculptured typing area
- Two-shot molded key tops
- Rigid chassis mounting
- Low profile
- Rugged construction
- Low power requirement
- Lock key with LED target
- Serial or parallel output
- Multiple baud rates

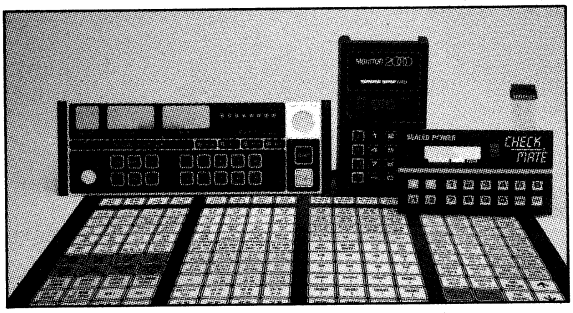
SNK 16



STANDARD FEATURES

- Serial RS 232C interface
- Prom Programmable
- Solid state circuitry
- N-key rollover
- Two-shot molded key tops
- High reliability
- Rigid chassis mounting
- Rugged construction
- Low power requirement

Bergquist Membrane Switches



Bergquist Company designs and builds custom membrane switches especially suited for harsh environments. Bergquist membrane switches are reliable and include the best graphics you can buy.

Bergquist membrane switches are often designed into an assembly to replace conventional discreet switches. Switch panels enable the designer to condense the control area and include more keys than bulky discreet switches will allow and in most cases show a significant cost savings.

Membrane switches are constructed in three different ways to meet the requirements of various applications. Circuitry can be either screened silver ink on polyester substrates or etched copper circuitry on a flexible or hardboard layer. These various constructions can be made with either pressure sensitive adhesives or Bergquist's HeatSealing for harsh environment applications. Screened silver is used for current levels below one watt and copper circuitry is used for current levels above one watt.

FEATURES

Bergquist offers many combinations of features which can be added to the basic switch constructions. These include:

- HeatSeal™ The HeatSeal switch is especially designed for applications with harsh environments. Layers are bonded together with thermoplastic adhesive which completely protects them from contamination.
- LEDs added to the copper hardboard or flex copper switch.
- Embossed domes on silver switches or stainless steel snap domes for copper switches to provide tactile feedback.
- Rim or pillow embossed graphics to enhance the look and feel of switches.
- Backer panels added to the switch panel with optional studs for mounting.
- Adhesive backed switch panels to aid in mounting the switch panel to the assembly.
- A variety of interconnects for both flex circuits and hardboard switches. These include male and female pins, headers, IDC connectors, and others.
- Electroluminescent lamp panels.
- Integral lenses screened into the graphic layer, eliminate cut-outs or die-cut lenses where applicable.
- Special shielding materials such as screened silver, vapor deposited gold or aluminum, aluminum foil or Kapton for EMI/RFI and ESD shielding.
- Deadfront nomenclature which is only visible when backlit.
- Selective textures applied to the graphics layer ranging from rough to matte to non-glare to glossy.
- Hardcoated graphic panels for improved chemical and abrasion resistance.
- Custom color using recognized color matching systems such as PMS, Federal Standard and Munsell or an actual sample to be matched.

THE BERGQUIST LABORATORY

To guarantee the quality and reliability of each membrane switch, Bergquist Company has developed a complete in-house laboratory. The laboratory tests materials, processes and completed membrane switches.

Materials compatibility is a key factor in the reliability of a switch panel. Each material is analyzed and tested alone and in combination with other materials before any construction begins. This is done to prevent interactions between materials after construction, for instance, solvents in pressure-sensitive adhesives could soften conductive silver inks if not carefully controlled during manufacturing.

Along with materials compatibility, the Bergquist laboratory has done extensive testing on the effects of pressure on vented and nonvented switches, hardcoating of graphic panels, membrane switch life, actuation force and modes of failure in dielectric jumpers.

Environmental testing attempts to simulate the field environment of completed switches. Switches are tested under extremes of heat, humidity and pressure. Life testing subjects switches to millions of actuation cycles and graphic panels are exposed to chemicals and abrasives to test hardcoating.

The Bergquist laboratory also works closely with trained quality control specialists to monitor each step of the production process.

Contact Bergquist Company for free copies of technical papers on membrane switch design and testing.

Call Toll Free 1-800-328-3882

BERGQUIST

When Performance Counts
5300 Edina Industrial Blvd.
Minneapolis, MN 55435
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CHERRY ELECTRICAL PRODUCTS
3600 Sunset Ave., Waukegan, IL 60087
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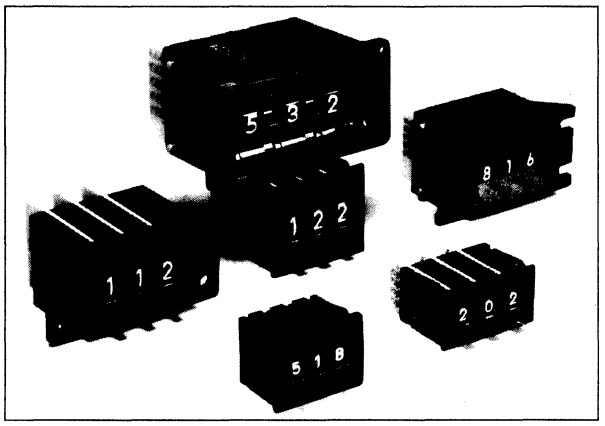
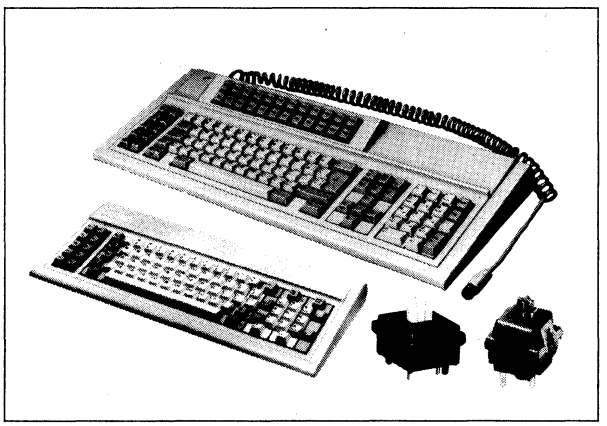
Thumbwheel Switches



Cherry's Thumbwheel, Leverwheel & Pushwheel Switches are available in over 20 types including Industrial Size Thumbwheels and Leverwheels (Series T10, L10, T11, L11) Standard Size Thumbwheels (Series T64, T65, T71, T72 and T75); Miniature Thumbwheels and Leverwheel (Series T20, L20, T24, T35, T38, T62 and T63); Subminiature Thumbwheel and Pushwheels (Series T50, T51, T52, T54, T56 and T57); Sub-Subminiature Pushwheels (Series T55 and T59). We offer many variations in output codes and readout symbols. 8-10-12 and 16 positions, gloss or matte finish.

Sizes—.590″ high .945″ high
1.15″ high 1.20″high
1.88″ high

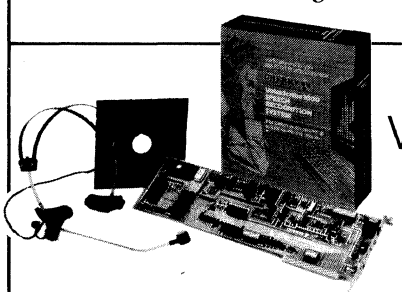
Keyboards and Keyswitches



Cherry is flexible, providing a broad range of custom designed keyboards...plus several stocked standard keyboards with 83, 84, 101 and 126 key designs. Super enhanced G80-2000 IBM compatible including Card Reader, Bar Code Reader and Mouse for PC/XT and AT systems. G80-1600 with Bar Code only, or with just Magnetic Swipe Reader. Reduced footprint G80-1800 with full 101 keys is under 16 inches in width. G81-1000 with full 101 key function in full travel membrane technology.

Individual keyswitches in three types...all with gold wire contacts for high switching reliability:

MX— Ergonomic design in modern full travel low profile. Available in linear, soft tactile and click tactile.
M8— Lowest profile keyswitch.
M7— Regular keyswitch profile.



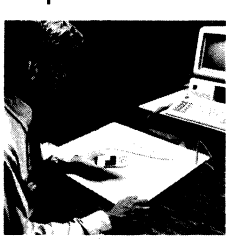
VoiceScribe™ 1000

Voice command of IBM PC/XT AT or compatible. Create custom vocabulary for any compatible application as you speak, responds to words or phrases. Ideal for hands free inventory control systems, quality assurance inspection program or technical records transcriptions . . . reduces error potential.

System includes complete operating instructions, tutorials, Dragon KEY MS-DOS program interface and Dragon LAB application tools.

Software noise cancelling microphone headset and Electronic Printed Circuit Board to fit full length expansion slot.

Graphic Tablet



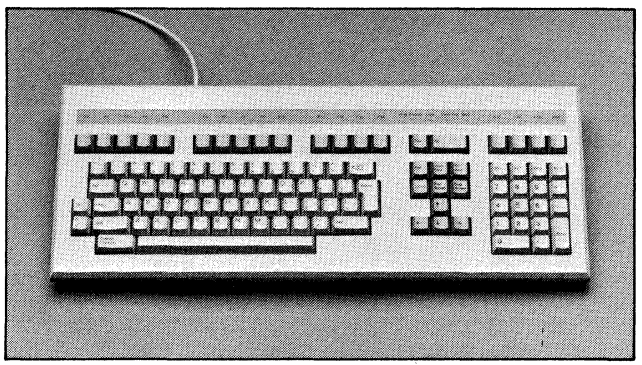
Software compatible with the top CAD program. Create drawings and graphics with your personal computer.

Drawings can be erased or stored in memory. Features relegendable menu strips to execute drawing commands, macros and symbols at a touch.

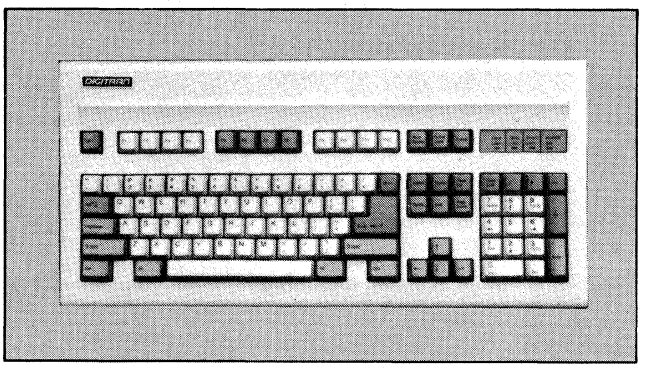
Has easy to use cursor puck and sketching pen. Sixteen option selector DIP switches allow user to configure the tablet to his computer's hardware and data format requirements.

INTRODUCING THE LATEST IN FULL-TRAVEL KEYBOARD DESIGN...

The KD-220 Standard Keyboard Series—All the Freedom and Flexibility of Custom Keyboard Design Without Costly Tooling.



MODEL KD-220-1



MODEL KD0234-01

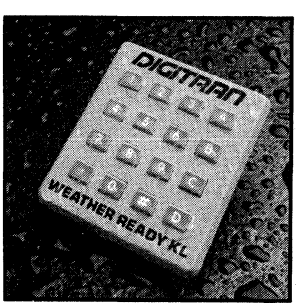
The **KD-220** and **KD-234** keyboard series are available in three standard formats including IBM compatibility. Digitran also offers custom capacitance or mechanical keyboards in addition to standard keyboards. While meeting DIN specifications, the keyboard features the lowest profile, full travel (.150 inch) key switches in the industry.

KD-220
- DEC VT-220 layout (105 keys) and IBM expanded layout
- Separate cursor control keys
- Separate numeric pad arrangements
- IBM XT, AT or ASCII codes
- 128 key positions for user customization
- Double shot keytops
- Low cost enclosure inserts for custom configurations
- N-key roll-over
- MCBF—100,000,000
- No keyswitch bounce
- Patented tease-proof switch
- Frame-less design
- Keyforces from 1 to 9 oz.
- Stepped sculptured keytops
- Relegendable function keys available
- Off-the-shelf delivery through distribution

KD0234-01
- IBM expanded keyboard layout
- Compatible to XT or AT, switch selectable
- Mechanical gold plated switches
- Sublimation printed keytops
- Off-the-shelf delivery through distribution

Options:
- Environmental Protection
- Custom keytop legends
- Custom keytop shapes
- Militarized capability
- Tactile or linear feel
- Custom Enclosures
- Value Added Distribution
- Fully automated, vertically integrated manufacturing

For Custom Keypad Design, Choose Our KL MINIKEY® Series



WEATHER READY KEYPAD MEETS NEMA 4X ENCLOSURE REQUIREMENTS

MINIKEY Keypads are available in standard arrays of 6, 12, 16, and 20 keys.

Standard keys are two-color, molded with black characters on white backgrounds. Standard frames are black, textured, non-glare finished, and special key legends, colors and configurations are available.

Environmental protection is provided by a flexible barrier under the keys to prevent contamination of contact area.

MINIKEYS can be rear or front mounted, and are designed to interface with all digital logic circuitry including TTL and CMOS.

Contacts are made of precious metal to insure low contact resistance. Contact bounce is less than 3 milliseconds.

Terminations: .025" (.64mm) square pins (tin plated) standard. (.027 max. sq. pins after soldering)
- Tampo printing on frame or keys for custom applications
- One year warranty
- Standard output codes include: 6XY, SP12, 2 of 7, 12XY, SP16, 2 of 8, 16XY, and 20XY.

DIGITRAN®

A DIVISION OF XCEL CORPORATION

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ERA/REFAC's 15 years of keyboard design and manufacturing expertise is yours for the asking. Call or write us with your inquiries. Our experienced engineers will provide the answers you need regarding applications and pricing. From keyboard components to totally integrated keyboards. ERA/REFAC has the capability to provide ideas and solutions.

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ERA/REFAC carries the highest levels of commitment to quality. Years of proven performance in high reliability aerospace, military, and tough industrial applications assure our customers that their products will achieve both design criteria and field performance.
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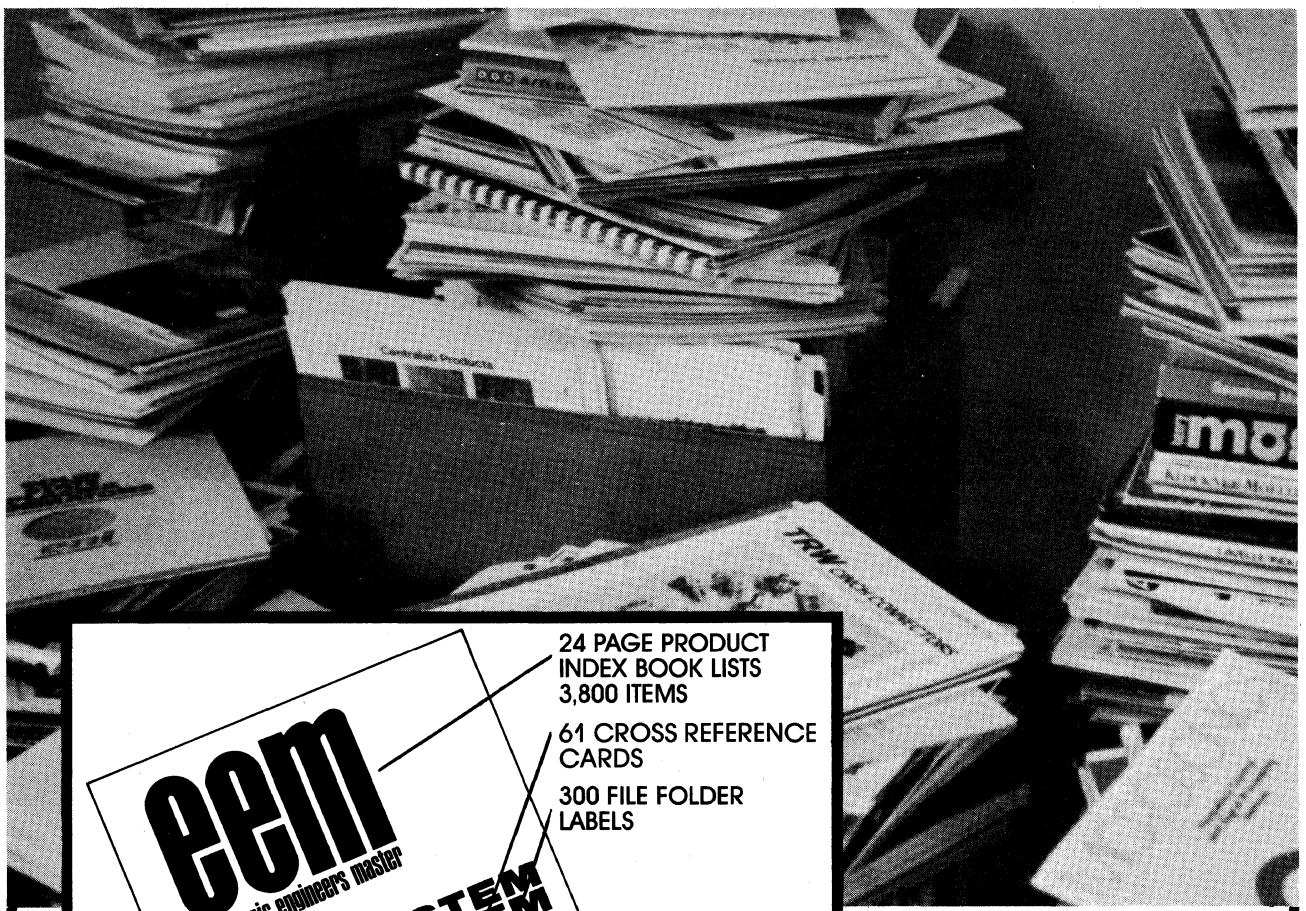

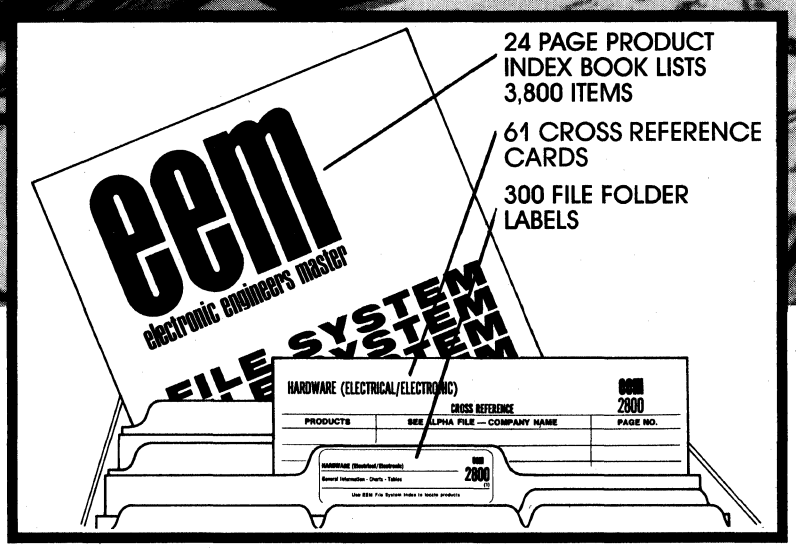

ALL NEW with this edition of EEM

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Don't waste any more time. Get organized now!

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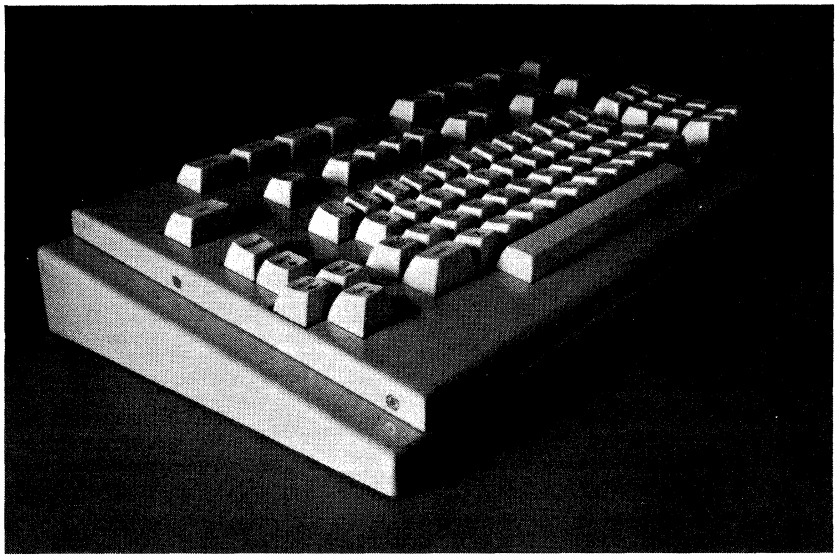
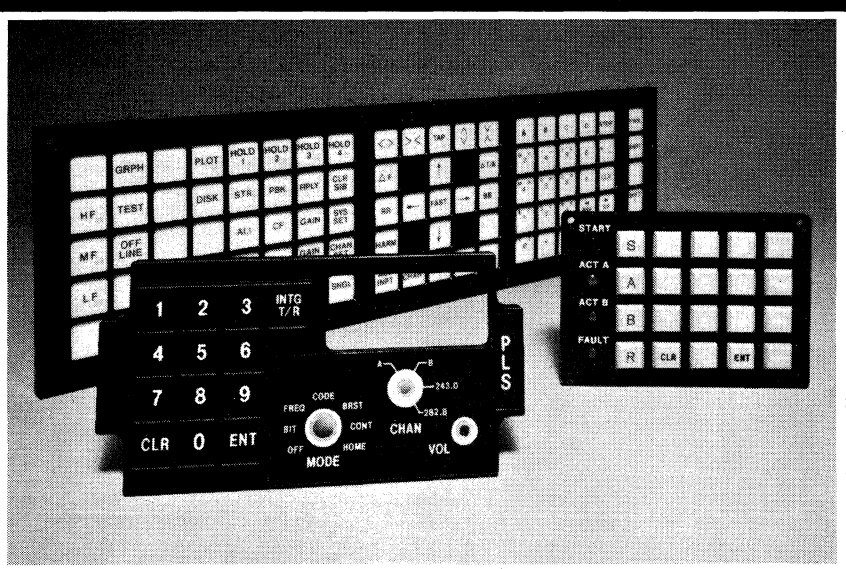


FLEX-KEY



specialists in military keyboard systems

KEYBOARD OPTIONS INCLUDE:

- TRACKBALL INCORPORATION
- BACKLIGHTING
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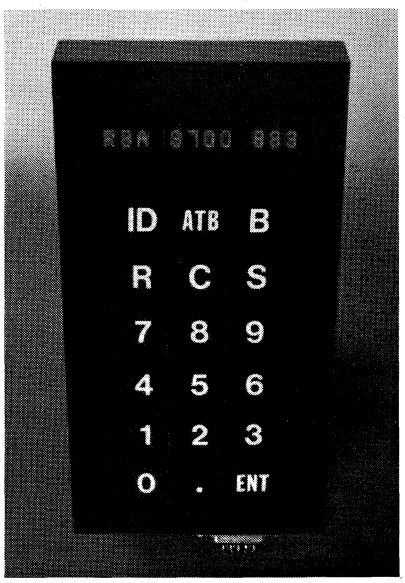
- HAND HELD TERMINALS
- EMI/EMP SHIELDING
- HARSH ENVIRONMENT OPERATION
  - SHOCK
  - VIBRATION
  - DRIP/WATER PROOF
  - HIGH/LOW TEMPERATURE



Flex-Key has designed and manufactured keyboards for military applications since 1974. Our focus has resulted in unique knowledge and experience in our chosen specialty. To our customers, this means unmatched competence in military keyboard technology.

Defense electronics companies from around the globe have come to rely on Flex-Key for the highest quality product, engineered and manufactured to meet rigorous specifications.

Contact Flex-Key to learn what our dedication to military keyboards can mean for your hardware system.

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Grayhill INC. 12, 16, & 20 Button Keypads

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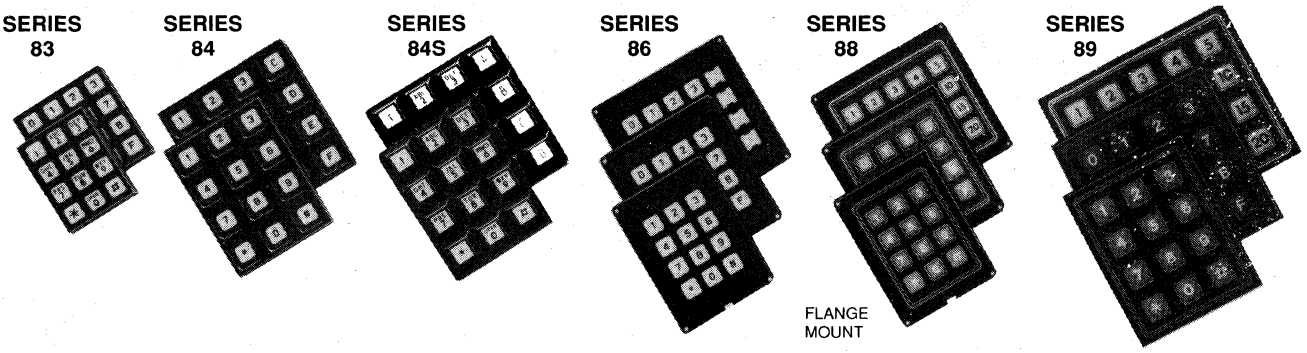
SERIES 83 SERIES 84 SERIES 84S SERIES 86 SERIES 88 SERIES 89



FLANGE MOUNT

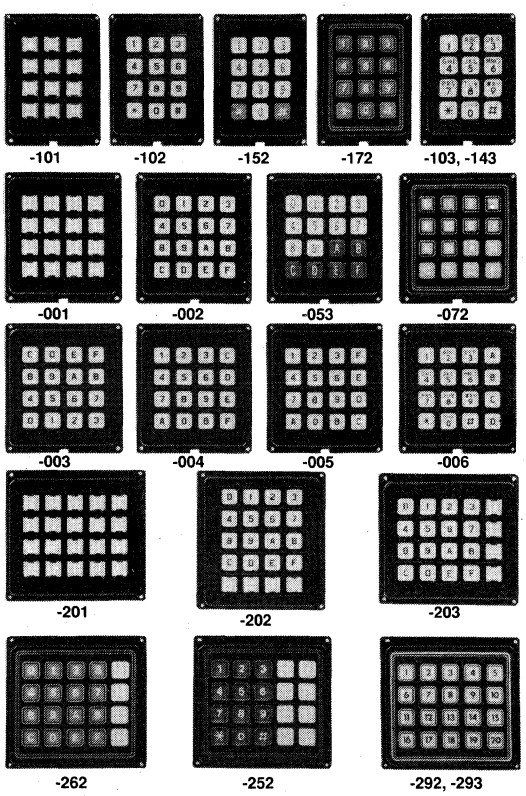
Features	Legend	Series	Btn. Cntrs.	Pinout	Mounting	Ht.	Length	Overall Width 3x4	4x4	5x4
Very Small Size	2-shot	83	.50"	Columns	Post	.35"	2.1"	1.6"	2.1"	—
Wide Spacing	2-shot	84	.75"	Columns	Post	.35"	2.1"	1.6"	2.1"	—
Environmentally Sealed	Printed	84S	.75"	Columns	Stud	.50"	3.1"	2.4"	3.1"	—
2 Choice Flange Mount	2-shot	86	.50"	In-line	Screw	.36"	3.0"	2.2"	2.7"	3.2"
Flange Mount, Sealed	Graphic	88	.50"	In-Line	Screw	.36"	3.0"	2.2"	2.7"	3.2"
Thin, Wide Spacing	Graphic	89	.75"	In-line	Adhesive	.10"	3.5"	2.8"	3.5"	4.3"

SEALED KEYPADS

Nitrile rubber 84S housing seals it to panel; a metalic back plane provides EMI/RFI shielding. The contact area of the Series 88 is sealed; a separate gasket is available to seal it to your panel.

STANDARD LEGENDS

Legends for 83, 84, and 86 are molded; for 84S, epoxy ink printed. Series 88 and 89 have colorful (blue), second surface printed graphics. Blanks of 83, 84, and 86 have snap-on caps for inserts. Removable ABS 84S blank buttons can be hot-stamped or epoxy ink printed. Adhesive labels are used for blank 89 buttons. For legendable verions of Series 88, contact GRAYHILL.



SPECIFICATIONS

Rated for 3 million operations at 10 mA 24 Vdc, -40°C to +80°C. Contact resistance is logic compatible; bounce, less than 4 mS at make, 10 mS at break. Housings (except 84S and 89) and molded buttons are ABS plastic; graphics (88 and 89) are polyester. Snap on caps are polycarbonate.

ORDERING INFORMATION

Keyboards

Complete the stem number by adding a legend dash number.

Size	Circuit Code 2 of 7 (8)	Matrix	SP/Common	Legend Choices
3x4	83AA1- 84AA1- — 86AA2-	83AB1- 84AB1- 84SAB1- 86AB2-	83AC1- 84AC1- — 86AC2-	-101, -102, or -103
	88AA2-	88AB2-	88AC2-	-143, -152, or -172
	—	89AB2-	89AC2-	-172-A
4x4	83BA1- 84BA1- 86BA2-	83BB1- 84BB1- 86BB2-	83BC1- 84BC1- 86BC2-	-001, -002, -003, -004, -005, or -006
	—	84SBB1-	—	-001, -004, or -006
	88BA2-	88BB2-	88BC2-	-053, or -072
	—	89BB2-	89BC2-	-072-A
5x4	—	86JB2-	86JC2-	-201, -202, or -203,
	—	88JB2-	88JC2-	-252, -262, or -293
	—	89JB2-	89JC2-	-252-A, -262-A, or -292-A

Accessories

Description	Series	3x4	4x4	5x4
Sheet of Legend Inserts	83, 84 unsealed, 86, & 88	All Sizes: **87AC2046**		
Legend Labels, In 2 Sheets	89	All Sizes: **89AC3038-1** and **-2**		
Gasket Seal For:				
Sub Panel Mount	All 88	**88M2001-2**	**88M2009-2**	**88M2019-1**
Top-Side Mount	All 88	**88M2012-1**	**88M2015-1**	**88M2018-1**

For prices contact a Sales Office, and authorized Distributor, or GRAYHILL.
Available From GRAYHILL Distributors

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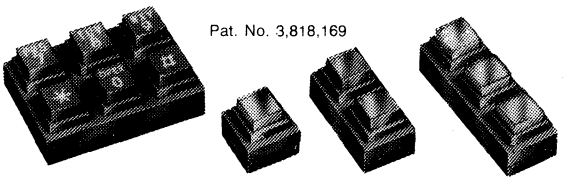
Keyboard Modules

CREATE YOUR OWN CONFIGURATION AND MAINTAIN BUTTON DISTANCES

Series 82 Modules

- 11/16″ Button Centers
- Long Stroke, Wiping Contacts
- 4 Sizes in 1 to 4 Poles
- Lightable Buttons/Legends
- Insertable Printed Legends
- Invisible Deadfront Option



Pat. No. 3,818,169

STANDARD LEGENDS OR INSTANT CUSTOM LEGENDS

Telephone modules have molded-in legends. Others have slotted caps for printed inserts. Lightable gray styles have lighted buttons. Lightable black styles, have legend-only lighting with a choice of legends: visible (thru-lit style) or invisible (deadfront) when unlit. Insert sheet includes letters, 0-19, phone legends, and common symbols and terms.

SPECIFICATIONS

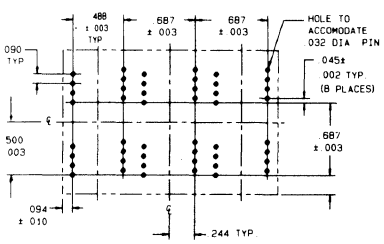
Momentary switches have a total travel of .130″ and a nominal overtravel of .080 inches. Operating force is 8 ± 3 oz depending on the number of poles. Switches are rated at 100 mA, 5 Vdc for 1,000,000 operations. Contact bounce is 10 mS or less. Voltage breakdown is 250 Vac. Insulation resistance is 1000 megohms minimum. Heat resistance to soldering is tested up to 260°C. Careful flux cleaning is required since switches are not sealed. Lightable modules fit over T-1 size LEDs/lamps which are .250″ maximum above board. Lamps are not supplied. For operating temperature, luminosity and factory legends, contact GRAYHILL.

DIMENSIONS

All modules are .750″ high.

Buttons:	Length	x	Width
1:	0.683	x	0.683
2:	1.370	x	0.683
3:	2.057	x	0.683
6:	2.057	x	1.370

PC board viewed from top.



Actual pin locations depend on circuitry and style. Layout for 4PST module is shown.

For prices and discounts, contact a local Sales Office, an authorized Distributor or Grayhill.

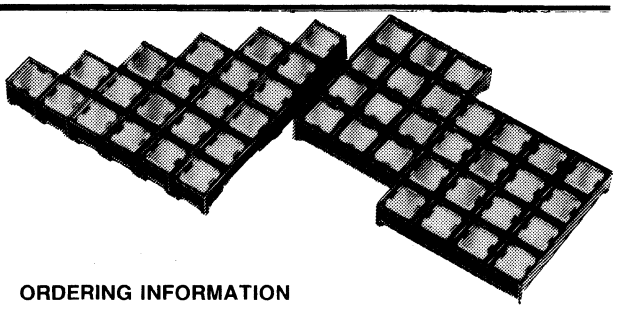
Available from GRAYHILL Distributors

No. Of Buttons	Circuitry Of Each Button	Part Number
Unlighted Telephone Keyset—Top Six Buttons		
6	Single Pole/Single Throw	82-601-65
6	Two Pole/Single Throw	82-601-86
6	Three Pole/Single Throw	82-601-87
6	Four Pole/Single Throw	82-601-88
Unlighted Telephone Keyset—Bottom Six Button		
6	Single Pole/Single Throw	82-601-89
6	Two Pole/Single Throw	82-601-90
6	Three Pole/Single Throw	82-601-91
6	Four Pole/Single Throw	82-601-92
Unlighted Gray Modules—For White Legend Inserts		
1	Single Pole/Single Throw	82-101-71
1	Four Pole/Single Throw	82-101-74
2	Single Pole/Single Throw	82-201-41
2	Four Pole/Single Throw	82-201-44
3	Single Pole/Single Throw	82-301-61
3	Four Pole/Single Throw	82-301-64
6	Single Pole/Single Throw	82-601-81
6	Four Pole/Single Throw	82-601-84
Lightable Gray Modules—For Legend Inserts		
1	Single Pole/Single Throw	82-150-38
1	Two Pole/Single Throw	82-150-16
3	Single Pole/Single Throw	82-350-12
3	Two Pole/Single Throw	82-350-9
6	Single Pole/Single Throw	82-650-19
6	Two Pole/Single Throw	82-650-9
Lightable Black Modules—For Thru-Lit or Deadfront Inserts		
1	Single Pole/Single Throw	82-150-211
1	Two Pole/Single Throw	82-150-213
3	Single Pole/Single Throw	82-350-41
3	Two Pole/Single Throw	82-350-43
6	Single Pole/Single Throw	82-650-71
6	Two Pole/Single Throw	82-650-73

Legend Insert Sheets	
White Legends on Clear Film	82AC2017-1
Black Legends on Clear Film	82AC2050-1
Thru-Lit White Legends Out of Black	82AC2055
Deadfront Legends Out of Black	82AC2060

SYSTEM 87 Modules

- Low Profile, Audible Dome Contacts
- 1/2″ Maintained Button Centers
- Preprinted Insertable Custom Legends



LEGEND INSERTS

Self adhesive printed inserts are die-cut to fit buttons. Sheet includes common symbols, terms, letters and 0-99, printed in black on clear film. Blank inserts are included for use with dry transfer lettering. Dry transfer assortments in 3 sizes of matching type are also available.

Snap-On Cap

SPECIFICATIONS

Logic compatible contact resistance and rated at 10 mA, 24 Vdc for 3 million operations. Voltage breakdown is 250 Vac. Contact bounce is less than 4 mS at make, 10 mS at break. Travel is .015″; operating force is 300 grams; operating temperature is −40°C to +80°C.

For prices and discounts, contact a local Sales Offices, an authorized local Distributor or Grayhill.

Available From Your Local GRAYHILL Distributor

ORDERING INFORMATION

Type Of Module Or Legend	Size	Part Number
1 Button—SP/Common Bus	0.5 x 0.5	87CC3-201
2 Button Strip—SP/Com. Bus	0.5 x 1.0	87DC3-201
3 Button Strip—SP/Com. Bus	0.5 x 1.5	87EC3-201
4 Button Strip—SP/Com. Bus	0.5 x 2.0	87FC3-201
5 Button Strip—SP/Com. Bus	0.5 x 2.5	87GC3-201
6 Button Strip—SP/Com. Bus	0.5 x 3.0	87HC3-201
12 Button—Matrix Circ.	1.5 x 2.0	87AB3-201
12 Button—SP/Com. Bus Circ.	1.5 x 2.0	87AC3-201
16 Button—Matrix Circ.	2.0 x 2.0	87BB3-201
16 Button—SP/Com. Bus Circ.	2.0 x 2.0	87BC3-201
Sheet of Legends Inserts	Die-cut	87AC2046
Dry Transfer Assortment	Small Type	87-DT-2096-088
Dry Transfer Assortment	Med. Type	86-DT-2096-125
Dry Transfer Assortment	Large Type	86-DT-2096-187

- **Membrane Switches**
- **PCB Switching Assemblies**
- **Elastomer Keypads**
- **Transparent Membrane Touch Screens**
- **Electroluminescent Panels**

VERTICALLY INTEGRATED MANUFACTURING

Pre-tested, ready-to-install key panels reduce your assembly costs.

- Custom Design and Graphics
- Color Filter Windows
- Multiple Hard Coat Finishes
- 100% Functionally Tested
- Installation-ready

PROCESS-CONTROLLED PRODUCTION

- Computerized quotation, order entry and production tracking through final shipment
- CAD Engineering
- On-site Tool & Die facility
- Laser-based art generation
- Spectrophotometer color analysis and match
- Class 1000 Clean Room print stations
- 100% testing for continuity, resistance, dielectric strength and actuation force
- Documented QA to MIL-I-45208A
- Prototype service

INTAQ SUPPORT SYSTEM

- Trained, nationwide sales force
- Experienced design/manufacturing team
- Follow up assistance after product delivery
- One account manager tracks each job from quote through shipment, coordinating manufacture to meet your production schedule.

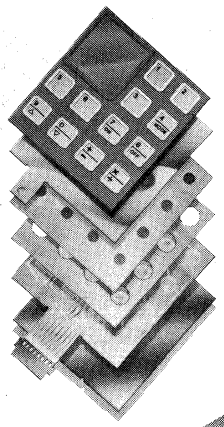
INTAQ ELECTROTOUCH SYSTEMS is the touch product division of GM Nameplate. We have been manufacturing key panels for a decade, and supplying product identification components to major manufacturers world wide since 1954. INTAQ is housed in the 97,000 sq. ft. headquarters/manufacturing facility.

GM NAMEPLATE CUSTOM PRODUCT IDENTIFICATION COMPONENTS
- nameplates
- roll and computer imprintable labels
- cosmetic front panels and overlays
- fabricated subassemblies
- fleet graphics and signage

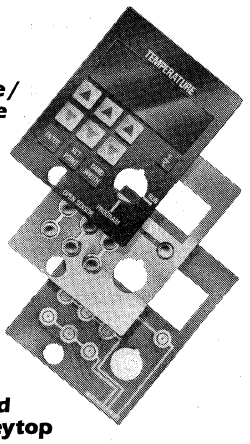
Call Customer Service **206-284-2200** for information, samples or price quotation.

INTAQ™ *The Custom Touch*℠

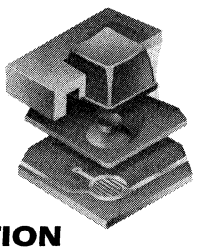
SHORT AND FULL TRAVEL KEY PANELS



Membrane/ Non Tactile
- Overlay
- EMI/ESD Shield (optional)
- Top Membrane
- Spacer
- Bottom Membrane
- Subpanel (optional)



PCB/Tactile/ Metal Dome
- Overlay
- Metal Dome Spacer
- PCB



Rubber Keypad with Plastic Keytop
- Overlay/bezel
- Plastic Keytop
- Rubber Keypad (with carbon pill)
- PCB

CONSTRUCTION

GRAPHIC OVERLAY Subsurface printed polycarbonate or polyester. No limit to perfectly matched colors. Surface protected from chemical attack and abrasion with hard coat finishes. Can include transparent, deadfront or colored display windows; selective texturing; embossed, die-cut and/or relegendable areas.

SWITCH Normally open, single pole, single throw momentary contact device, activated by light, direct pressure. Standard encoding xy or common bus.

MEMBRANE Layers of thin, flexible film (printed circuit patterns, insulators and spacers), die cut and laminated with high strength adhesive to form low profile switches. Can be installed to a subpanel, complete with mounting hardware, or fit within a bezel or housing. **Non Tactile** Conductive patterns are printed on the facing, inner surfaces of the two outermost layers, separated, except at the contact pad, by a spacer. **Tactile** Substitutes metal domes (or polyester dome layer) for the top circuitry, as a shorting pad.

PCB Similar to membrane construction, but meets broader electrical requirements and permits board mounted components. Substitutes a PCB for the bottom membrane layer, forming its own subpanel. **Accessory PCB** used to mount components and for accessory circuitry. Mounts directly below the PCB key panel using standoffs.

ELASTOMERIC KEYPAD Used over a membrane or PCB construction. For extended switch life, uses silicon rubber/carbon pills (over a PCB) as the shorting device. Sealed construction ideal for harsh environments. Silent feedback available in progressive feel or positive snap. Under a **plastic keytop,** snap-action metal domes also can be used.

EMI & ESD SHIELDING (optional) Printed or fabricated from copper, aluminum or other alloys.

TERMINATION Unterminated (with terminal pads), solder tabs, male/female connectors; PCB headers or terminal pads.

TRANSPARENT MEMBRANE TOUCH SCREENS xy or analog coding. Construction details and specifications sent by FAX or mail- CALL 206-284-5475

SWITCH SPECIFICATIONS

	MEMBRANE AND PCB KEY PANELS			ELASTOMER KEY PANELS				
	Non-tactile	Tactile Metal Dome	Tactile Polydome	Rubber Keypad/ Membrane	Rubber Keypad/ PCB Switch	Rubber Keypad/ Shorting Pad/ PCB Switch	Plastic Keytop/Rubber Keypad/Shorting Pad/ PCB Switch	Plastic Keytop/Metal Dome/PCB Switch
ELECTRICAL								
Contact rating (Membrane)	30 VDC, 100mA, 1 Watt	30 VDC, 100mA, 1 Watt	30 VDC, 100mA, 1 Watt	30 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt
Contact rating (PCB)	50 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt	50 VDC, 100mA, 1 Watt					
Contact resistance	<100 ohms	<100 ohms	<100 ohms	<100 ohms	<20 ohms	<20 ohms	<20 ohms	<20 ohms
Contact bounce	<10 ms	<10 ms	<10 ms	<10 ms	<10 ms	<10 ms	<10 ms	<10 ms
Capacitance	<20 pf	<20 pf	<20 pf	<20 pf	<20 pf	<20 pf	<20 pf	<20 pf
MECHANICAL								
Actuation force	3 - 10 oz.	10 - 16 oz.	4 - 18 oz.	4 - 12 oz.	3 - 10 oz.	4 - 12 oz.	4 - 12 oz.	10 - 16 oz.
Life cycle*	5,000,000	5,000,000	1,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000
Key travel	.007 - .011 in.	.015 - .025 in.	.010 - .030 in.	.045 - .075 in.	.040 - .075 in.	.045 - .075 in.	.040 - .075 in.	.015 - .025 in.
ENVIRONMENTAL								
Operating temp.	-30° - +65° C	-30° - +65° C	-20° - +55° C	-30° - +65° C	-30° - +65° C	-30° - +65° C	-30° - +65° C	-30° - +65° C
Storage temp.	-40° - +80° C	-40° - +80° C	-40° - +80° C	-40° - +70° C	-40° - +70° C	-40° - +70° C	-40° - +70° C	-40° - +70° C

* Life cycle may decrease approaching upper and lower extremes of operating range.

THE CUSTOM TOUCH

From simple, thin profile membranes to complex, multi board PCB assemblies with surface mounted components, each INTAQ design is custom engineered to meet your unique requirements.

For more information, samples or price quotation, contact

INTAQ ELECTROTOUCH SYSTEMS™
Division of GM Nameplate, Inc.

2040 15th Avenue West, Seattle, Washington 98119
206-284-5475 ▸ FAX 206-284-3705

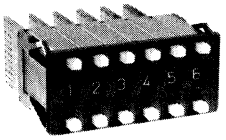
CALL OR WRITE FOR INTAQ "CUSTOM TOUCH" KEY PANEL DESIGN GUIDE

INTERSWITCH
ONE OF THE PURDY GROUP OF COMPANIES

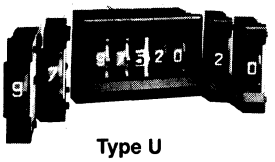
Thumbwheel & Rotary DIP Switches, Immersion Proof Key Pad

770 AIRPORT BLVD., BURLINGAME, CA 94010 • TEL (415) 347-8217 • FAX (415) 340-1670 • MCI/TLX 677-1439 (PURDY UW)

Thumbwheel Switches



Type D&Z Pushbutton

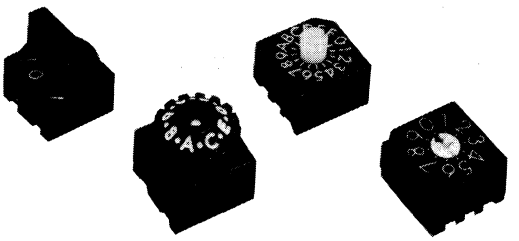


Type U

Available Switches (dimensions in millimeters)

Series A		B	D	E	G	H	L	M	N	P	R	S	U	V	Z
Front Mounting		•	•		•	•		•			•	•	•	•	•
Rear Mounting	•			•			•		•	•					
Width	11	12.5	7.62	16	20	10	8	8	7	10	20	10	8	8	7.62
Height	39	58	24	18	76	33	18	33	18	24.2	33	33	33	26.5	15
Mounting Depth	63.6	67.1	33.5	31.5	79	38	31.5	38	31.5	38.25	38	38	40	32.5	24
Spacer 2.54 mm			•												
Spacer 2.7 mm						•				•		•			

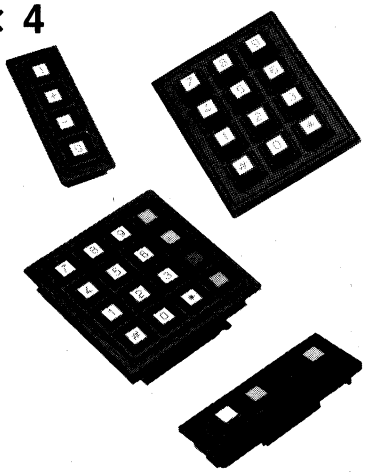
RDS Rotary DIP Switches



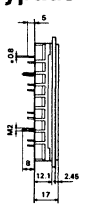
Features

- ☐ Available in BCD and hexadecimal codes.
- ☐ "O" ring around the rotor shaft. Molded-in contacts, ultrasonic welded body to base.
- ☐ Kinked terminals to hold switches in PC board. Switches are still socket pluggable.

The New Interswitch Keypads 1 × 4, 3 × 4 and 4 × 4

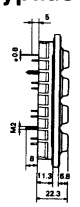


KNM 2 Series KNM 2, Immersion Proof (IP 67 Protection) with Flush Keys 1 × 4, 3 × 4 and 4 × 4 Keypads



Series KNM 2

KNM 3 Series KNM 3, Immersion Proof (IP 67 Protection) with Raised Keys 1 × 4, 3 × 4 and 4 × 4 Keypads



Series KNM 3

Features:

- ☐ immersion proof, IP 67 rated
- ☐ superb tactile feel
- ☐ long life, 5,000,000 operations
- ☐ magnetic return (no springs, no domes, no membranes)
- ☐ dual gold plated contacts
- ☐ individual addressable keytops
- ☐ contact resistance (0.15 Ω)

Applications:

- ☐ shipboard/naval
- ☐ remote outdoor communication systems (telephones, etc.)
- ☐ geophysical
- ☐ wherever extreme, rugged, environmental conditions are encountered

Technical Data

Mechanical:	
Housing:	Crastin/silicon rubber
Key Travel:	1.35 mm
Actuating Force:	2.2 N ± 0.4 N
Termination:	Solder pins
Service Life (at nominal load):	5 × 10^6 operations
Electrical:	
Contact:	n.o. contact (5μ Ni/2μ Au)
Operating Voltage:	max. 50 V≅
Test Voltage:	500 V≅
Nominal Current (resistive load):	max. 125 mA≅
Contact Rating:	max. 2 W
Contact Resistance:	<150 mΩ
Insulation Resistance:	>10^2 MΩ
Bouncing Time:	<5 ms
Environmental:	
Application Class (DIN 40040):	GSF
Operating Temperature Range:	−40°C to +70°C
Storage Temperature Range:	−40°C to +70°C
Relative Humidity:	75% annual average, 95% 30 days
Protection Type:	IP 67

Order No. Description

KNM20S14	Keypad, 1 × 4, flush keys
KNM20S34*	Keypad, 3 × 4, flush keys
KNM20S44*	Keypad, 4 × 4, flush keys
KNM30S14	Keypad, 1 × 4, raised keys
KNM30S34*	Keypad, 3 × 4, raised keys
KNM30S44*	Keypad, 4 × 4, raised keys
KZDIV34	Sealing ring for front mounting KNM2, 3 × 4.
KZDIH34	Sealing ring for rear mounting KNM2, 3 × 4.
KZDIV44	Sealing ring for front mounting KNM3, 4 × 4.
KZDIH44	Sealing ring for rear mounting KNM3, 4 × 4.

*Without Keytops

Standard Keytop Sets

Keytop Sets KKE4L-ACCC, KKE12L-ALLL, and KKE16L — ALLL have black markings on white polystyrol. They also include transparent polycarbonate covers.

The 1 × 4 keypad includes the KKE4L-ACCC keytop marking set. 3 × 4 and 4 × 4 keypads do not include keytop markings and keytops must be purchased separately.

KKE4L-ACCC set of 20 keytops 0-9/A-F/4 blanks

KKE12L-ALLL set of 25 keytops 0-9/A-F/+/−/*/#/./4 blanks/12 transparent covers

KKE16L-ALLL set of 25 keytops 0-9/A-F/+/−/*/#/./4 blanks/16 transparent covers

Other Keytop Sets

Keytop sets KKE1B-A — have black markings on ABS material

KKE1B-A... KKE1B-AAAA Set of 12 keytops 0-9/*/#
KKE1B-ABBB Set of 12 keytops 0-9/*/−
KKE1B-ACCC Set of 16 keytops 0-9/A-F
KKE1B-ADDD Set of 16 keytops 0-15
KKE1B-AEEE Set of 12 keytops 0-9/+/−
KKE1B-AFFF Set of 10 keytops 0-9
KKE1B-AGGG Set of 26 keytops A-Z
KKE1B-ALLL Set of 21 keytops, marked 0-9/A-F/+/−/*/#/.

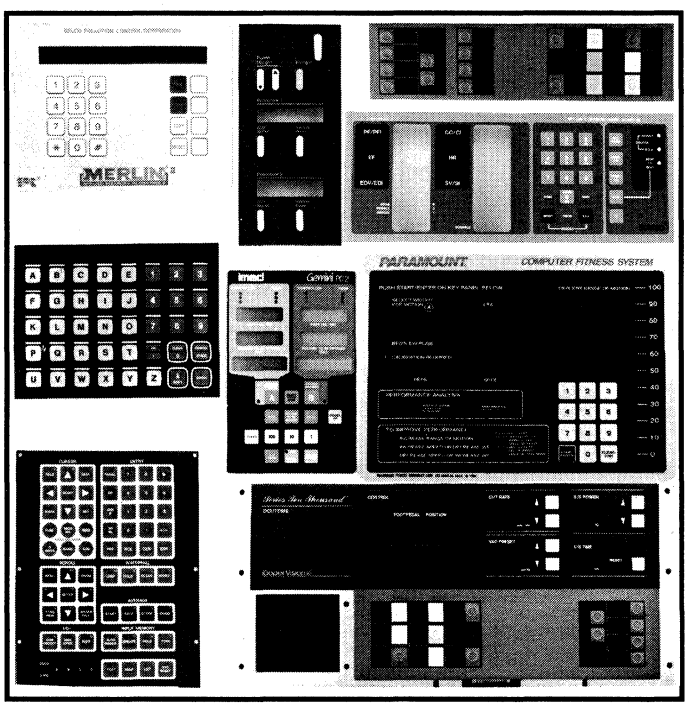
JAYCO

507 W. Blueridge Ave. • Orange, CA 92665, U.S.A. • Telephone: (714) 974-1701 • Fax: (714) 998-4954

LEADERS IN FLAT PANEL TECHNOLOGY

At Jayco we only manufacture flat panel switch products. This specialization has enabled us to design and manufacture products that are consistently preferred for their visual appeal, switch performance, and quality standards. These products include:

MEMBRANE SWITCHES
KEYBOARDS AND KEYPADS
HYBRID SWITCH PANELS
SILICONE RUBBER KEYPADS



MEMBRANE SWITCHES

Membrane switches are normally open, momentary contact switches. Their light weight and low profile (0.030" - 0.040" thick) make them ideal for use on portable equipment and on rack, console and desktop units where space may be limited.

Membrane switches are more reliable and economical than conventional switching systems and they add design flexibility which simply isn't available with any other switch technology.

Simplicity = Dependability. The switch consists of two contacts, one above the other, separated by a specific volume of air. Finger pressure on the top contact closes the switch, and release of pressure opens it.

The contacts are usually made of printed conductive ink. Therefore, membrane switches are designed specifically for low voltage and low current applications (see technical specifications).

HYBRID SWITCH PANELS

Membrane switches are made of flexible materials. Hybrid switch panels utilize some aspect of membrane switch construction, but are built on printed circuit boards. They are therefore, a hybrid of membrane and PCB technology.

All hybrid switch circuitry is usually contained on the PCB and, switch closure is performed by either a printed membrane or a metal dome (as in a tactile switch).

Hybrid switches can be mounted directly to your chassis with no additional sub-panel required. They can also be supplied as a sub-assembly complete with connectors, hardware and LEDs mounted and ready for installation. Significant savings result from the reduction of the number of components necessary to order, stock, and assemble.

Hybrid switches provide all the advantages of design freedom offered by membrane switches as well as conventional mounting and connection techniques.

KEYBOARDS AND KEYPADS

These simple switch arrays usually do not incorporate all the design features available with custom membrane switch panels. Since Jayco manufactures custom keyboards and keypads to your precise design there are no limitations regarding size, layout, number of switches, circuitry or graphic design. You receive an economical keyboard without standard keyboard compromises.

SILICONE RUBBER KEYPADS

These are an effective alternative to membranes where additional tactile feedback is required. Switch travel is typically 0.040" - 0.060" versus 0.015" for membranes and this is achieved at lower operating pressures. Silicone keypads can be conductive or non-conductive and with integral or separate keytops. Silicone keypads can also be designed into membrane and hybrid switch panels to produce totally integrated front panel assemblies. Call for further information.

JAYCO

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FLAT PANEL DESIGN OPTIONS

The following is a guide to aid in the selection of appropriate features. Contact your sales representative regarding any questions you may have.

EMBOSSING

Any part of the front panel can be embossed to add a third dimension. Switch areas are those most commonly embossed.

Embossing is usually pad or rim type. With pad embossing, the entire switch area is raised like a top hat. Rim embossing raises the outline of the switch like a crater. Rim and pad embossing can be combined for special effects.

The type of embossing most appropriate depends upon the application. Pad embossing gives a more conventional keyboard appearance and is generally used with tactile switches. Rim embossing assures better switch location, an important factor in applications requiring a lot of data input.

Unlike many others, Jayco embosses all overlays in-house. Proprietary techniques provide exceptional results, lower tooling costs, and a perfect match between printing and embossing.

TACTILE FEEDBACK

Tactile feedback is the snap action felt at switch closure. It's achieved by the oil can effect of a stainless steel or polyester dome and gives positive feedback of closure. It's important in applications utilizing unskilled operators or where other forms of feedback are impractical.

Jayco makes switches with both stainless steel and polyester domes, depending on the application requirements. Metal domes offer consistency of operation and reliability. Plastic domes are considerably more economical, and make tactile feedback a practical feature, even on large switch arrays.

Our new tease-resistant tactile feedback mechanisms guarantee simultaneous contact and snap with both metal and plastic dome systems. This is a significant improvement over other designs and effectively eliminates the possibility of miss-keying.

SHIELDING

All Jayco panels can be specified with EMI/RFI or ESD shielding. The shielding is usually between the overlay and the switch layer for maximum protection. Shielding materials include metalised polyester, transparent ITO for windows, and printed thick film. Grounding or connection to the shield can be by separate tab, through the connector, or through hardware.

SELECTIVE TEXTURES

This process allows Jayco to offer a textured background with optically clear windows for LCD displays without diecut window holes in the overlay. The process can also be used to highlight particular functional areas of the switch panels. For example, the background can be matt textured with high gloss switch areas. Different graphic treatments within the texture coat can also eliminate other colors. For example, a grid or stripe pattern can be created in the texture instead of using additional colors.

INSERTABLE LEGENDS

Panels can be specified with legend windows behind which you can insert different legends/graphics. This is ideal for user definable keys, different model options, foreign language versions or prototyping. Access to the legend windows can be from the edge of the panel, behind the panel, or from the front.

INTEGRATED DISPLAYS

Through proprietary processes, Jayco can provide one piece or laminated display windows for almost any kind of display device. Windows can be transparent for use with LCDs, or filtered, for use with LEDs or vacuum fluorescent displays. Standard filters are available in red, green, or grey. Other filters available upon request.

In addition to providing windows for display devices we are now able to integrate thin film plastic LCDs within a membrane switch to provide seven segment displays, annunciators and lit switches, all in an assembly less than 0.060" thick. Please call for more details.

DEADFRONT PANELS

Deadfront or secret-til-lit panels are invisible or blank until their displays are lit from behind. This effect is typically used for warning displays, or where a normal display would clutter up the appearance of the panel. Deadfront makes a complex instrument appear simpler to the user while making the displays more effective.

JAYCO QUALITY

Building a switch panel that meets all your requirements means more than following a set of blueprints. At Jayco, quality begins with an analysis of your requirements and the application and environmental details. Only then will appropriate materials, design, and construction methods be determined. All switches must undergo a comprehensive array of tests including aesthetic qualities, mechanical dimensioning, electrical testing, actuation force, and life expectancy. In addition, we have devised systems that ensure batch to batch consistency. These, together with quality assurance systems to provide manufacturing to MIL-I-45208A enable a higher degree of reliability than is available elsewhere.

TECHNICAL SPECIFICATIONS

Typical Values	
Current Rating	50mA at 30VDC
Circuit Resistance	Less than 100 Ohms
Contact Bounce	Less than 5 Milliseconds (non-tactile) Less than 20 Milliseconds (tactile)
Insulation Resistance	1 Gohm Min at 100VDC
Dielectric Strength	250VRMS Min
Capacitance	27 pf Max Between Any Two Traces
Actuation Force	Variable from 3oz and up
Operating Temperature	-40°C to +80°C
Operational Life	Greater than 5 Million Operations (non-tactile) Greater than 1 Million Operations (tactile)
Termination	Dupont "Clincher" Offered as Standard
Tolerances	+ or – 0.010" as Standard
Emboss Height	0.010 - 0.015"

low key

THERE IS NO GREATER PRIORITY AT LOW KEY THAN THE COMMITMENT TO QUALITY & DESIGN EXCELLENCE

A FULL SERVICE MEMBRANE SWITCH MANUFACTURER FEATURING COMPLETE DESIGN, PROTOTYPING AND PRODUCTION OF CUSTOM SWITCHES/KEYBOARDS, PC ENCODERS AND ASSEMBLY SERVICES

INTRODUCING 1st KEY SERVICE FROM "LOW KEY CORP."

A comprehensive package that translates your prototype design into production ready systems in 15 working days or less.

1st KEY SERVICE is more than just the proven reliability of membrane keyboard technology. 1st KEY SERVICE is the state-of-the-art in producing prototype, brass board, or pre-production keyboards, in as little as 2 weeks! With over 25 years of combined hands-on design knowledge and CAD/CAE support, your prototype is an investment in quality.

Think what the advantages of 1st KEY SERVICE can do to eliminate the work/time loss and bottlenecks created through confusion and the world of parading would-be keyboard suppliers flooding your lobbies today.

CAD/CAE ANALYSIS AND CORRECTION

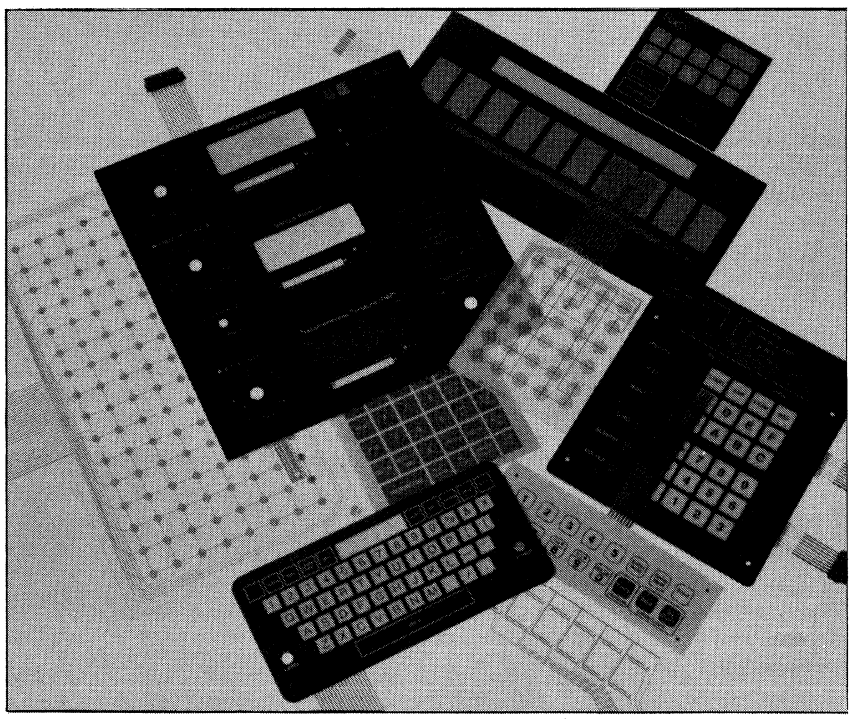
With 1st KEY SERVICE your design documentation must stand the "test." It will undergo CAD/CAE Analysis as the 1st step in validating your design. If conflicts exist, you will be notified immediately by phone and provided with options and solutions.

Most importantly 1st KEY SERVICE ensure conformance to the most rigid of mechanical and electrical standards. We can't afford to give you anything less than outstanding quality.

If you've got a hot project that needs 1st key treatment call us.

BACKLIGHTING

Low Key offers a wide variety of options and configurations. Utilizing both electroluminescent panels, liquid crystal reflective displays and surface mount L.E.D.'s.



CUSTOM SWITCHES/ KEYBOARDS

Low Key membrane products represent the ultimate in state of the art materials, design options and operational stability over a wide range of User environments. Low Key design options, include both polyester film and printed circuit board substrates, offering a wider range of current, temperature and mounting geometries.

GRAPHICALLY APPEALING

Low Key graphics are more than, just so much decorative "window dressing." Utilizing its years of experience, Low Keys graphic arts department has met the most enduring standards of excellence developed over the widest possible range of photographic imaging requirements; And end User environments. The graphic standards today, are what sells "your products" tomorrow.

UNIVERSAL MEMBRANE SWITCH/KEYBOARD ENCODERS

Low Key introduces the USE-144 universal encoder series, providing a pure PC encoding interface for Low Keys custom membrane switch/keyboard designs. The USE-144 is software configurable which can be used with any contact type keyboard with a switching matrix up to $12 \times 12 = 144$ keys.

ASSEMBLY SERVICES

Low Key provides turn-key assembly and testing of display, driver and controller boards, in conjunction with specific switch/keyboard related applications. One stop shopping lessens the USER exposure to costly delays and confusion with multiple sources.

LOW KEY CORP. 105 MAPLEWOOD AVE. / GLOUCESTER, MA 01930-1195 / (508) 281-0448 FAX (508) 281-6321

low key

THERE IS NO GREATER PRIORITY AT LOW KEY THAN THE COMMITMENT TO QUALITY & DESIGN EXCELLENCE

MEMBRANE SWITCHES

A Low Key membrane switch consists of a decorative, silk screened graphic overlay combined with conductive inks on a polyester carrier which, when assembled, forms a low voltage switching device.

Low Key membrane keyboards are sealed from the environment. This protects them from gross chemical and atmospheric contamination. Having no moving mechanical parts to fail, the membrane keyboard is highly reliable, cost effective, and environmentally efficient.

OPERATING CHARACTERISTICS

- Operating Voltage 30Vdc
- Operating Current 20ma Typical
- Contact Resistance 2-50 Milliohms
- Circuit Resistance 20-30 Ohms*
- Life Cycles (MTBF) 5,000,000
- Activation Forces Ounces 3-12 oz
- Travel Inches 0.006 Typical
- Bounce, Milliseconds 20 Typical
- Operating Temperature 0 to 150°F** −18 to 65°C**

Normal range forces can be varied to meet your specifications.

* Depending on size and configuration of circuit.

** Selected lamination materials are available for high temperature applications.

DESIGN OPTIONS TO CONSIDER

A. Transparent lens for LCD display (UV-hardcoated—clear glossy)
B. Frosted windows for LEDs
C. Membrane switch contact with embossed locating ring
D. Die-cut keyways for pushbuttons
E. Electroluminescent lighting
F. Printed gas discharge display window (UV-hardcoated—transparent green)
G. UV-textured velvet finish
H. Membrane switch contact flat keypad surface
I. Printed deadfront legend for seven segment display, visible only when illuminated. A variety of colors available
J. Membrane switch contact with embossed keypad and stainless steel domes
K. Aluminum molded on machined subplates
L. Threaded studs and fasteners
M. Polycarbonate Face with UV-printed hardcoat finish
N. Embossed surface for decorative effect

Note: See Design Data Sheets for specific details on A through N.

CONSTRUCTION & FINISHING

DIE CUTTING

Low Key utilizes laser cut steel rule dies. Steel rule die cutting is carried out on all components of the keyboard. Typical tolerance levels of a steel rule die is generally ±0.010 for overall dimensions, and less for die cut holes, key ways, cut outs, and rounded corners.

EMBOSSING

Embossing of the keypad areas on membrane switch overlays is offered by Low Key, to accent key switch areas and to enhance tactile response. Embossed areas can raise circular, square, or rectangular keys more than 0.030 inches above the overlay surface.

TERMINATIONS

Low Key membrane keyboards are most commonly terminated with Dupont/Berg insulation displacement connectors. Common to all flat and flexible circuit connectors, the clincher assembly mates to 0.025 inch pins or headers on a 0.100 center to form a complete interconnection system. Low Key offers other types of interconnect systems in varying configurations and geometry.

SNAPDOMES

Low Key metal snap action domes provide positive feedback over a wide spectrum of operational conditions. Dome sizes range from 0.50 inches in diameter and smaller. Domes are fabricated from a passivated stainless steel spring material. Electrical contact is made when a snap dome is given sufficient finger pressure, causing the dome to snap over into a flattened shape. This forces the dimple to bring the top and bottom circuits into contact with each other. Snap domes are not in intimate contact with the circuit.

Typical specifications on Low Key tactile domes are:

Operational M.T.B.F.	1.0 million
Total Travel	0.015 max.
Pretravel	0.008
Overtravel Nominal	0.007
Trip Travel at Make Point gm	250 gm ±4
Tactile Range	medium

L.E.D.'S

If densities are shrinking, combine size efficient surface mounted L.E.D.'s within your next membrane switch design. Low Key's construction techniques provide unlimited SMD arrays at no increase in assembly thickness, typically 0.035″ to 0.042″.

ELECTROLUMNESCENT PANELS

The durable thin film of the EL panel offers long life, uniform lighting. They are individually addressable, and add as little as 0.011″ to your assembly.

Capacitance	.0035 ufd/in²
Phase Angle	Up to 75 degrees leading
Frequency	60-400 Hz
Voltage	115 AC
Current consumption	0.2-1.0 mA/in²

Low Key's construction techniques provide unlimited SMD arrays at no increase in assembly thickness, typically 0.03″ to 0.04″ thick.

UNIVERSAL MEMBRANE SWITCH/KEYPAD . . . . . .ENCODER. . . . . .

Low Key offers the USE-144 micro-processor based encoder with its custom membrane switch and keyboard products. The USE-144 is software configurable, detecting and encoding up to 144 keys in matrices up to 12 x 12. Selectable output data provides either, PCXT/AT format or in RS232/432 formats. The USE-144 is powered from a single + 5v power supply. No + / − 12v supply is required even for true RS-232 signals. The encoder is uniquely size efficient 1.500″ x 3.500″ x 0.500″ and is easily mounted to the back of your custom membrane switch/keyboard. Complete technical data is available upon request.

LOW KEY CORP. 105 MAPLEWOOD AVE. / GLOUCESTER, MA 01930-1195 / (508) 281-0448 FAX (508) 281-6321

low key

THERE IS NO GREATER PRIORITY AT LOW KEY THAN THE COMMITMENT TO QUALITY & DESIGN EXCELLENCE

A TRUE MEMBRANE KEYBOARD MANUFACTURER

In a class by itself, when your design concept is simple, why take the long way around and settle for less?

Experience and perfection are the keys to providing expert design and manufacturing leadership. At Low Key, we provide you with over 25 years of combined engineering, materials management, and manufacturing expertise.

GRAPHICALLY APPEALING

The modern look of Low Key's membrane keyboards is aesthetically appealing and uniquely stylish. Combinations of graphic materials and processes provide many visual effects, so necessary in this imaginative market.

ECONOMICAL, RELIABLE, & EFFICIENT

Membrane keyboards don't just happen!

We combine old-fashioned one-on-one design review meetings with modern, computer-aided engineering to address each crucial design consideration within hours of schematic validation.

Low Key's efficient size and approach to service is the cornerstone to premium service and quality, but at prices that are well within your budget considerations.

The essence of quality and reliability begins when we design your keyboard. We engineer quality in the lab, not in your customer's facilities. Through research and testing, Low Key maintains continuous vigilance over all materials, processes, and operational keyboard characteristics.

PRINTING

A GUIDE TO SELECTING GRAPHIC OVERLAYS

Low Key graphic overlays for membrane switches and panels can be screen printed in an endless array of colors, utilizing Low Key's vast library of UV ink formulations. Matching colors to PMS standards and special corporate colors is standard procedure.

DIELECTRIC COATINGS

Low Key membrane switches can incorporate dielectric inks for separating portions of the switch from environmental influences. The dielectric coating is a single-component, very-high-solids polyurethane. The dielectric can be applied over or under conductive inks, and will not interfere with their conductive abilities.

FILTERS & LENSES

Transparent inks, in several colors including smoke, can be used to provide filter or lens capability to a membrane switch or panel keyboard. These windows can be clear glossy, diffused, or fluffy textured. This allows light transmission to be controlled from LED or gas discharge displays, which are located behind the display window.

DEADFRONTS

Deadfronts are those portions of the panels or switches where messages, instructions, or read-outs are completely concealed until the panel light is activated. Deadfront graphics are used for aesthetic appeal. Additionally, they tend to draw attention to a particular function or legend when lit. The best deadfront effect is achieved when a black background is used. However, most dark colors and certain shades of grey have been used with satisfactory results. Each application should be evaluated using the actual light that is to be used with the display, in conjunction with the deadfront panel.

ULTRAVIOLET CURING AND TEXTURING

Low Key incorporates UV curing of the graphic sheet to provide selective texturing of the overlay. Hardcoating may be achieved in a similar way, making the overlay extremely resistant to solvents, chemicals, and abrasion. The UV-cured hardcoat is available in a variety of finishes, including clear glossy, matte, and velvet.

Selective texturing of the overlay, with a UV-cured coating, provides visual appeal. This is accomplished by allowing certain portions of the overlay to be textured, while others are left clear and glossy, as in a window or filter area. Textures and colors can be combined to enhance the aesthetics of the final product, while greatly extending the useful life of the switch.

SHIELDING

Printed R.F.I., E.M.I., and static discharge shielding can be provided to protect the electronic components to which the switch is connected. A grounded border, printed on the membrane or a separate printed laminate, can be provided. This may be necessary if there is a likelihood that the switch will be subjected to a static electric charge.

Low Key recommends that in any situation, a thorough evaluation be carried out to determine the effectiveness of R.F.I. and E.M.I. shields prior to production.

LOW KEY IS A CERTIFIED SUPPLIER TO MIL-I-45208A PROVIDING MEMBRANE SWITCHES AND PANELS TO THE MILITARY AND AEROSPACE INDUSTRIES.

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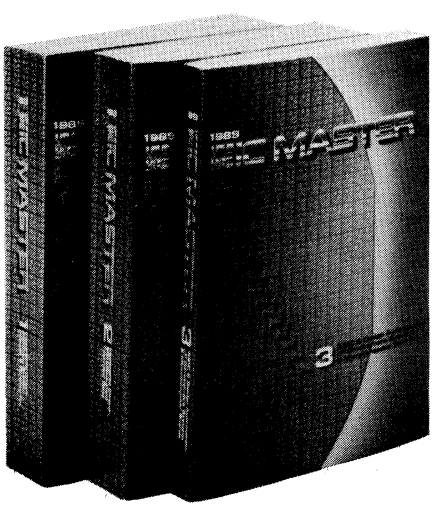

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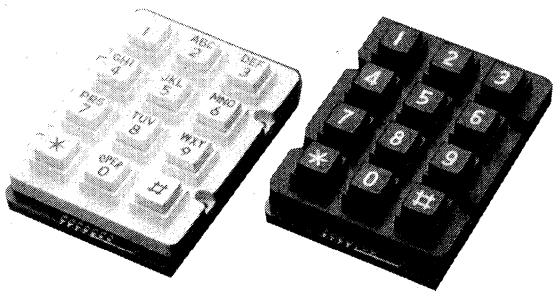
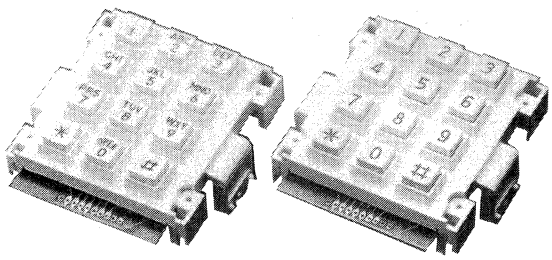
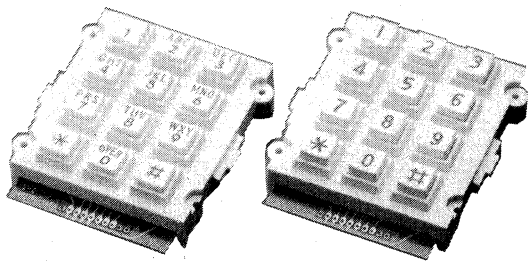


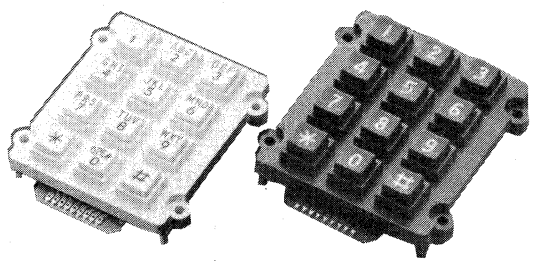
TKA2200 TKN2201



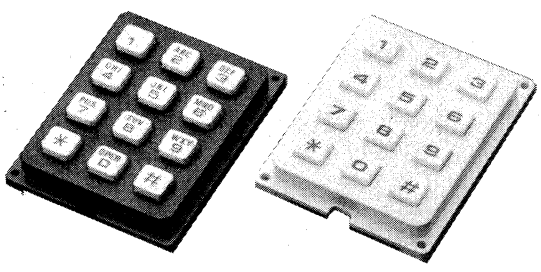
TKA2300 TKN2300



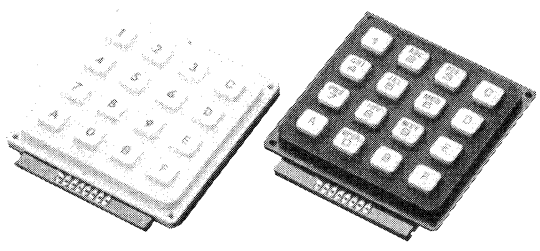
TKA2400 TKN2400



TKA2500 TKN2501



TKA2602 TKN2600



TKN6100 TKA6102

SPECIFICATIONS and TRUTH TABLES

GENERAL:

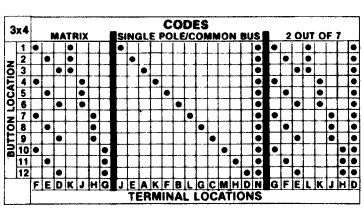
- Contact Rating: 20mA 24VDC.
- Contact Resistance: 20 ohm max.
- Contact Bounce: 10msec max.
- Life Expectancy: 1,000,000 cycles per key.
- Operating Temperature: −20°C to +60°C.
- Storage Temperature: −40°C to +65°C.

MATERIALS AND FINISHES:

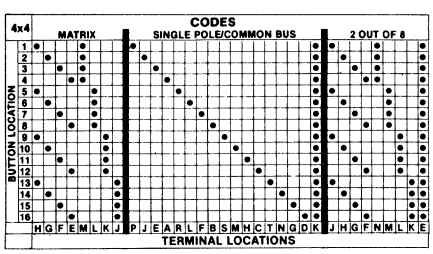
- Bezel and Keytops: ABS black, white or grey
- PCB: Grade HB with wire jumpers or 2-layer jumpers and gold plated contacts
- Terminal: Pinwafer
- Legends: Doubleshot molded black or white
- Special orders: Colors, custom legends, shielding, FR2 PCB material, connectors

Minimum quantities apply to special orders.

12 KEY MODELS



16 KEY MODELS



FOR FURTHER INFORMATION, DETAILED DRAWINGS & SAMPLES PLEASE CONTACT OUR SALES OFFICE.

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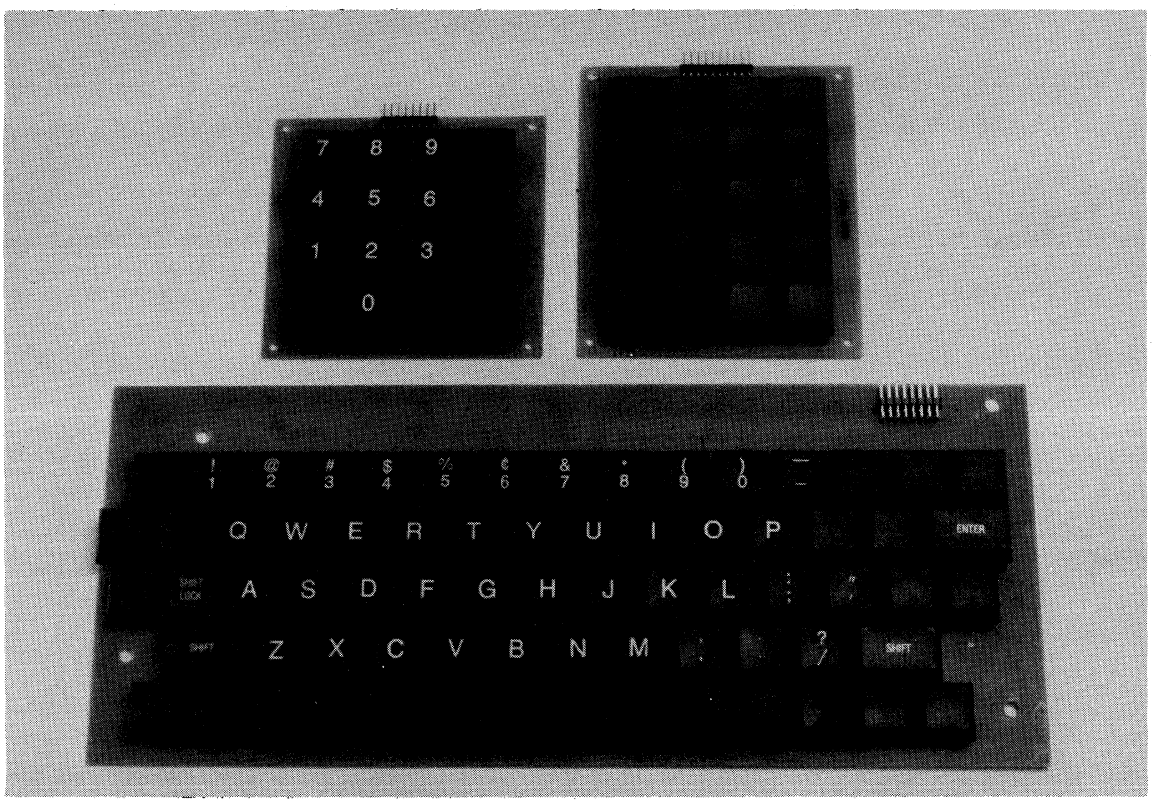
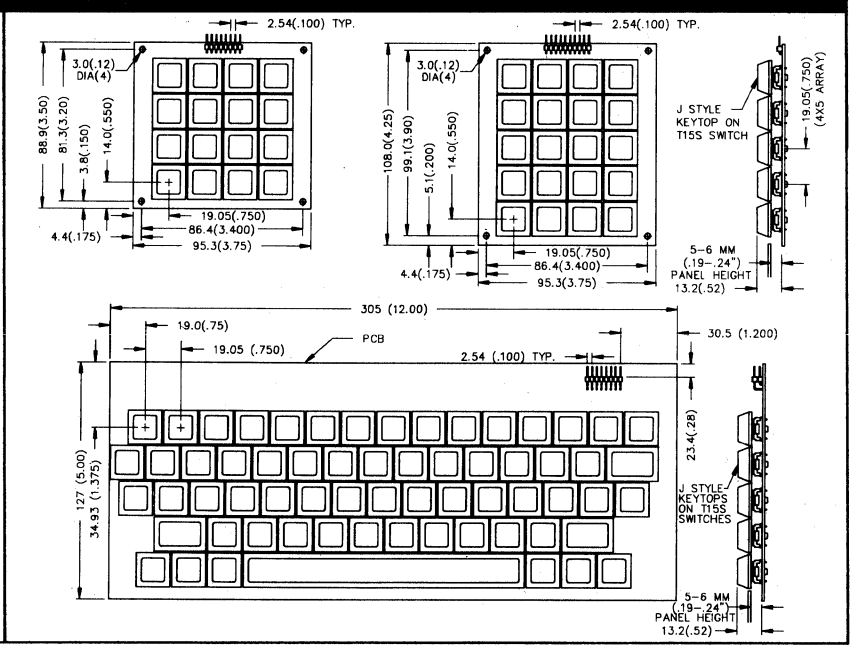
MEI Stock Keypads and Matrix Wired Keyboards Feature Sealed Contact Full Travel Switches



STANDARD ARRAYS

MEI offers from stock 16, 20 and 64 position keyboards made from T-15 switches and standard truncated keytops of any selection from stock legends. Keyboards are all matrix only output terminating in a male 0.100 header.



MECHANICAL ENTERPRISES INC.

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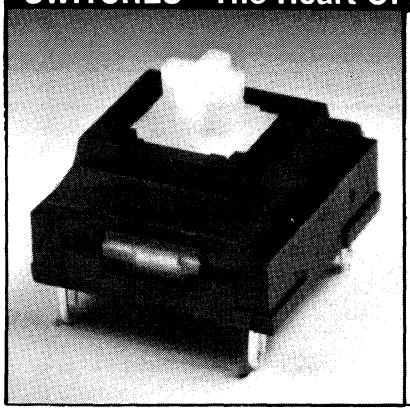
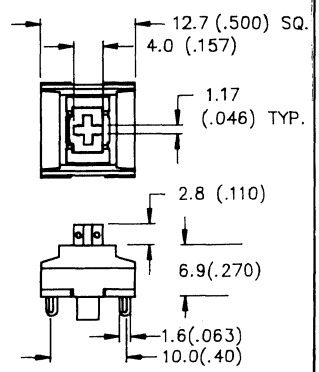
MEI Components Make In-House Keyboard and Keypad Construction Easy and Cost Effective

SWITCHES - The Heart Of Any Keyboard

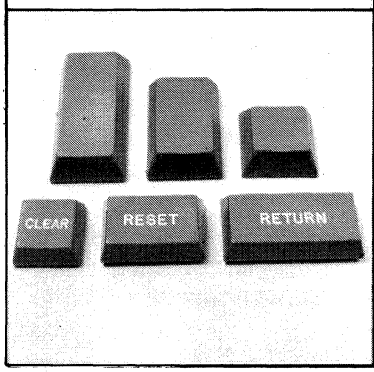


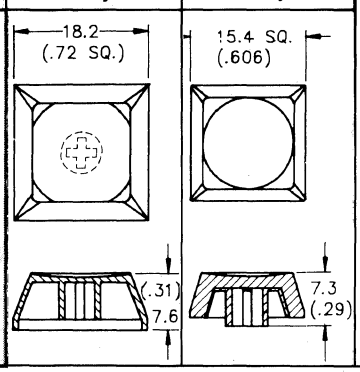


MEI's new T-15 Keyboard switch is produced and tested on fully automated machinery in the USA providing a quality and low price not matched with hand assembled switches. With their sealed contacts they may be easily wave soldered and aqueous cleaned along with other components. Primary features are:

- Sealed low resistance, low bounce contacts
- Very low profile, full travel, tactile response
- Built-in wide jumpers allowing a single sided matrix
- Spring like terminals to hold switch while soldering
- Industry standard cruciform keytop mount
- Stable mounting without a metal sub-panel
- Center to center mounting as close as 12.7mm

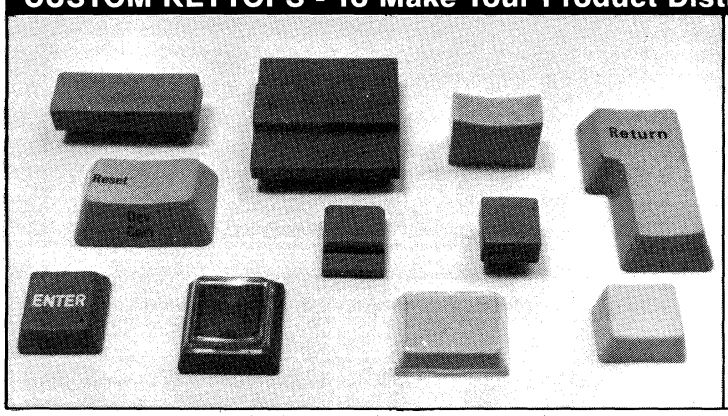
STOCK KEYTOPS - For A Fast Start





MEI offers from stock two styles of keytops to fit the T-15 switch, one for mounting on 19mm (0.75) centers and the other for a closer mounting of 15.8mm (0.625). Each is complete with 1½X, 2X and space bar lengths. Leveling kits for wide keytops are also available. A complete assortment of the most frequently needed legends such as numerals and ASCII symbols is maintained in stock as well as blanks in 5 colors. Hand engraving, custom pad printing and doubleshot molding are additional services MEI offers with the stock keytops.

CUSTOM KEYTOPS - To Make Your Product Distinctive



MEI makes extensive use of miniature family molds both for itself and its switch customers. As a result a custom keytop shape can be tooled for hundreds, not thousands of dollars, and in a reasonable time. We offer this service to OEMs whose product requires unique keytops to improve functionality or set it apart from the competition.

CUSTOMER ASSISTANCE - Provided Before and After The Sale

With years of experience in keyboard construction MEI is able and willing to assist with any design problems from the PCB layout to the selection of the most cost effective keytop legending system. This service extends to introducing customers to other sources for keyboard hardware and keytops when required.

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MEMBRANE SWITCHES

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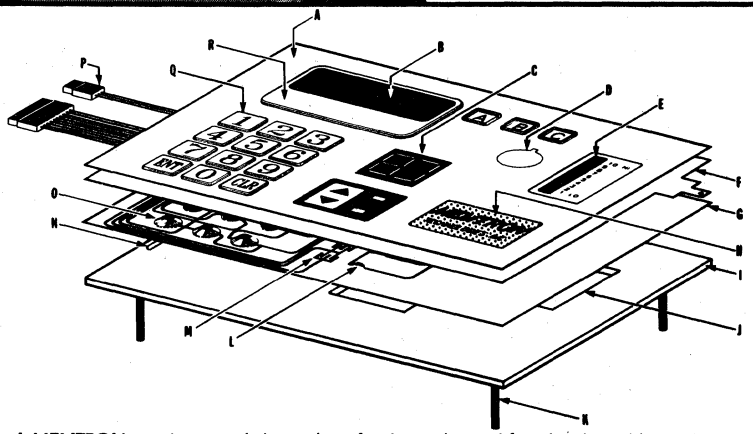
Over the years, many membrane switch manufacturers have come and gone, but at MEMTRON, we're stubborn, we've stuck to our guns. And now, when it comes to **quality, research and development, product warranties,** and **service,** we're

*"IN TOUCH WITH **YOUR** TECHNOLOGY®."*



A MEMTRON membrane switch consists of a decorative and functional graphic overlay combined with conductive inks on a polyester carrier which, when assembled, form a low-voltage switching device.

MEMTRON membrane switches are completely sealed from the environment, making them extremely impervious to chemical and solvent attack. With no mechanical parts to fail, the panel is highly reliable and efficient.

SPECIFICATIONS OF SNAP DOMES

Life Expectancy, cycles	2,000,000
Total Travel, nominal inches	0.015
Pretravel, nominal inches	0.012
Overtravel, nominal inches	0.003
Trip Force at Operating Point, grams	300
Tactile Feel	high

STANDARD OPERATING CHARACTERISTICS:

Operating Voltage, volts dc	30
Operating Current, milliamps	30
Contact Resistance, ohms	2 to 10
Circuit Resistance, ohms*	20 to 100
Life Expectancy, cycles	5,000,000
Activation Force, ounces†	5 to 8
Travel, inches	0.006
Bounce, milliseconds	1 to 10
Operating Temperature, °F (°C)**	0 to 150 (-18 to 65)

*Depending on size and configuration of circuit.
†Normal range. Any force can be obtained to meet your specifications.
**Special laminations and materials are available for high-temperature applications.
Note: Contact Memtron engineering for special operating requirements.

DESIGN OPTIONS

A. **The Membrane Switch Overlay:** To meet special environmental and design conditions. May consist of polycarbonates, polyesters, or special-composition plastics.

B. **Transparent Display Windows:** Used primarily for viewing LCD displays. May consist of the clear, glossy overlay material, with or without U.V. hardcoating. Inserted lenses are also available.

C. **Tinted or Deadfront Display Windows:** Used primarily with LED or gas-discharged displays. May be printed or inserted lenses.

D. **Die-Cut Holes With Keyways:** For application of mechanical switches, in conjunction with the membrane switch, in higher voltage applications.

E. **Gloss UV Hardcoat on Textured Overlay:** Used to create an inexpensive transparency when using a pre-textured overlay material such as velvet polycarbonate.

F. **Shielding Layer:** May consist of solid foil or plastic layer printed with conductive inks. May be designed to guard against EMI, ESD, and RFI conditions.

G.-1 **Membrane Switch Composite:** Consists of layers of heat-stabilized plastics with printed circuitry and spacer layer. Assembled with special adhesives.

G.-2 **Printed Circuit Board Construction:** Consists of tin-lead reflowed copper-etched circuits on glass epoxy or other PCB substrate.

H. **Selective Texturing:** UV hardcoat textures may be applied in selected areas on gloss overlay materials to impart abrasion, chemical attack, or glare resistance.

I. **Sub-Plates:** A rigid plate used for mounting membrane switches to an enclosure. May consist of aluminum, glass epoxy, or other materials.

J. **Sub-Plate Cut-Outs:** To allow the viewing of displays mounted on a PC board behind the sub-plate.

K. **Studs and Stand-Offs:** For fastening sub-plates to enclosures or for fastening PC boards and displays to sub-plates.

L. **Surface-Mounted Embedments:** May consist of surface-mounted LEDs within the membrane switch composite and powered through the switch circuits.

M. **Standard or Micromotion Switch Design:** Consists of upper and lower circuit layers separated by a 5- to 7-mil spacer. May also consist of a single circuit layer with shorting pad separated by a spacer.

N. **Tail Cut-Out:** An opening in the sub-plate to allow connection of switch with logic board.

O. **Domed (Tactile) Switch Design:** Consists of metal or plastic snap domes for touch response when depressing a membrane switch keypad.

P. **Connector:** May consist of prong or receptacle types with or without housing. May also consist of solder tabs or exposed traces for friction-fit connection.

Q. **Embossing (Functional):** Raised or embossed keypad areas to allow room for tactile domes. Also serves as key referencing device when keypad is ring embossed.

R. **Embossing (Decorative):** Embossed areas to enhance design or draw attention to special features. May also allow space for special legend inserts behind overlay.

For the name of our nearest representative or for literature and details, call collect 1-517-652-2656 or 1-800-234-7525

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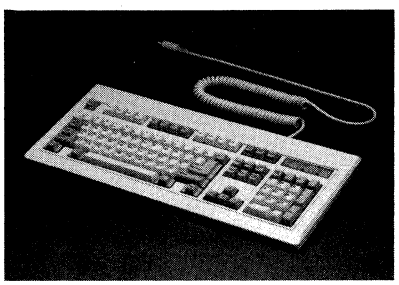
FEATURES

Standard or custom design, NMB Technologies offers keyboards having more features, more benefits and the highest quality. Automated factories offer high volume for OEM users worldwide at very competitive prices. The membrane or mechanical keyswitches can be employed in DIN standard low profile layouts.

- Plug compatibility
- User friendly key layout
- Sublimation printed keycaps
- Linear or tactile feel
- Retractable legs and rubber foot pads

RT 101 KEYBOARDS

Now with membrane or mechanical switches

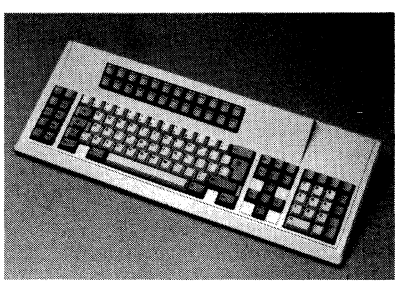


The RT keyboard line is a high performance affordable answer to requirements for PC, AT or PS2 systems. RT-101 is the popular new industry standard keyswitch layout.

FEATURES

- Three popular keyswitch configurations
- Easy access slide switch changes modes
- Immediate delivery from stock
- 50 and 100 pc orders available from stock; call today to order! 1-800-321-3536.

PC-122 KEYBOARDS

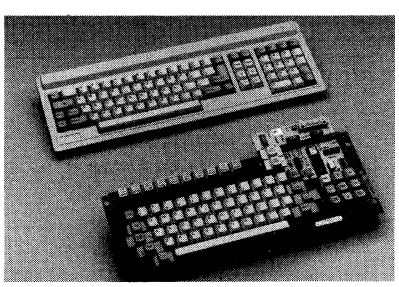


The PC-122 keyboard family features plug compatible, fully encoded models for the IBM 3270 PC, PC/AT or emulating systems. The smooth feel and quiet operation of the keyswitch attest to inherent quality and reliability.

FEATURES

- Long life mechanical keyswitches
- New compact enclosure style
- Interface customization for all applications

CUSTOM KEYBOARDS



Custom layouts, full encoded models are offered for the simplest or the most sophisticated systems. Membrane keyswitches are also available for custom applications in low cost systems.

FEATURES

- High volume capability for large OEM's
- Domestic application engineering and stock
- Convenient regional offices

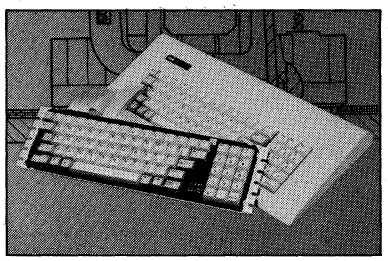
NMB TECHNOLOGIES INCORPORATED

HI-TEK KEYBOARD DIVISION

For complete specifications and pricing, contact

NMB TECHNOLOGIES INCORPORATED
9730 Independence Ave., Chatsworth, CA 91311 • Telephone: (818) 341-3355
FAX: (818) 341-8207 • TWX: (910) 494-1232 • Telex Number: 651340

OAK Keyboards and Keypads

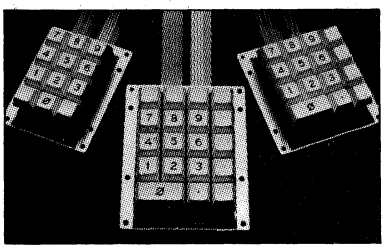


Low Profile FTM Keyboards

Measuring just 19.9mm from the center of the home row keycap to the bottom of the aluminum baseplate, Oak's low profile FTM keyboard allows designers to place the FTM in an enclosure and still meet the international 30mm DIN standards.

One of the most notable features of the keyboard is a rocker mechanism which gives a distinct nonfatiguing feel for the keyboard operator. Other features include LED indicators for shift lock and function keys, variable operating force, RFI/EMI/ESD protection, single tail termination and custom encoding electronics. Oak's FTM keyboards can be customized to meet specific design requirements with options in profiles, legends, colors, keycap styles, enclosures and more.

Request brochure F-1119.

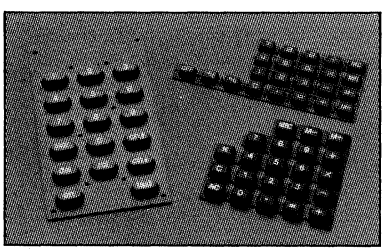


Full Travel Membrane Keypads

Oak's rugged full travel membrane keypads are low cost with high reliability and life expectancy rated at 100 million cycles per key. The keypads are EMI/RFI shielded with a front-sealed design that protects the contacts against spilled liquids, dust and other contaminants. The pretravel and overtravel features promote operator ease, input accuracy and low fatigue.

Available in standard or low profile, Oak FTM keypads are useful in a wide range of data entry applications. The FTM keypad comes in standard sizes of 3″ x 4″, 4″ x 4″ and 4″ x 5″ with a full travel of .160 in. Low profile FTM keypads are available with a .150 in. travel for DIN compatible designs.

Request brochures F-1118 and F-1118A.



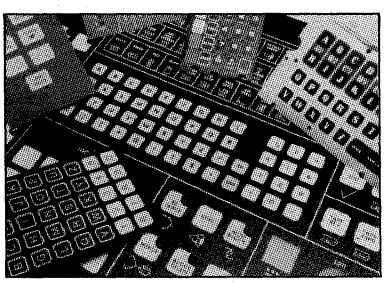
Silicone Rubber Keypads

Oak also offers conductive and non-conductive short-travel rubber keypads in custom versions or standard 3″ x 4″ size. Made of silicone rubber, they are resistant to ozone, corrosion, contamination and puncture. The keypads operate at a temperature range of -40°C to +85°C and perform up to five million cycles depending upon stroke, key pressure and snap effect.

Available with a choice of tactile feel in a key travel range of 0.3 to 6.0 mm, these keypads require an actuation force of 30-260 grams.

In the non-conductive versions, the rubber keypad serves as the switch actuator over a three-layer membrane panel. Conductive keypads utilize a carbon-impregnated silicone "pill" molded on the underside of the rubber dome to accomplish the switching. The conductive switch mounts onto a glass epoxy PC board.

Molded translucent or opaque, the switches are available with custom color options, LED backlighting and alphanumeric or symbolic legends screened onto rubber or plastic keycaps.



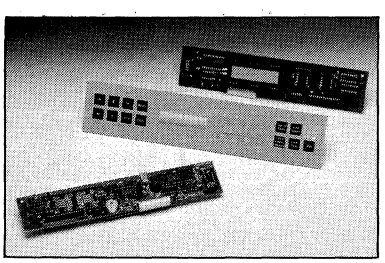
Membrane Switches

Oak Micromotion membrane switches offer the ultimate in environmental resistance and flexibility, and come in a choice of many sizes, colors and designs. Tactile feel is also available.

The membrane switch product line consists of two designs. Type A products use rigid single- or double-printed circuit boards. Operating voltage: 1 to 50 (AC or DC). Operating current: 0.05 to 100 milliamps.

Type C products are completely film-based, using a non-rigid polymer-substrate instead of a PC board. Termination is achieved via a "tail" which is compatible with standard commercial connectors. Operating voltage: 1 to 30 (AC or DC). Operating current: 0.05 to 50 milliamps.

Request brochure F-1087.



Electronic Packaged Systems (EPS)

Oak Switch Systems not only has the capability of supplying components, but we also supply electronic assemblies beginning with your concept through our design and manufacture. EPS enhances Oak switch and keyboard products with value-added components and circuitry such as surface mount PCBs and custom touch screens.

By combining switch, plastics, display and electronic technologies, we search for innovative ways to meet customer needs at a lower cost. Whether your application is commercial or military, our staff will work closely with yours, giving you application design support every step of the way.

Request brochure F-971.

OAK Switch Systems Inc.
P.O. Box 517 • Crystal Lake, IL 60014
Phone: 815/459-5000

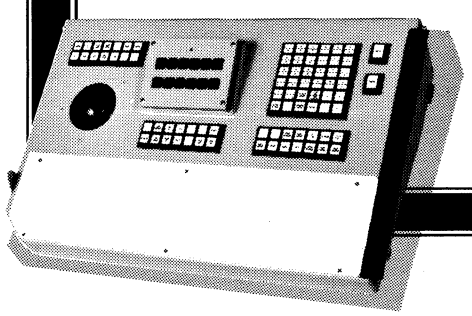
OAK Your Partner in Excellence

RUGGEDIZED SWITCH PANEL DESIGNS

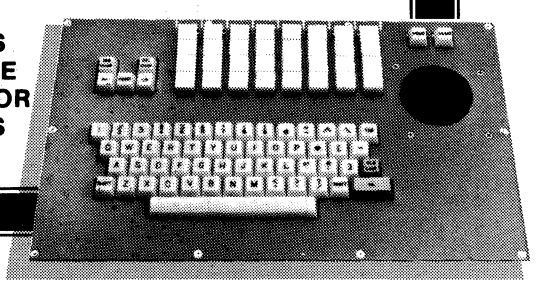
CORPORATE FACILITIES: 80 CABOT COURT, HAUPPAUGE, L.I., NY 11788, TELEPHONE: (516) 435-8300 • FAX: (516) 435-8458
6431 GLOBAL DRIVE, CYPRESS, CA 90630, TELEPHONE: (714) 527-0561 • FAX: (714) 527-7552

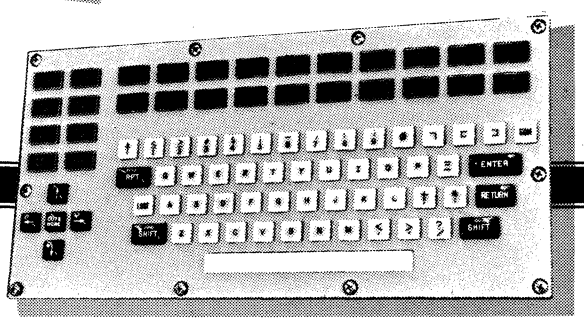
ORBIT INSTRUMENT CORP.

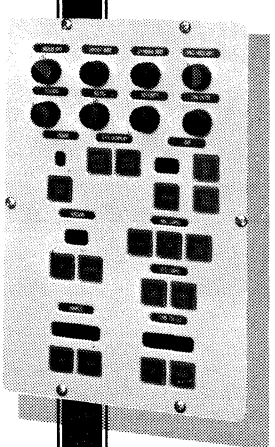
MILITARIZED KEYBOARD/BALL TRACKER ASSEMBLIES



INSTALLED IN CONSOLES AS REMOVABLE ASSEMBLIES FOR EASY ACCESS



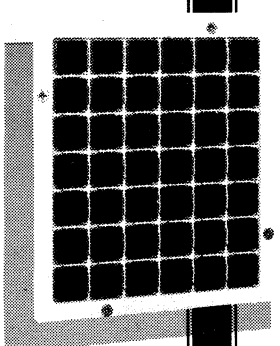


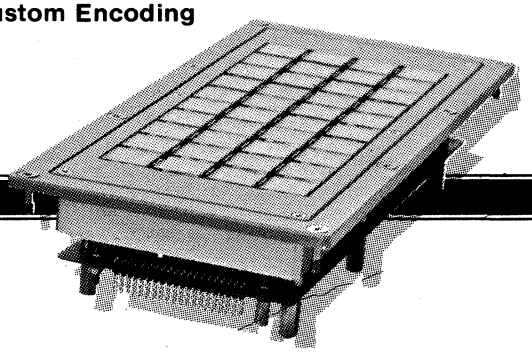


*BACK LIGHTED KEYBOARDS & *CUSTOM PANEL DESIGNS

USING

- **Orbit low profile snap action switch technology**
- **Switches can be split legend or TRI split**
- **Rugged design construction**
- **Relegendable keycaps**
- **Custom Encoding**





Preh Electronic Industries, Inc.
470 East Main Street, Lake Zurich, IL 60047-2578 U.S.A.
Phone (312) 438-4000 • Telex 297-112 PEI UR • FAX 312-438-5522

REMOTE CONTROLS/KEYBOARDS

Remote control systems available from Preh Electronics include both standard and completely customized units. IR remotes up to 53 keys and an optional waterproof (floating) unit with 16 channel capability are available.

Preh's flexibility allows wide design possibilities in the fields of commercial and satellite television systems, video tape recorders and monitors, and industrial controls.

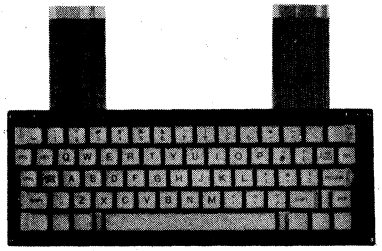
Full travel membrane keyboards of unique German technology. Metal to metal contacts ensure high reliability, long life, and excellent tactile feedback. The tops (facing) of Preh keyboards are waterproof.

PREH COMMANDER PC-AT

Full travel membrane keyboard with 111 keys. Arranging each function group in the form of "key clusters" enables the operator expedient data entry. The system is dust and splash proof. More than just IBM compatible.

PREH COMMANDER, PC/XT

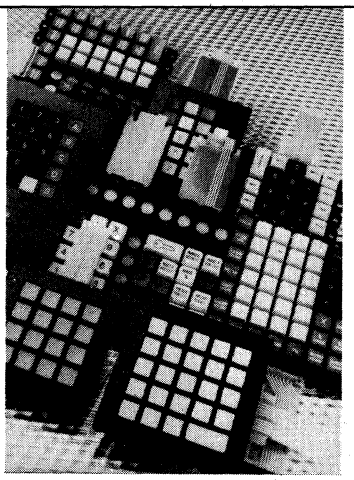
IBM-PC compatible. An extremely flat, full travel membrane keyboard with glare-free surface for operator comfort and "Crisp" tactile feedback. Additional standard units can be combined and spaced to customer requirements to provide up to 15 additional keys in the alphanumeric field. Standard unit measures 17.5" L x 7.5" W x 1.5" H. Height to center key row is 1.18".



PREH STANDARD KEYBOARDS

PREH Keyboards are dust and waterproof according to DIN 40050 specifications. The unique long life polymer domes (acting as springs) are molded in a single shot operation on a metal substrate with 20 million cycles within tolerance guaranteed.

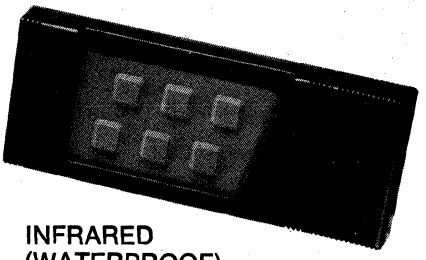
FEATURES
- full travel
- membrane technology
- low profile
- relegendable key caps
- ASCII encoder: serial (standard) parallel (optional)
- excellent tactile feel
- Standard PREH Commander or custom versions
- New IBM 101 layouts (PC-AT3)



PREH STANDARD KEYPADS

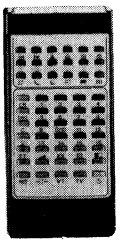
PREH offers a creative link between precision mechanics and reliable membrane technology. Standard keypads are dust and splashproof or even waterproof according to DIN 40050 specifications. Special shock resistant and vandal proof bezels are available for heavy duty or outdoor environment. Standard layouts include: 3x4, 4x4, 4x5, 4x7, 5x5, 7x8, 5x12, and 7x12 arrangements. Other custom designs available)

COMMON FEATURES
- full travel
- membrane technology
- low profile
- relegendable keycaps
- tactile feel
- reconfigurable version available
- IP65 or 54 rating



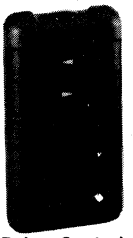
INFRARED (WATERPROOF) TRANSMITTER TYPE S-90

Up to 16 functions on this unique waterproof transmitter. Precise engineering and fine workmanship coupled with more than seven decades experience in custom tool and plastic moldmaking have established PREH as a respected industry leader.



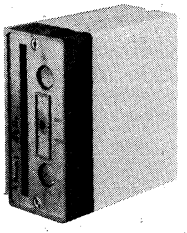
TRANSMITTER, 53 BUTTON MODEL S88/53

TECHNICAL DATA:
Transmitting Mode: PCM (Pulse Coded Modulation)
Clock Frequency: 4 MHz (Quartz)
Programmable Functions: 16 x 64 (Max. 53 Buttons)
Usable Functions: 36
Available TV Channels: 16
Analog Functions: 4
Additional Functions: 8
Supply Voltage: 9 Volt (to IEC 6F22)
Quiescent/Operating Current: 1.0 µA/6 mA Typical
Transmitting Elements: 2 Infrared Diodes



TRANSMITTER, 2 CHANNEL MODEL S11-07

TECHNICAL DATA:
Transmitting Mode: PCM (Pulse Control Modulation)
Supply Voltage: 9 Volt (to IEC 6F22)
Quiescent/Operating Current: 10µA/15 mA Typical
Transmitting Elements: 3 Infrared Diodes



RECEIVERS MODEL S12-07

TECHNICAL DATA:
Plastic Enclosure-Dim: 4" x 2" x 4"
Components: Electronic Decoder, Power Supply for Receiver and Pre-Amplifier and Switching Relay as Output Component
Electronic Systems: PCM Decoder w/ Power Supply and 4 Relay Outputs
Supply Voltage: 220 VAC, 11
Outputs: 4 Separate Outputs
Power Ratings: 250 VAC, 2000 VA, 200 VDC, 30W, 24 VDC, 100W
For Both SPST and SPDT Applications

*DETAILED CATALOG AVAILABLE UPON REQUEST

GEORGE RISK INDUSTRIES, INC.

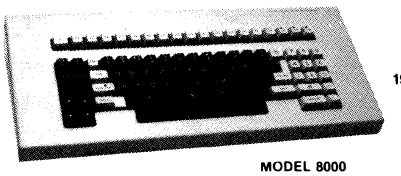
G.R.I. PLAZA / KIMBALL, NEBRASKA 69145 / TEL. (308) 235-4645 / TWX 910-620-9040 / FAX (308) 235-2609

STANDARD KEYBOARDS

16.26" x 7.85"

MODEL 9062

62 keys • full 128 character ASCII encoding two-key lockout or N-key rollover • Outputs: parallel, TTL serial, RS-232, RS-422, PC-XT/AT • easy mounting provisions • non-glare double shot molded keycaps–separate cursor control keys • user defined key • auto-repeat on all keys • +5V power.

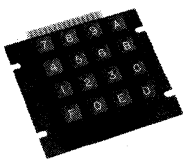


19.0" x 8"

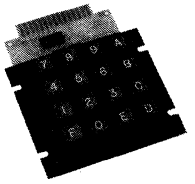
MODEL 8000

• State-of-the-art microprocessor keyboard, 95 keys, including 19 special function keys • High reliability performance • Four-wire serial interface, 300 or 1200 baud • Unique variable key rollover with phantom key lockout • High speed operation • Ergonomic design.

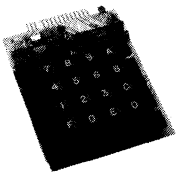
KEYPAD MODELS 10, 12 or 16 Keys



• Unencoded wiring, 1 of 16 or X-Y matrix
• One side of each keyswitch is common
• Design to be used with custom-supplied encoding.



• 4 bit hex encoded
• Full CMOS design
• Outputs compatible with LS and standard TTL logic



Serial RS-232, RS-422 or TTL output • parallel output • microcontroller keyboard encoder • full 7-bit ASCII characters.

CUSTOM KEYBOARDS

GRI builds custom keyboards to your exact specifications and drawings for all types of applications—air traffic control, process control, military, etc. Our lighted keyboards are especially attractive due to their visibility and high reliability. We offer both the dry reed and mechanical contact switch technologies. We have manufactured custom keyboards for companies such as Burroughs, Eaton-AIL, FAA, Ford Aerospace, Goodyear Aerospace, Lockheed, Magnavox, Raytheon, Rockwell, Texas Instruments, and many others. Send us your specifications and drawings for a quotation today.

PUSHBUTTON SWITCHES

DRY CIRCUIT & LOGIC SWITCHING

"B" SWITCH
1.125 H x .420 W

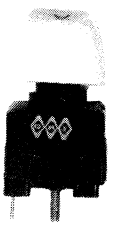
"G" SWITCH
1.745 H x .625 dia.

"D" SWITCH
1.470 H x .350 dia.

"V" SWITCH
1.320 H x .590 case dia. - .675 bezel dia.

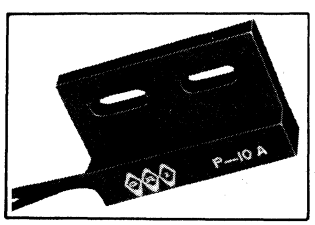
"KB" SERIES
1.550 H x .705 dia.

"KBLP" SERIES
1.125 H x .750 sq.

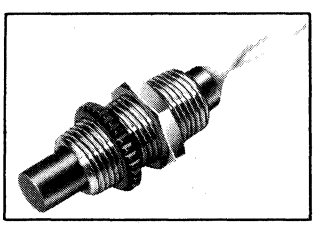


SPST-NO, NC; DPST-NO, NC-Available in 4 form A or B-Illuminated and non-illuminated Hi-rel-50 million operations-Mounting collars and buttons available-Mercury wetted reed switches available

PROXIMITY SWITCHES & VANE SENSORS



P-10



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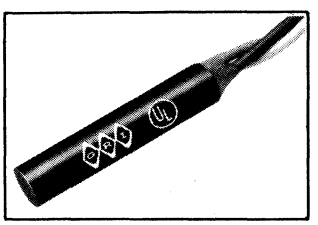
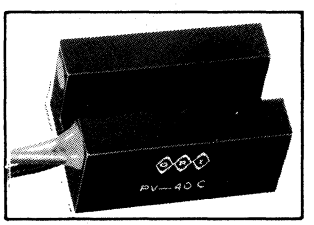


P-30

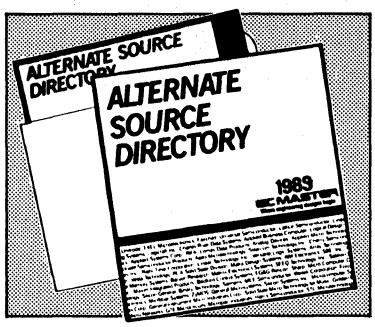


PV-40

HEARST ENGINEERING SOFTWARE

ICMASD...IC Alternate Source Directory

If you've used the IC MASTER, you know what the Alternate Source Directory is. Engineers tell us that it's one of the most valuable sections of the Master. The Alternate Source Directory...ASD...is now available in floppy disk form.



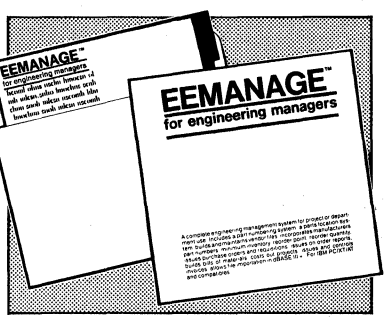
The electronic ASD is FAST! Just ask a question and the answer pops up in a split second.

The electronic ASD is FLEXIBLE! You can add ICs and you can add comments. You can add part numbers, prices, technical notes or anything else you like. You can customize the ASD to fit your needs and the needs of your company.

Order the Alternate Source Directory for your AT, XT or compatible. We'll send you two floppies and a very simple piece of printed documentation. Download the floppies and you're in business. All you need is a hard disk.

EEMANAGE...for engineering managers

Developed by the publishers of EEM/ Electronic Engineers Master, EEMANAGE is a software program designed to make life easier for engineers and engineering managers.



EEMANAGE does many things: 1. Develops Bills of Materials 2. Assigns Part Numbers logically 3. Manages Engineering Inventories 4. Issues Purchase Requisitions 5. Relieves Engineering Inventories 6. Manages a Parts Storage System 7. Issues Engineering Change Notices 8. Interfaces with dBaseIII+ Programs.

EEMANAGE is completely menu driven. It is simple to understand and operate. Any competent secretary can be up and running on EEMANAGE in minutes.

Order EEMANAGE for your AT, XT or compatible. We'll send you one floppy and brief, very user friendly documentation.

The basic price for ICMASD or EEMANAGE is $149.50* each and includes floppy disk(s) and complete program documentation.

For immediate shipment you can order ICMASD or EEMANAGE on your VISA or MasterCard credit card simply by calling Marie Botta at (516) 227-1300.

To order by mail send your purchase order to:

Hearst Business Communications

645 Stewart Avenue Garden City, NY 11530 Att: Marie Botta FAX (516) 227-1901

*Taxable in NY, MA, IL, CA

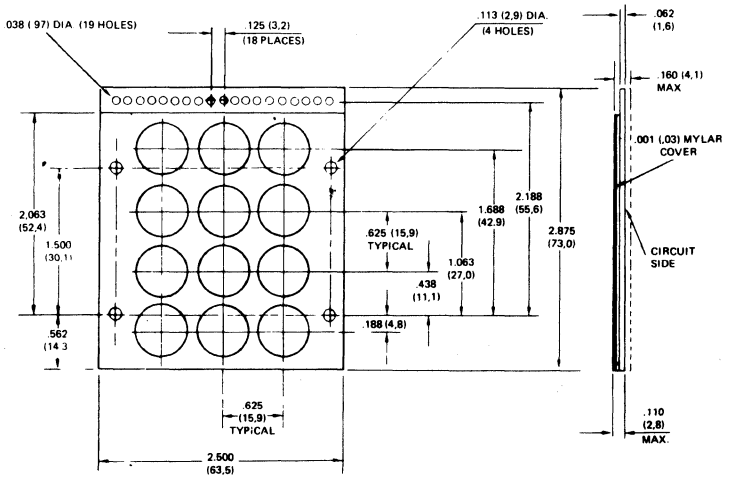
11KS AND 1KS KEYBOARDS FROM TEXAS INSTRUMENTS

- **Crisp Tactile Feedback**
- **Minimum Life Cycles of 500K**
- **Custom Options**

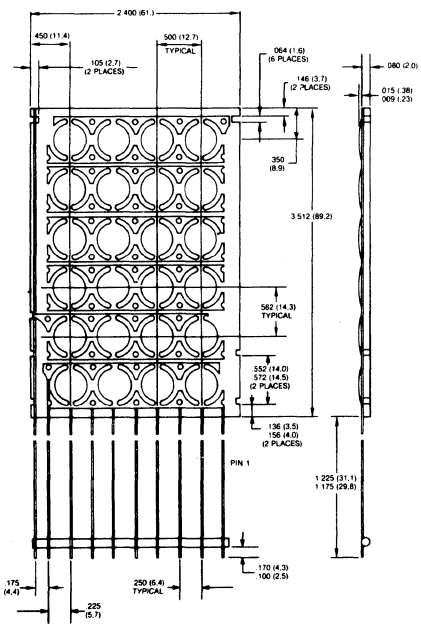
Standard Keyboards

Part Number	Number of Positions	Electrical Layout
1KS208	10 (1 X 10)	Individual
1KS187	12 (3 X 4)	Individual
1KS237	12 (3 X 4)	X - Y
1KS232	16 (4 X 4)	Individual
1KS243	16 (4 X 4)	X - Y
1KS196	20 (4 X 5)	Individual
1KS212	20 (4 X 5)	X - Y
1KS231	25 (5 X 5)	X - Y
11KS149-3	12 (3 X 4)	X - Y
11KS121	20 (4 X 5)	X - Y
11KS131	24 (4 X 6)	X - Y

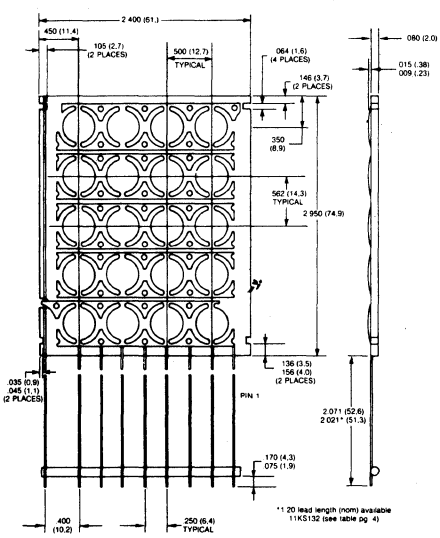
1KS 187/237 Switch Pushbutton 12 Positions



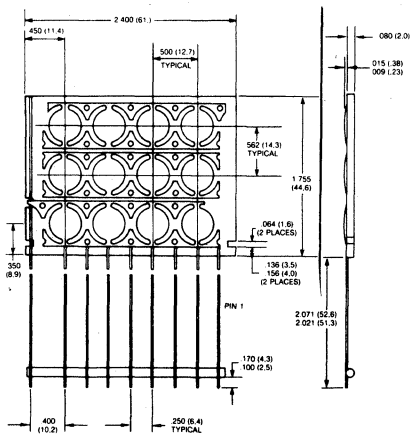
11KS 131 Switch Pushbutton 24 Positions



11KS 121 Switch Pushbutton 20 Positions



11KS 149-3 Switch Pushbutton 12 Positions



Call (508) 699-5269 or write:
Texas Instruments Incorporated
CSD Marketing, MS 14-1
Attleboro, Massachusetts 02703

PRODUCTION DATA documents contain information current as of publication date. Products conform to specificatons per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

TEXAS INSTRUMENTS
34 Forest Street • Attleboro, Massachusetts 02703

THERMISTORS, THERMOCOUPLES, & SENSORS

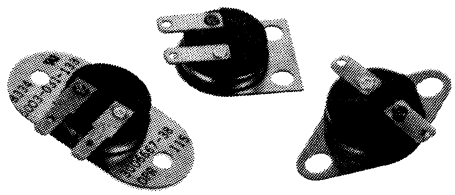
Manufacturer	Starting EEM Page No.	NTC	PTC	Leaded Chip	Bar	Cube	Disc	Hybrid Chip	Inter-change-able	Switches, Temper-ature Sensing	Sensors, Temper-ature	Inrush Current Sup-pressors	Thermo-couple	Other Features
Best Technology Inc.	B•1888										√		√	
Beta Therm	B•1889	√		√			√		√		√			
Dale Electronics	B•1890	√		√	√	√	√	√	√		√	√		MIL, Curve tracking
Fenwal Electronics	B•1896										√			
International Resistive Co.	B•1897									√	√	√		
Ketema Rodan Div.	B•1898	√	√	√	√	√	√	√	√	√	√	√		
Keystone Carbon Co.	B•1901	√	√	√			√		√	√	√	√		
Melcor Materials Elctrn.	B•1904				√	√	√	√			√		√	
Micro-Ohm Corp.	B•1907		√				√				√			
Midwest Components Inc.	B•1908	√	√	√	√	√	√	√	√	√	√	√		
Omega Engineering	B•1912								√		√		√	
Quality Thermistor Inc.	B•1914		√					√		√	√			
Sensor Scientific Inc.	B•1918				√	√	√		√	√	√			
Therm-O-Disc	B•1921									√	√			Thermal circuit cut-off
Western Electrical Comps.	B•1922	√		√	√	√	√				√	√		Probes/ Assemblies
World Products	B•1926											√		

THERMOSTATS

Manufacturer	Starting EEM Page No.	Low Profile	Grounded	Sealed (Immersion)	Isolated Contact	Isolated Case	Hermetic Seal	Disc
Airpax Corp.	B•1887	√	√	√	√	√	√	√
Elmwood Sensors	B•1894	√		√	√	√	√	
Fenwal Electronics	B•1896							√
Midwest Components Inc.	B•1908					√	√	√
Selco Products Co.	B•1917	√		√	√		√	√
Therm-O-Disc	B•1921	√						

THERMOSTATS

Accurate. Reliable. In standard and custom design. Contact Airpax Company, Husky Park, Frederick, MD 21701. (301) 663-5141. A division of North American Philips Corporation.

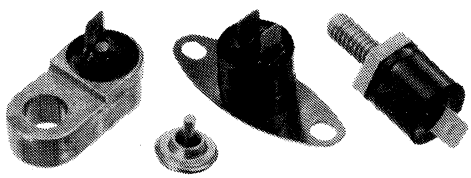


Series 5003 — Low-Profile Thermostat

Extremely thin, lightweight, wafer-type thermal switch that provides fast, positive response, excellent repeat reliability, good shock and vibration resistance over a wide operating range.

Features:

- Overall depth is only .250".
- Operating temperature range from 15°F to 355°F.
- OPR or CLR contacts are available.
- 120 VAC 5 amp, 240 VAC 3 amp.
- Weight 2.3 grams.
- Variety of mountings and terminations available.
- Environmental sealing available.
- Approval: 𝕽𝕷 Ⓒ

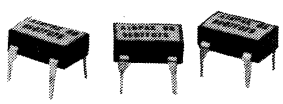


Series 5011 — Low-Cost, Grounded Thermostat

A very low-cost thermostat that will meet a number of exacting requirements for shock and vibration resistance. It is hermetically sealed and offers fast response. Plug, wire-lead, and isolated base mountings are available. 1/4-20 boss-mounted and 3/8-16 UNC-2A sizes.

Features:

- Low-cost, grounded unit.
- Operating temperature range from 15°F to 525°F.
- Many mounting packages available: 120 VAC, 32 VDC, 3 amp.
- Stud-mounted version available.

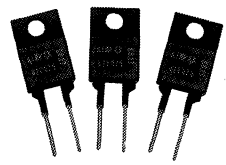


Series 6600 — PC Board-Mountable Thermostat

A miniature bimetallic snap-acting thermostat in an 8-pin N8A Dual In-Line Package. Single pole/single throw switch assembly available in either normally closed, open on rising temperature or normally open, close on rising temperature configurations. Compatible with auto-insertion equipment, the Series 6600 will withstand wave soldering and board washing operations. Typical uses include turning on an indicator light, changing the speed of a fan or switching on a control circuit.

Features:

- Operating temperature range 40°C to 120°C.
- 1 amp 48 VDC switching capability.
- Standard 8-pin N8A Dual In-Line Package for auto-insertion compatibility.
- OPR or CLR contacts available.
- Sealed to withstand wave solder and board washing.

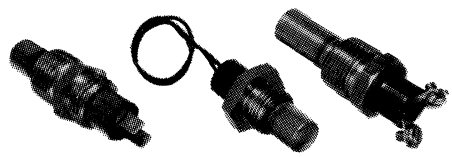


Series 6700 — Surface Sensing Thermostat

This miniature, bimetallic, snap-acting thermostat conforms to the International product package standard Y220/TO220. Included are gold-plated silver cross bar contacts rated for 100,000 cycles at 5 Vdc, 1mA resistive and 30,000 cycles at 48 Vdc/120 Vac, 1 amp resistive. Excellent repeatability over an operating temperature range of 40°C to 110°C.

Features:

- Operating temperature range 40°C to 110°C.
- TO-220 packaging — compatible with high-speed automated assembly equipment.
- Epoxy sealed for wave soldering and cleaning.
- Approval: 𝕽𝕷 Ⓒ VDE pending



Series 5100 — Isolated Case Thermostat

This two-terminal, immersion-type hermetically sealed thermostat can be used on water-cooled engines, hydraulic systems, degreasers, industrial air compressors and tanks where liquids are heated. Its isolated contact is designed to switch 110 VAC within your control circuitry. It offers rapid response to liquid or air temperature.

Features:

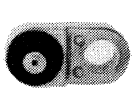
- Hermetically sealed.
- All stainless T.I.G. construction.
- Operating temperature range from 15°F to 550°F.
- 120 VAC 3 amp and 240 VAC 1.5 amp models available.
- Approval: 𝕽𝕷 Ⓒ

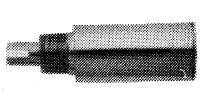
Series 5020 — Hermetically Sealed Thermostat

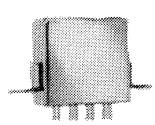
This snap-action hermetically sealed temperature control is designed for use wherever a sealed unit and high vibration resistance are required. Protects engines from damage from overheating by sensing high water or oil temperatures. Snap-action disc located in the very tip of the probe assures rapid and true response to liquid temperature. The all-welded construction (and grounded case) of this sealed thermostat ensures meeting Thermal Shock Specifications of MIL-STD-202, Method 107, Test Condition B. The tube will withstand a Pressure Exposure Limit of 1500 PSI. Insulation Resistance of 50 megohms minimum at 500 VDC.

Features:

- Hermetically sealed.
- Grounded case.
- Operating temperature range from 15°F to 525°F.
- 32 VDC, 3 amp.
- 5020 — 13 Conforms to MIL-12285/1.

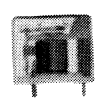






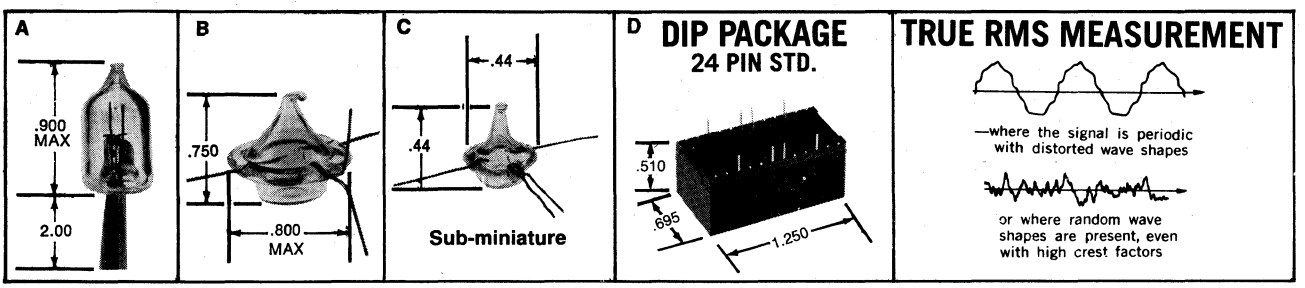
AIRPAX®

FREDERICK DIVISION



BEST TECHNOLOGY INC.
400 Boren Ave. N., Seattle, WA 98109 206/382-1300 FAX 206/382-0186

VACUUM THERMAL CONVERTERS



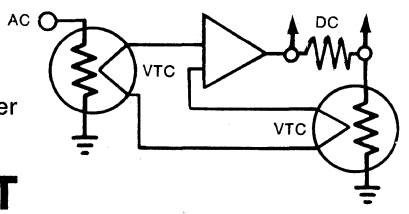
Vacuum Thermal Converters (VTC) provide a simple solution to a difficult design problem. That problem is, economically measuring the true RMS value of a current independently of waveform and frequency.

While VTCs have been in existence for many years, their work is often not understood. The basic structure looks like a simple incandescent light bulb. The outer shell is clear glass. There is a near total vacuum inside. The active elements are a heater wire with a thermocouple suspended at midpoint.

Current flows through the heater wire and the thermocouple measures the temperature at midpoint. This midpoint temperature is proportional to the true RMS current through the heater wire. The ability to calibrate at DC and measure AC accurately is inherent.

Operating range is from 0 to 65 MHz for standard pattern models, up to 300 MHz for UHF pattern and up to 1 GHz for miniature UHF pattern models. Sub-miniature models are supplied in a low profile glass shell.

D package will house one or two sub-miniature units. Ideal for T.C. Control, Spare or Matched Pairs.



Typical application.
RMS — DC Converter
Using two VTCs

APPLICATIONS CHART

VTCs are used as basic AC-DC transfer standards as well as other instrumentation applications including vacuum measurement.

VTC Type	Current mA	Freq MHz	R/E %*	Applications
UHF	2.5-1000	0-300	.04	General purpose
UHF Matched Pairs	2.5-1000	0-300	.005	Voltmeters
Sub-Min. UHF	2.5-1000	0-1GHz	.08	Artificial squibs
Sub-Min. UHF Matched Pairs	5	0-1GHz	.005	Voltmeters
Std. Pattern	1-1000	0-65	.005	Low current models available
Std. Pattern Matched Pairs	1-1000	0-65	.005	Voltmeters
Low AC-DC Transfer error	5-100	0-65	.005	AC-DC transfer std.
Vacuum Gages	1-1000	NA	NA	Vacuum measurement
Open Heaters	1k-50k	0-300	.20	High current RF

* Best reversal error, standard is 0.2%

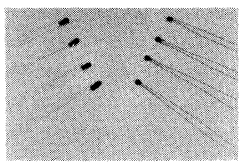
POPULAR MODELS

Model No.	Range mA	Heater Resis. Ohms ±10%	Couple Resis. Ohms ±10%	O/C EMF ±12% mV	Max. Overload %	See Fig.
S1	1.0	1750	13	7	250	A
S4	2.0	800	12	7	250	A
S7	5.0	90	8	7	250	A
S9	10.0	25	8	7	250	A
S48	5.0	180	8	20	200	A
S50	10.0	125	8	20	200	A
S102	5.0	125	8	10	200	A
S104	10.0	40	4	10	200	A
U1	5.0	90	8	7	250	B
SUB MIN U1	5.0	90	8	7	250	C or D
U2	10.0	25	8	7	250	B
U27	2.5	200	8	7	250	B

Hundreds of other models available. Write or call for application assistance.

NTC Thermistor Devices

INTERCHANGEABLE **BetaCURVE** THERMISTOR DEVICES



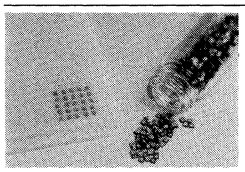
FEATURES
- **Available in all Chip & Probe styles, insulated & non-insulated leads • Superior Temp. Accuracy & Interchangeability • Rugged—Reliable—Cost Efficient • Proven Stability and Life Capability**
- **Rapid Time Response • Rated from −55 to 150°C. • 1.0 mW/°C Dissipation Constant**
- **10 sec. maximum Time Constant**

BetaCURVE THERMISTOR DEVICES (±0.2°C 0 to 70°C.)

Nominal R @ 25°C. (ohms)	Part Number	R-T Curve #	0-50°C. Beta Value (K.)	α @ 25°C. (%/°C.)
100	0.1K1A1	1	3108	−3.5
300	0.3K1A1	1	3108	−3.5
1,000	1K2A1	2	3263	−3.7
1,000	1K7A1	7	3422	−3.9
2,252	2.2K3A1	3	3892	−4.4
5,000	5K3A1	3	3892	−4.4
10,000	10K3A1	3	3892	−4.4
10,000	10K4A1	4	3749	−4.0
30,000	30K5A1	5	3811	−4.3
50,000	50K6A1	6	4143	−4.7
100,000	100K6A1	6	4143	−4.7

+ *BetaCURVE* devices have ±0.2%C. curve track tolerance capability over the recommended use temperature span. Products with tighter deviation or extended temperature range can be factory ordered.
++ Interchangeable *BetaCURVE* products with ±0.2 to 1.0 deg. C curve-track tolerance capability over 0-70°C are available. Products with tighter dT deviation or extended temperature range can be factory ordered.

LEADLESS **BetaCHIP** THERMISTOR



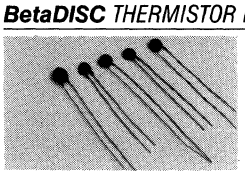
FEATURES
- **Available with either Silver or Gold Terminations**
- **Top and Bottom Metallization • Rapid Time Response • Rated from −55 to 150°C • Surface Mount Capability**
- **Uniformly Sized for Pick & Place Assembly**
- **1.0 mW/C. Dissipation Constant**
- **10 sec. Maximum Time Constant**

LEADLESS BetaCHIP THERMISTOR (±10% Tolerance @ 25°C.)

Nominal R @ 25°C. (ohms)	"Chip" Part Number	R-T Curve #	0-50°C. Beta Value (K.)	α @ 25°C. (%/°C.)
100	0.1K1C2	1	3108	−3.5
300	0.3K1C2	1	3108	−3.5
1,000	1K2C2	2	3263	−3.7
1,000	1K7C2	7	3422	−3.9
2,252	2.2K3C2	3	3892	−4.4
3,000	3K3C2	3	3892	−4.4
5,000	5K3C2	3	3892	−4.4
10,000	10K3C2	3	3892	−4.4
10,000	10K4C2	4	3749	−4.0
30,000	30K5C2	5	3811	−4.3
30,000	30K6C2	6	4143	−4.7
50,000	50K6C2	6	4143	−4.7
100,000	100K6C2	6	4143	−4.7

Standard *BetaCHIP* Leadless Thermistor Elements available in other R_{25} tolerance limits.
BetaCHIP Products with tighter R_{25} tolerance or sorted at T other than 25°C can be factory ordered.

BetaDISC THERMISTOR ELEMENTS



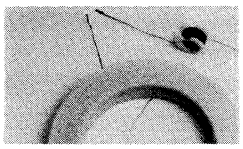
FEATURES
- **Low Cost**
- **Rugged Construction, Epoxy Coated**
- **PC Board Mounting**
- **Higher Power Dissipation**
- **Extended Time Constant**
- **Controlled Size (<0.200" Uncoated)**

K SERIES THERMISTOR DEVICES

Nominal R @ 25°C. (ohms)	BetaDISC Part Number	R-T†† Curve #	Nominal 0-50°C. R Ratio	0-50°C Beta Value (K.)	α @ 25°C. (%/°C.)	Dissipation Constant[1] (mW/°C.)	Time Constant[2] (s)
100	K1K7A2	7	6.95	3422	−3.9	4	16
200	K2K7A2	7	6.95	3422	−3.9	5	18
300	K3K7A2	7	6.95	3422	−3.9	6	20
500	K5K7A2	7	6.95	3422	−3.9	6	25
1,000	K1K3A2	3	9.06	3892	−4.4	6	20
2,000	K2K3A2	3	9.06	3892	−4.4	6	20
3,000	K3K3A2	3	9.06	3892	−4.4	6	22
5,000	K5K3A2	3	9.06	3892	−4.4	7	25
10,000	K10K6A2	6	10.45	4143	−4.7	4	20
20,000	K20K6A2	6	10.45	4143	−4.7	5	20
50,000	K50K6A2	6	10.45	4143	−4.7	7	25

†Standard *BetaDISC* thermistors available at ±10% R_{25} tolerance limits
††See Betatherm R-T Characteristics Tables for Thermistor Properties Specifications

microCHIP THERMISTOR PROBES



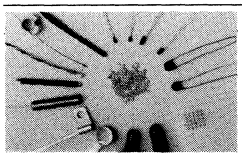
FEATURES
- **High Stability Probe (Industrial & Medical Applications Typically)**
- **Temperature Accuracy +0.1 C.**
- **Extremely small profile diameter**
- **Rapid Time Response Design**
- **Time Constant — <1.0 sec.***

microCHIP THERMISTOR PROBE CHARACTERISTICS DEVICE AVAILABILITY

Part No.	Material No.	Ro @ 25°C (ohms)	Temp. Tol. (t°C)	Max Exposure Temp. (°C)	Typical Application Use
2K7MCD1	7	2000	0.2	150	Laboratory Instrument Probe
10K3MCD1	3	10,000	0.1	150	Medical Probe
22K7MCD5	7	22,000	0.1	150	Catheter Probe
100K6MCD1	6	100,000	0.2	150	Fast Response Probe

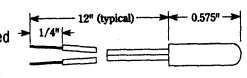
Other Styles, Resistance Values and Tolerances Available.
Contact Betatherm Application Engineering for details.

CUSTOMIZED PROBE ASSEMBLY CONSTRUCTIONS (TYPICAL)



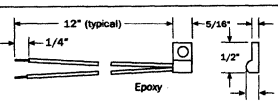
FEATURES
- **Customized for Each Application**
- **Cost-Effective Designs to Performance Specs**
- **Prompt Betatherm Design/Build Execution**
- **Rugged—Reliable—Stable—Constructions**
- **Surface, Immersion and Gas Sensing Designs**
- **Customized Sense Element for Each Application**

ALL PURPOSE
#28 A.W.G. Silver Plated Stranded Copper Wire, Teflon Insulated



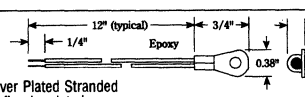
Housing — Type 304 St. Stl with Thermistor (Epoxy Filled)

SURFACE SENSOR
#28 A.W.G. Silver Stranded Plated Copper Wire, Teflon Insulated



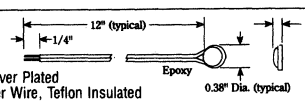
#4 Screw Mounting Hole (0.116" Dia.)
Tin Plated Copper Housing with Thermistor (Epoxy Filled)

ALL PURPOSE
#28 A.W.G. Silver Plated Stranded Copper Wire, Teflon Insulated



Copper Ring Tongue Housing Tin Plated with Thermistor (Epoxy Filled)
#6 Screw Mount Hole

ALL PURPOSE
#28 A.W.G. Silver Plated Stranded Copper Wire, Teflon Insulated



Materials and Probes designed to customer performance and T.C requirements available. Contact Betatherm Application Engineering for specific details.

CUSTOM NTC THERMISTOR PROBE ASSEMBLY EXAMPLES

Probe Style	Chip Part No.	Material No.	R-T Slope Capability	Ro @ 25°C (ohms)	Typical Temp. Tol. (±°C.)	Max. Exp. Temperature (°C.)
All Purpose	1K2D(x)	2	***BetaCHIP***	1,000	1.0	150
	10K3D(x)	3	***BetaCURVE***	10,000	0.2	150
	100K6D(x)	6	***BetaCHIP***	100,000	0.5	150
Surface Sensor	.1K1D(x)	1	***BetaCHIP***	100	0.5	150
	10K4D(x)	4	***BetaCHIP***	10,000	0.5	150
	100K6D(x)	6	***BetaCURVE***	100,000	0.2	150
All Purpose	1K2D(x)	2	***BetaCURVE***	1,000	0.5	150
	10K3D(x)	3	***BetaCURVE***	10,000	0.2	150
	50K6D(x)	6	***BetaCHIP***	50,000	1.0	150
All Purpose	1K7D(x)	7	***BetaCHIP***	1,000	0.5	150
	2.2K3D(x)	3	***BetaCURVE***	2,252	0.2	150
	5K3D(x)	3	***BetaCHIP***	5,000	1.0	150

Probe Style	Chip Part No.	Typical Application Use
All Purpose	1K2D(x)	Refrigeration Regulation
	10K3D(x)	Precision Temperature Probe
	100K6D(x)	High Temperature Regulation
Surface Sensor	.1K1D(x)	Low Temperature Alarm
	10K4D(x)	Intermediate Temperature Probe
	100K6D(x)	High Temperature Sensor
All Purpose	1K2D(x)	Temperature Alarm
	10K3D(x)	Stable Precision Sensor
	50K6D(x)	High Temperature Regulation
All Purpose	1K7D(x)	Refrigeration Regulation
	2.2K3D(x)	Stable Medical Probe
	5K3D(x)	Wide Range Temperature Sensor

Other wire types and cables are available on special order

BETATHERM CORPORATION
910 Turnpike Road • Shrewsbury, MA 01545 • Tel.: 508•842•0516
FAX 508•842•0748

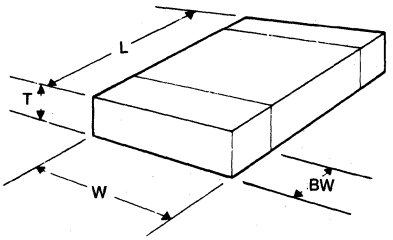
DALE®

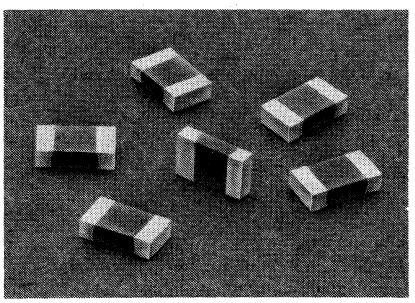
SURFACE MOUNTED HYBRID CHIP THERMISTORS

G, H and J Thermistors – Hybrid Chip

FEATURES

- Wraparound terminations
- Allows design flexibility for use with hybrid circuitry
- High-density monolithic ceramic construction
- Available in 8mm tape and reel





G, H and J Style chips are thermistor dies with wraparound terminations for mounting directly to the bonding pads of a hybrid substrate. The use of low temperature 2% to 5% silver bearing solder paste, or a suitable conductive epoxy is suggested for mounting of G and H Styles. The J Style is suitable to use with standard soldering techniques such as wave or vapor phase.

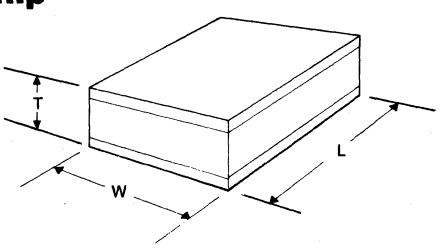
Style G = Palladium Silver
Style H = Silver
Style J = Platinum Palladium Silver

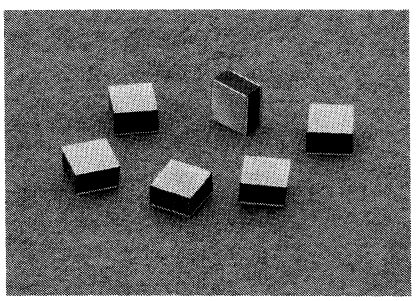
10%, 5% R_{25} tolerance Value range is 5K to 1 Meg. Ω (substitute "G", "J" or "H" in part number according to terminal style required)

W Style Thermistors – Chip

FEATURES

- Top and bottom surface terminations
- High-density monolithic ceramic construction
- Allows design flexibility for use with hybrid circuitry





W style is a thermistor die with silver conductors fired on the top and bottom surfaces. The bottom surface can be reflow soldered or conductive epoxied directly to a substrate bonding pad, and the top surface wire bonded to complete the circuit connection.

W STYLE ±10%, ±5% R_{25} tolerance Value range is 50Ω to 1Meg Ω

RESISTANCE vs. TEMPERATURE CONVERSION TABLES (Ratio = $R_T \div R_{25}$)

TEMP. °C	CURVE 1			CURVE 2			CURVE 4			CURVE 7			CURVE 9		
	Ratio	MT±%	NTC	Ratio	MT±%	NTC	Ratio	MT±%	NTC	Ratio	MT±%	NTC	Ratio	MT±%	NTC
−55	96.44	4.5	7.4	53.40	6.3					132.15	6.0				
−50	67.06	3.9	7.2	38.99	6.1	6.2				90.49	5.0	7.5	44.13	3.9	
−40	33.66	3.3	6.7	21.45	5.5	5.8	40.16	5.3		43.92	4.2	7.0	23.98	3.3	5.9
−30	17.70	2.6	6.2	12.27	4.8	5.4	20.64	4.3	6.5	22.26	2.9	6.7	13.52	2.6	5.6
−20	9.712	2.1	5.8	7.278	4.0	5.1	11.03	3.5	6.1	11.73	2.7	6.2	7.891	2.1	5.2
−10	5.534	1.5	5.5	4.459	3.2	4.7	6.119	2.6	5.7	6.418	2.1	5.9	4.754	1.5	4.9
0	3.266	1.1	5.1	2.815	2.3	4.5	3.510	1.8	5.4	3.632	1.4	5.5	2.949	1.1	4.6
10	1.990	0.6	4.8	1.826	1.4	4.2	2.078	1.0	5.1	2.121	0.9	5.2	1.879	0.6	4.4
20	1.249	0.1	4.5	1.215	0.5	4.0	1.267	0.2	4.8	1.276	0.2	5.0	1.226	0.1	4.2
25	1.000	0.0	4.4	1.000	0.0	3.8	1.000	0.0	4.7	1.000	0.0	4.8	1.000	0.0	4.0
30	.8058	0.2	4.3	.8276	0.5	3.7	.7942	0.4	4.6	.7889	0.4	4.7	.8194	0.2	3.9
37	.6016	0.6	4.1				.5814	1.0	4.4				.6258	0.6	3.8
40	.5326	0.7	4.0	.5758	1.4	3.5	.5105	1.1	4.3	.5003	0.9	4.4	.5592	0.7	3.7
50	.3602	1.1	3.8	.4086	2.3	3.3	.3359	1.8	4.1	.3249	1.5	4.2	.3893	1.1	3.5
60	.2488	1.3	3.6	.2954	3.1	3.2	.2259	2.4	3.9	.2147	1.9	4.1	.2760	1.3	3.4
70	.1751	1.8	3.4	.2172	4.1	3.0	.1550	2.9	3.7	.1447	2.4	3.8	.1990	1.8	3.2
80	.1256	2.1	3.3	.1622	5.1	2.8	.1084	3.4	3.5	.09941	2.7	3.7	.1458	2.1	3.1
90	.09164	2.3	3.1	.1229	5.5	2.7	.0771	3.9	3.3	.06949	3.2	3.5	.1084	2.3	2.9
100	.06792	2.6	2.9	.09446	6.7	2.6	.0557	4.4	3.2	.04938	3.6	3.3	.08168	2.6	2.8
110	.05108	2.7	2.8	.07350	7.4	2.4	.0408	4.9	3.0	.03564	4.0	3.2	.06235	2.7	2.6
120	.03894	3.2	2.7	.05788	8.5	2.3	.0303	5.3	2.9	.02610	4.4	3.0	.04818	3.2	2.5
125	.03416	3.3	2.6	.05158	8.7	2.3	.0263	5.5	2.9	.02246	4.5	3.0	.04253	3.3	
130	.03006	3.4	2.5	.04609	8.9	2.2	.0228	5.7	2.8	.01939	4.7	2.9	.03764	3.4	2.4
140	.02348	3.7	2.4	.03708	9.7	2.1	.0173	6.0	2.7	.01459	5.0	2.8	.02972	3.7	2.3
150	.01854			.03012			.0133			.0111			.02370		

CONTACT: DALE ELECTRONICS, INC. P.O. Box 26728, El Paso, TX 79926-6728 • Phone (915) 592-3253
. . . a VISHAY Company

DALE® **NTC THERMISTOR**

B - Series Thermistors
2.5 to 500 Ω

D - Series Thermistors
25 to 5,000 Ω

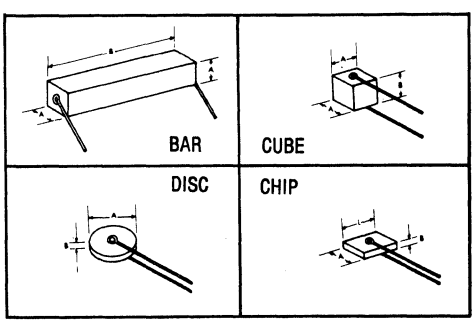
J - Series Thermistors
200 to 30,000 Ω

Techno Components thermistors conform to AQL and confidence levels specified in MIL-T-23648, tables V and VI.

Coatings, markings, special leads, probes, resistor/thermistor networks, resistance values from 1 ohm to 150 K Ω, and other product variations are produced to meet your design requirements.

Resistance tolerance of ± 1% through ± 20% are available and may be specified at 25°C or any temperature within the operating range. Maximum operating temperature with leads is 150°C.

CURVE B	Ratio $\frac{R\ @\ 25°C}{R\ @\ 125°C}$ = 12.95% ±10%
CURVE D	Ratio $\frac{R\ @\ 25°C}{R\ @\ 125°C}$ = 19.8% ±10%
CURVE J	Ratio $\frac{R\ @\ 25°C}{R\ @\ 125°C}$ = 29.85% ±10%



THERMISTOR SPECIFICATIONS

R @ 25°C Ω ±10%	Part Number	NTC %/°C @ 25°C	Nominal D.C.*	Nominal T.C.**	Max. Dimensions A	Max. Dimensions B	Leads AWG#	Type
100,000	2J05	−4.4	3	10	.06	.26	30	Bar
75,000	2J06	−4.4	3	8	.06	.20	30	Bar
50,000	2J07	−4.4	3	7	.06	.15	30	Bar
30,000	2J08	−4.4	2	6	.06	.08	30	Bar
25,000	2J09	−4.4	2	5	.06	.07	30	Bar
20,000	2J10	−4.4	2	5	.06	.06	30	Chip
15,000	2J11	−4.4	2	4	.06	.05	30	Chip
10,000	2J12	−4.4	2	4	.06	.04	30	Chip
10,000	1J112	−4.4	2	4	.08	.05	30	Disc
10,000	1J13	−4.4	4	12	.11	.10	28	Disc
8,000	1J14	−4.4	4	10	.11	.08	28	Disc
7,000	1J145	−4.4	4	10	.11	.07	28	Disc
6,000	1J147	−4.4	3	9	.11	.06	28	Disc
5,000	1J15	−4.4	3	8	.11	.05	28	Disc
5,000	2J15	−4.4	3	8	.10	.04	28	Chip
4,000	1J154	−4.4	5	23	.16	.10	28	Disc
4,000	2J165	−4.4	3	8	.10	.04	28	Chip
3,000	2J16	−4.4	3	—	.12	.04	28	Chip
3,000	1J155	−4.4	6	20	.16	.08	28	Disc
2,500	1J158	−4.4	5	19	.16	.07	28	Disc
2,000	2J17	−4.4	3	5	.10	.03	28	Chip
2,000	1J20	−4.4	7	25	.22	.09	24	Disc
2,000	1D10	−3.9	2	3	.06	.04	30	Disc
2,000	2D10	−3.9	2	4	.06	.04	30	Chip
1,500	1D111	−3.9	2	3	.08	.06	30	Disc
1,000	2J21	−4.4	6	15	.18	.04	24	Chip
1,000	1J24	−4.4	9	48	.32	.09	24	Disc
1,000	1D112	−3.9	2	4	.08	.04	30	Disc
1,000	1D13	−3.9	4	10	.11	.08	28	Disc
1,000	2D13	−3.9	2	3	.08	.04	28	Chip
800	1D14	−3.9	3	8	.11	.06	28	Disc
700	1D145	−3.9	3	7	.11	.06	28	Disc
600	1D147	−3.9	3	7	.11	.04	28	Disc
500	1D15	−3.9	3	6	.11	.04	28	Disc
500	2D15	−3.9	2	4	.10	.04	28	Chip
500	1D153	−3.9	7	20	.16	.08	28	Disc
400	2D165	−3.9	2	4	.11	.04	28	Chip
300	2D16	−3.9	3	5	.10	.03	28	Chip
300	1D19	−3.9	7	25	.22	.09	24	Disc
200	2D20	−3.9	6	—	.15	.04	—	Chip
100	2D21	−3.9	6	—	.18	.04	24	Chip
100	2B13	−3.3	2	4	.07	.04	28	Chip
80	2B14	−3.3	2	4	.08	.04	28	Chip
80	2D211	−3.9	5	—	.20	.04	24	Chip
50	2D24	−3.9	6	—	.32	.04	24	Chip
50	2B15	−3.3	2	4	.10	.04	28	Chip
30	2D31	−3.9	7	—	.35	.04	24	Chip
30	2B16	−3.3	2	4	.10	.03	28	Chip
25	2D33	−3.9	7	—	.36	.04	24	Chip
20	2D34	−3.9	7	—	.36	.04	24	Chip
20	2B17	−3.3	3	4	.16	.04	28	Chip
10	2B21	−3.3	5	—	.18	.04	28	Chip
5	2B24	−3.3	6	—	.30	.04	24	Chip

***DISSIPATION CONSTANT**
Dissipation Constant expressed in mw/°C, represents the amount of power required to raise the temperature of a thermistor 1°C.

****TIME CONSTANT**
Time Constant, expressed in seconds, is the time required for a thermistor dissipating zero power to change 63% of the difference between its initial temperature value and that of a new temperature environment.

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DALE®

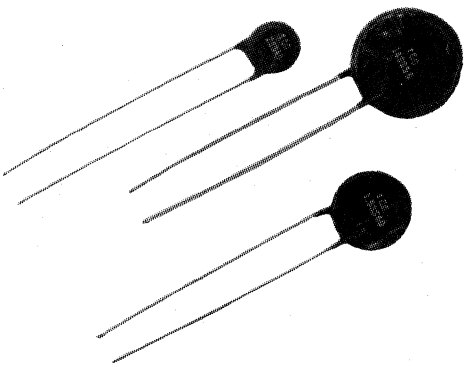
"SOFT START" INRUSH CURRENT SUPPRESSING DEVICES

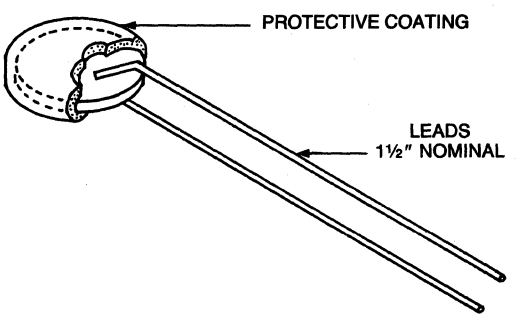
"Soft-Start" devices display relatively high resistance to starting currents in a variety of electronic circuits. Having a negative temperature coefficient of resistance, these devices exhibit a large decrease in resistance when an AC or DC current is applied.

Unlike circuit breakers and fuses, "Soft-Starts" prevent dangerous, short-duration, peak inrush currents present at turn-on. Especiallly useful in power supplies where charging capacitors initially present extrememly low impedance, "Soft-Starts" actually limit inrush currents thereby extending the life of other critical components.

Part Number	Imax. (Amperes)	R_o °25C (Ohms)	R @ Imax. (Ohms)	Max. Diameter (Inches)	Max. Thickness (Inches)	Lead Diameter (Inches)
25SS25	25	1	.01	1.10	.35	.040
20SS20	20	1	.015	.90	.30	.040
18SS36	18	2	.03	.90	.35	.040
15SS38	15	2.5	.03	.90	.30	.040
14SS56	14	4	.05	.90	.35	.040
12SS60	12	5	.06	.90	.50	.040
12SS30	12	2.5	.04	.90	.35	.040
10SS50	10	5	.06	.90	.35	.040
10SS25	10	2.5	.04	.90	.25	.040
9SS45	9	5	.06	.90	.25	.040
9SS23	9	2.5	.04	.90	.25	.040
8SS40	8	5	.05	.60	.25	.040
8SS32	8	4	.07	.60	.25	.040
7SS35	7	5	.07	.60	.25	.032
7SS18	7	2.5	.05	.60	.25	.032
6SS60	6	10	.15	.60	.35	.040
6SS42	6	7	.15	.60	.30	.040
6SS30	6	5	.07	.60	.25	.032
5SS50	5	10	.20	.60	.35	.040
5SS35	5	7	.15	.60	.30	.040
5SS20	5	4	.15	.60	.25	.032
4SS48	4	12	.22	.50	.30	.040
4SS28	4	7	.15	.60	.30	.040
4SS20	4	5	.15	.60	.25	.032
3SS30	3	10	.20	.50	.30	.032
3SS21	3	7	.14	.60	.25	.032
3SS15	3	5	.17	.60	.25	.032
3SS08	3	2.5	.15	.60	.25	.032
2SS80	2	40	.60	.70	.25	.032
2SS40	2	20	.28	.60	.25	.032
2SS20	2	10	.20	.60	.25	.032
2SS10	2	5	.40	.60	.25	.032
1.5SS90	1.5	60	1.00	.60	.25	.032
1.5SS60	1.5	25	.80	.60	.25	.032
1.5SS38	1.5	40	.60	.50	.30	.032
1.5SS15	1.5	10	.25	.50	.25	.032

- Standard Ro25°C tolerance is ± 20%. Closer tolerances are available upon request.
- Protective silicone coating is standard and has a nominal thickness of .02 inches. Other coatings are available upon request.
- Standard lead materials is tinned copper-clad steel. Nickel or copper leads are available upon request.
- Special marking is available upon request.





DEFINITIONS

I max
Represents the maximum rated steady state DC or RMS current and is expressed in amperes.

R o 25°C
Represents the zero power resistance of the device at +25°C and is expressed in ohms.

R@Imax
Represents the approximate resistance at maximum steady state current conditions and is expressed in ohms.

Ambient Temp.
Full rated current may be applied in the ambient temperature range of +25°C to +65°C and must be derated in accordance with Imax derating curve.

I op
Represents the actual operating current applied.

Cool-Down Time
Is the amount of time needed for a "Soft-Start" device to cool enough to cause the necessary amount of resistance to limit inrush current.

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INTERCHANGEABLE CURVE TRACKING AND POINT MATCHED THERMISTORS

Interchangeable curve tracking thermistors

are "curve matched" to desired temperature tolerances over selected temperature ranges. They allow component standardization and can reduce cost associated with assembly because they are "interchangeable" to within the tolerance and temperature range specified without re-calibration. They are ideally suited for use in microcomputer measurement and control circuits. The temperature tolerance corresponds to a resistance tolerance based on the temperature coefficient at each temperature point within the specified range. Standard temperature tolerance and ranges are listed below, along with the available styles and resistances.

To specify, add the appropriate suffix from the following table to the part number.

Example: 1M1002-B3 = Curve 1, 10K @ 25°C, interchangeable to ±.5°C from 0° to 70°C.

	TEMP. RANGE	0°C to +70°C			−20°C to +50°C		0°C to +100°C			+20°C to +90°C			0°C to +50°C		
	TEMP. TOLERANCE	±1°C	±.5°C	±.2°C	±1°C	±.5°C	±1°C	±.5°C	±.2°C	±1°C	±.5°C	±.2°C	±1°C	±.5°C	±.2°C
CURVE NUMBER	PART NUMBER SUFFIX	-A3	-B3	-C3	-A2	-B2	-A4	-B4	-C4	-A5	-B5	-C5	-A8	-B8	-C8
	*R 25 Ω STYLES														
1	2252 M,T	X	X	X	X	X	X	X					X	X	X
	3000 C,T	X	X	X	X	X	X	X					X	X	X
	5000 M,F,T	X	X	X			X	X		X	X	X	X	X	X
	10,000 M,F,T	X	X	X			X	X	X	X	X	X	X	X	X
	20,000 M,T	X	X	X			X	X	X	X	X	X	X	X	X
	30,000 M	X	X	X			X	X	X	X	X	X	X	X	X
2	1000 M				X	X							X	X	
4	30,000 M,T	X	X	X			X	X		X	X	X	X	X	X
	50,000 M,T	X	X	X			X	X		X	X	X	X	X	X
	100,000 M,T	X	X	X			X	X		X	X	X	X	X	X
8	30,000 M,T	X	X	X			X			X	X	X	X	X	X
	50,000 M,T	X	X	X			X			X	X	X	X	X	X
	100,000 M,T	X	X	X			X			X	X	X	X	X	X
9	10,000 M,T	X	X	X						X	X	X	X	X	X
	20,000 M	X	X	X						X	X	X	X	X	X
	30,000 F	X	X	X						X	X	X	X	X	X

X = Available. Popular Values — contact factory for other values.

* = Standard R_{25} Values (25° resistance)

Point Matched Thermistors

are available for applications which require a specific resistance value matched to a specific temperature point. (Example: 10,000Ω ±2% at 80°C). They are useful for applications which require temperature monitoring at a critical temperature point to control, measure, or shutdown. Consult factory with requirements. Note: All thermistors listed in this catalog are point-matched thermistors at 25°C. (X Styles at 70°C)

SENSOR ASSEMBLIES AVAILABLE TO MEET STANDARD AND CUSTOM REQUIREMENTS

Note: For complete specifications on these and all models in the Dale Thermistor Line, write or call for your copy of the Dale Thermistor Catalog.

CONTACT: **DALE ELECTRONICS, INC.** P.O. Box 26728, El Paso, TX 79926-6728 • Phone (915) 592-3253
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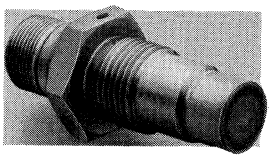
ELMWOOD SENSORS

WHERE RELIABILITY IS BUILT IN.

PRECISION THERMOSTATS



When applications call for precise specifications, Elmwood has a full line of Precision Thermostats with a variety of mounting and package configurations available. For narrow or wide differentials. When accuracy and reliability is serious business, you can count on these high quality thermostats.

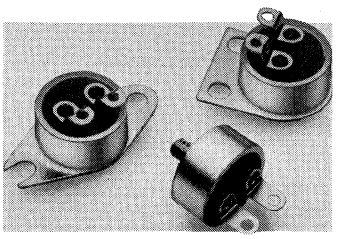
APPLICATIONS:

- Aerospace & Avionics
- Medical Equipment
- Power Supplies
- Data Processing Equipment

FEATURES:

- 1/2" and 3/4" Sizes
- Internal and External Design Options
- Variable Probe Lengths and Connecting Methods Available

AEROSPACE/ MILITARY THERMOSTATS



Designed to meet the requirements of the aerospace industry and exceed the criteria of MIL-S-24236. Elmwood's Aerospace/Military Thermostats are capable of optimum performance in rigid environmental conditions such as extreme temperature, shock and vibration.

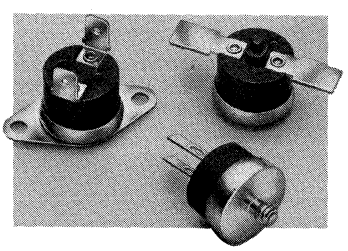
APPLICATIONS:

- Satellites
- Aircraft
- Missiles
- Instrumentation

FEATURES:

- QPL Listed
- Small Size and Weight
- Variety of Mounting & Package Configurations Available

1/2" THERMOSTATS



Designed to open or close on temperature rise, 1/2" Thermostats operate in an ambient temperature range up to 550°F (287°C). Devices are thermally and mechanically inspected at the factory. Cost-efficient for commerical applications.

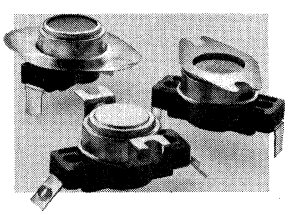
APPLICATIONS:

- Small Appliances
- Fire and Smoke Alarms
- Data Processing Equipment

FEATURES:

- Cost Efficient
- Set to Specifications
- UL Recognized, CSA Certified & European Approved

3/4" THERMOSTATS



Designed to open and close on temperature rise, 3/4" Thermostats are specifically designed to meet the demanding temperature control requirements of a wide range of major appliances and equipment. Thermostats are rated up to 25 Amps-240 Volts and meet UL Standard 353.

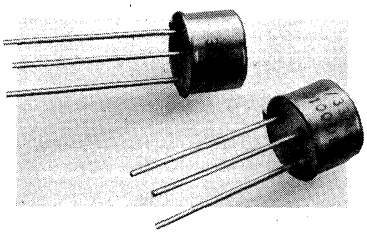
APPLICATIONS:

- Major Appliances
- Commerial Appliances
- Data Processing Equipment
- Spa and Hot Tub Equipment

FEATURES:

- 25 Amp Capacity
- Narrow Temp Differential
- Tight Temp Tolerances
- Rugged Construction
- Recognized by UL, CSA and European Approval Agencies

THE WORLD'S FIRST TO-5 THERMAL SWITCH

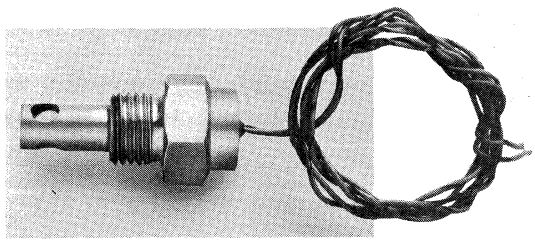


Elmwood's 3600 Series TO-5 Thermostat provides reliable protetion against damage caused by hazardous temperatures on your printed circuit board. Customized configurations are available.

APPLICATIONS:
- Power Supplies
- Logic Boards
- Medical Electronics
- Telecommunications
- Personal Computers

FEATURES:
- Hermetically Sealed/ Wave Solderable
- Switches Up To 1 Amp
- 100% Temperature Tested
- Heat Sink Mounting Brackets Available

THERMISTOR ASSEMBLIES

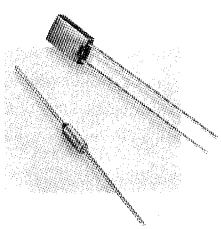


Elmwood's Accumistor Series of thermistor assemblies are available with PTC's and NTC's to meet your needs. Thermistors can be combined for reliable multi-purpose sensing capabilities and as self-regulating heaters in electronics, process control and automative applications.

APPLICATIONS:
- Temperature Setting
- Level & Flow Sensing
- Precision Heating
- Over-Current Protection

FEATURES:
- Packaged Assemblies
- Range: −40°C to 200°C
- Solid State Technology
- Customized Assemblies

THERMAL FUSES AND MOTOR & TRANSFORMER PROTECTORS

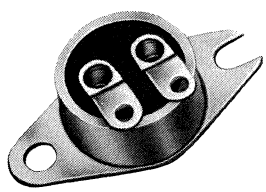


Miniature, heat-sensitive devices designed for over temperature protection of electrical appliances and equipment or transformers and fractional horsepower motors. Thermal Fuses are rated to 15 Amps and can be configured to your specifications. Motor and Transformer Protectors have a patented, non-eutectic design, feature an isolated and sealed cap and are rated to 5 Amps. Both are UL Recognized, CSA Certified and meet major international approvals. Immediate off-the-shelf availability in a variety of standard temperatures and leads.

APPLICATIONS:
- Small Appliances
- HVAC
- Major Applicance
- Motor & Transformer

FEATURES:
- Popular Temp Range
- Insulated Case (MTP)
- Customized Assemblies Available

CUSTOMER SERVICE PROGRAMS



REDI-TEMP

At Elmwood, our commitment to customer service goes beyond product quality. Our customer service programs are designed to fit your specific needs:

- Redi-Temp—An off-the-shelf program with a one week delivery schedule.
- Elmwood Express—A priority delivery service that puts your rush order on the fast track.
- Design Assistance—Pre-packaged assemblies made to fit your requirements complete with custom brackets, terminals, wiring, connectors, overmolds, etc.
- Lead Time Programs—Production and sample lead times that others try to beat.

And our customers service representatives are trained professionals assigned to you from order entry to order shipment.

No one puts more into thermal sensing than Elmwood. Don't accept anything less.

CALL TOLL FREE: 1-800-ELMWOOD

ELMWOOD SENSORS, INC.
A Subsidiary of FASCO Industries
500 Narragansett Park Drive/Pawtucket, RI 02861-4325
Tel: 401-727-1300/Telex: 681-4066/Fax: 401-728-5390

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APD SEMICONDUCTORS

NTC and PTC THERMISTORS

FREE Technical State-of-the-Art Thermistor Literature

CHIP SERIES • BEAD SERIES • THERMISTOR PROBE ASSEMBLIES DISC SERIES • PTC THERMISTORS

STANDARD NTC/PTC THERMISTORS PRODUCTS

Chip Series

- Surface Mounted, End-Banded
- Without Leads
- Uninsulated Leads
- Insulated Leads
- Series I Glass Encapsulated
- Series II Glass Encapsulated, Interchangeable
- MINI-CHIP Glass Encapsulated Series
- UNI-CURVE® Interchangeable, R-T Curve-Matched
- LTN® Linear Thermistor Networks
- MICRO-MINI CHIP
- MICRO-MINI CHIP Medical Grade, Interchangeable
- OTHER AVAILABLE Chip Thermistors
- "MELF" Glass Encapsulated Chip

Bead Series

- SMALL BEADS
- E-I MATCHED BEADS
- STANDARD BEADS
- GLASS PROBES
- ISO-CURVE® Interchangeable Glass Probes & Beads
- OTHER AVAILABLE BEAD THERMISTORS
- MID-TEMP. (200°C TO 600°C)
- MICRO-MINI PROBES
- SUB-MINI PROBES
- CRYOGENIC GLASS ENCAPSULATED PARALLEL MATCHED

Disc Series

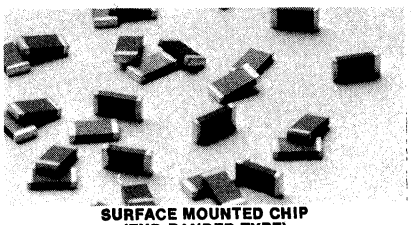
- DISCS 0.1 TO 0.3" DIA.
- OTHER AVAILABLE DISC THERMISTORS 0.4" DIA. DISCS
- INRUSH CURRENT LIMITING (ICL)

PTC Thermistors

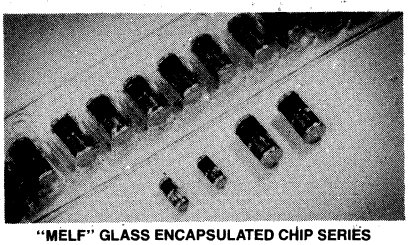
- STD. and MINI-POSI-CHIP SERIES, Glass Encapsulated, Silicon Based
- CERAMIC BASED PTC THERMISTORS for Switching, Current Limiting, Heating and Measurement and Control Applications
- PTC/VARISTOR
- SURFACE MOUNTED POLYMERE ENCAPSULATED

Thermistor Probe Assemblies

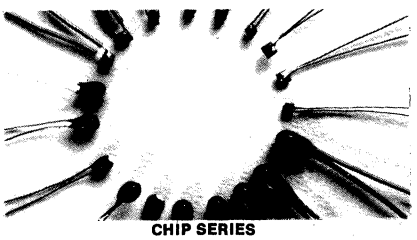
SURFACE, IMMERSION, GAS/AIR, OVEN PROBES, GENERAL PURPOSE AND SPECIAL MEDICAL SENSORS.



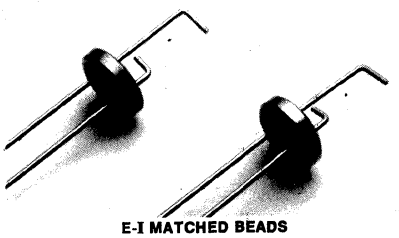
SURFACE MOUNTED CHIP (END-BANDED TYPE)



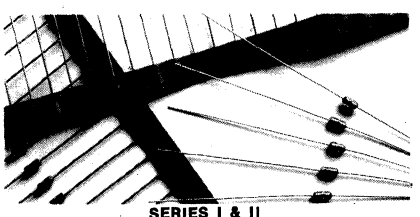
"MELF" GLASS ENCAPSULATED CHIP SERIES



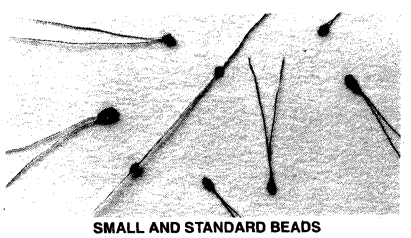
CHIP SERIES



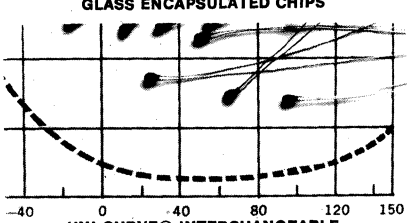
E-I MATCHED BEADS



SERIES I & II GLASS ENCAPSULATED CHIPS

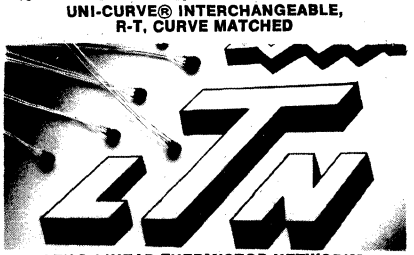


SMALL AND STANDARD BEADS

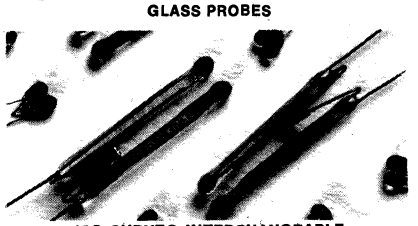


UNI-CURVE® INTERCHANGEABLE, R-T, CURVE MATCHED

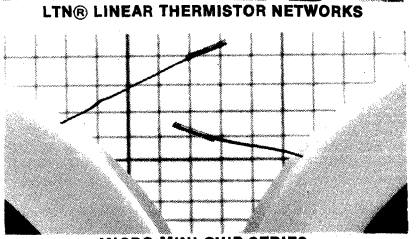
GLASS PROBES



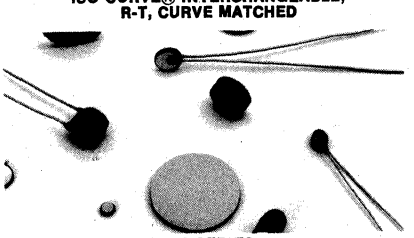
LTN® LINEAR THERMISTOR NETWORKS



ISO-CURVE® INTERCHANGEABLE, R-T, CURVE MATCHED



MICRO-MINI CHIP SERIES



DISC SERIES

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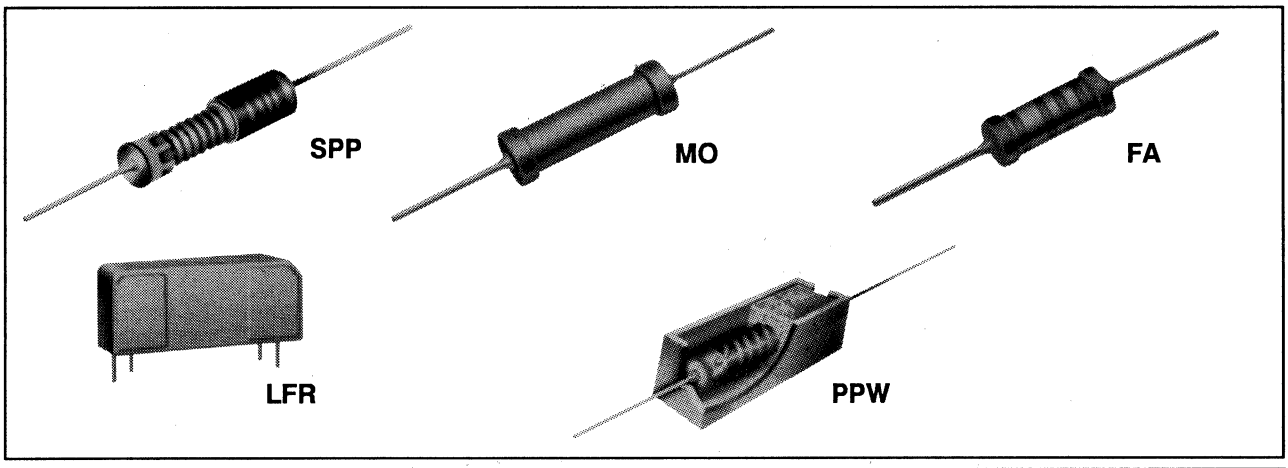
- Low cost, prompt delivery
- Excellent long term stability



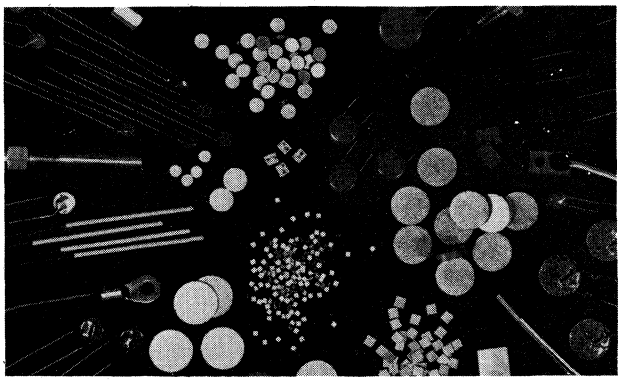
IRC Type	Power Ratio		Resistance Range		Tolerance		TCR/°C	Working Voltage
	Min	Max	Min	Max	Min	Max		
GF	1/4 watt	3 watt	.4 ohm	2 meg ohm	±1%	±5%	±50 to ±200 ppm	250 - 750V
MO	1/2 watt	5 watt	.5 ohm	1 meg ohm	±2%	±10%	±200 ppm	250 - 750V
FA	1/4 watt	2 watt	1 ohm	1 meg ohm	±1%	±10%	±250 ppm	250 - 700V
FA80	1/2 watt	7 watt	.1 ohm	80K ohm	±5%	±5%	±100 to ±500 ppm	250 - 650V
FA8025	1/4 watt	1 1/2 watt	.2 ohm	12K ohm	±5%	±10%	±250 ppm	250 - 500V
FA90	--	2 watt	2.6 ohm	1 meg ohm	±1%	±5%	±150 ppm	500V
SPP	1 watt	3 watt	.1 ohm	2400 ohm	±5%	±10%	±300 to ±600	√PR
SP20/20F	--	1 watt	.1 ohm	1200 ohm	±2%	±10%	±150 to ±800 ppm	√PR
SPH/SPF	--	2 watt	.05 ohm	2400 ohm	±2%	±10%	±400 to ±800 ppm	√PR
LFR	2 watt	5 watt	1 ohm	1600 ohm	±1%	±10%	±50 to ±300 ppm	250 - 1000V
PPW	2 watt	15 watt	1 ohm	5000 ohm	±1%	±3%	±20 ppm	√PR

Custom configurations, wattages, resistance values, and assemblies available upon request.
Please contact factory for special/custom fuse/circuit protection parameters.

KETEMA RODAN DIVISION
2900 Blue Star Street, Anaheim, CA 92806 • (714) 630-0081 • FAX: 714-630-4131

INTRODUCTION

Thermistors are temperature sensitive passive semiconductors which exhibit a large change in electrical resistance when subjected to a relatively minute change in body temperature. Negative temperature coefficient (NTC) thermistors decrease in resistance when subjected to an increase in body temperature. Conversely positive temperature coefficient thermistors (PTC) increase in resistance when subjected to an increase in body temperature. Ketema-Rodan Division manufactures NTC thermistors as well as two basic types of PTC thermistors. The silicon PTC offers a nearly linear positive temperature coefficient of approximately +.7%°/C and the switching PTC thermistor which exhibits a very large increase in resistance (several powers of 10) over a designated temperature range. Their extreme sensitivity to minute temperature changes enables them to perform many unique functions heretofore impossible with standard electronic components.



NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS

The NTC devices are available in resistance values from less than 1 ohm to 1 megohm, and in sizes ranging from 0.010 inch cubes to 1 inch diameter discs. Available configurations include: discs, chips, rods, bars, probes, and resistor/thermistor networks. Units can be molded, dip coated, or encapsulated to your specifications, using packaging materials such as epoxy, glass, or high temperature silicon resin.

SURGE-GARD™ INRUSH CURRENT LIMITING DEVICES

DESCRIPTION

Rodan® SURGE-GARD devices are manufactured of a specially-formulated metal oxide ceramic material which is capable of suppressing high inrush current surges. They are especially useful in power supplies (See Fig A) where, due to the extremely low impedance of the capacitor being charged, the bridge is subjected to an exceedingly high current surge at turn-on. The SURGE-GARD, being of relatively high resistance, limits the current for 1 to 2 seconds during which time the device decreases in resistance substantially to a point where its voltage drop is negligible.

SPECIFICATIONS

Part Number	Ro @ 25°C ±15% (OHMS)	I_{max} Max Steady State Current (AMPS)	* R_{Imax} Resistance At Max Current (OHMS)	"D" (Diameter max over coating)	"T" (Thickness max over coating)	"L" Lead Diameter ±.003"
SG260	.5	30	.01	1.25	.200	.040
SG100	1	20	.015	.900	.300	.040
SG110	2	18	.03	.900	.350	.040
SG120	2.5	3	.15	.600	.250	.032
SG130	2.5	7	.05	.600	.250	.032
SG140	2.5	9	.04	.600	.250	.032
SG150	2.5	10	.04	.900	.300	.040
SG160	2.5	15	.03	.900	.300	.040
SG170	4	8	.07	.600	.250	.040
SG180	5	2	.40	.600	.250	.032
SG190	5	4	.15	.600	.250	.032
SG200	5	7	.07	.600	.250	.032
SG26	5	12	.06	.900	.500	.040
SG210	7	4	.20	.600	.300	.040
SG64	7	10	.08	.950	.500	.040
SG220	10	3	.20	.450	.300	.032
SG40	10	8	.1	.900	.350	.040
SG230	20	1.75	.6	.500	.300	.032
SG240	40	2	.6	.625	.250	.032
SG250	120	3	.9	.925	.250	.040

1 Other resistance values available upon request.

2 I_{max} = The maximum steady state DC or RMS AC current.

3 * RI_{max} = The approximate resistance under maximum steady state current conditions.

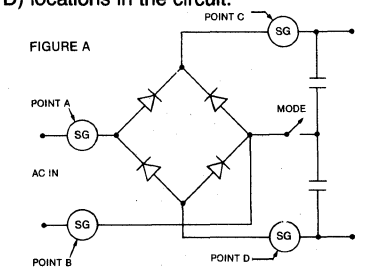
4 **Max Operating Temp** = All Rodan Surge-Gard devices are rated for operation to a maximum ambient temperature of 65°C. If your application requires operation above 65°C ambient, please consult Rodan's applications engineering department.

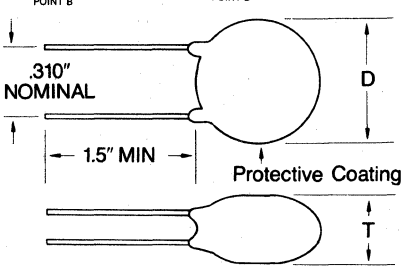
5 **Recovery Time** = Since Rodan Surge-Gards self-heat due to current flow, which in turn causes a reduction in their resistance, the devices require cool-down time after power is removed. The cool-down time allows the resistance to increase sufficiently to provide the required inrush current limiting. This time varies with the particular device, mounting method and ambient temperature. Usually, a one minute cool-down period is adequate. Selection of capacitor bleeder resistors which will provide a one minute or so bleed down time can eliminate the cool down time requirement.

APPLICATIONS

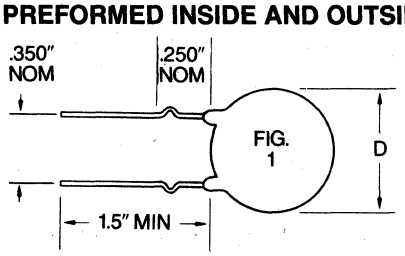
If the resistance of one Surge-Gard does not provide sufficient inrush current limiting for your application, two or more may be used in series or in separate legs of the supply circuit. Surge-Gards cannot be used in parallel since one unit will tend to conduct nearly all the current available. Surge-Gards may be used in the AC (Point A or B) or the DC (Point C or D) locations in the circuit.

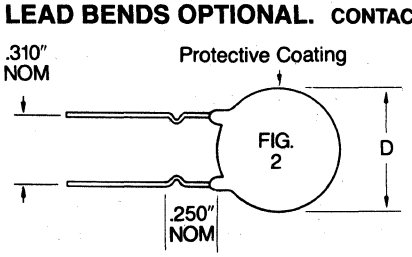
FIGURE A

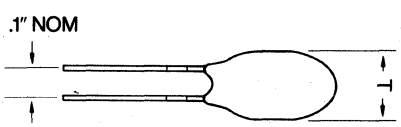




PREFORMED INSIDE AND OUTSIDE LEAD BENDS OPTIONAL. CONTACT FACTORY FOR PART NUMBERS.







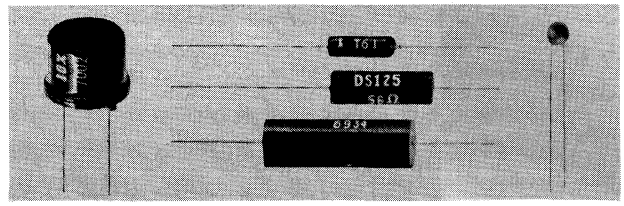
Shorter leads can be supplied upon request

KETEMA RODAN DIVISION 2900 Blue Star Street, Anaheim, CA 92806 • (714) 630-0081 • FAX: 714-630-4131

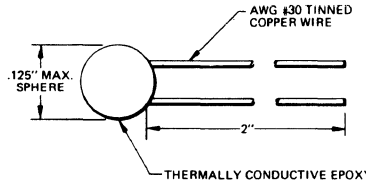
SILICON PTC THERMISTORS

DESCRIPTION

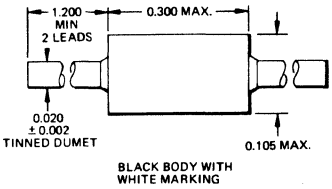
The positive temperature coefficient of resistance is very large: approximately 0.7%/°C, making these units ideal for use in temperature-compensating and sensing applications. Just a few such applications include amplifiers, power supplies, transducers, telemetry, computers, magnetic amplifiers, thermometry, meteorology, temperature regulation and overtemperature protection. Lead material other than standard, such as weldable nickel or gold plated, is available on request.



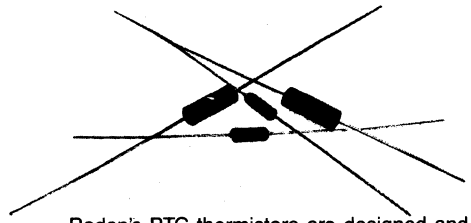
MINIATURE PROBE—DU100



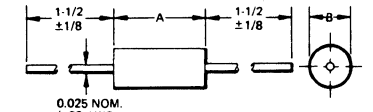
GLASS TYPE—DG125



MIL-APPROVED SERIES

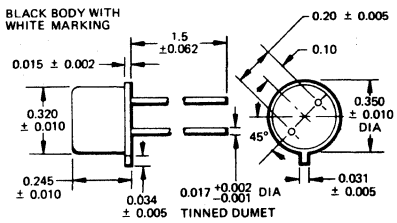


MOLDED TYPES—DS125, DS200, DS250



TYPE	A	B
DS125	0.406 ±0.015	0.140 ±0.015
DS200	0.406 ±0.015	0.140 ±0.015
DS250	0.585 ±0.015	0.200 ±0.015

TRANSISTOR TYPE—DC125



Rodan's PTC thermistors are designed and built to withstand all environmental conditions required by the most stringent Mil specs. They meet or exceed all requirements of MIL-T-23648A for Positive TC Thermistors.

RTH 42 Per MIL-T-23648A/19. Glass, hermetically-sealed type, similar to DG 125 series above.

RTH 22 Per MIL-T-23648/9. Molded style, similar to DS 200 series above.

ELECTRICAL SPECIFICATIONS

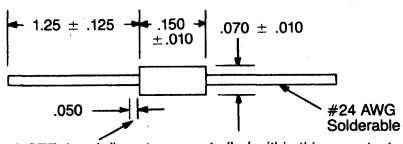
PART NUMBER	WATTAGE RATING @ 100°C	STD RESISTANCE RANGE	THERMAL TIME CONSTANT	OPERATIONAL AMBIENT TEMPERATURE RANGE
DS 125	0.125	10 to 39,000	34.8	−65 to +150
DS 200 (RTH22)	0.250 0.250	10 to 39,000 10 to 10,000	34.8 34.8	−65 to +150 −65 to +150
DS 250	0.250	10 to 39,000	54.0	−65 to +150
DG 125 (RTH42)	0.125	10 to 10,000	60.0	−65 to +125
DC 125	0.125	10 to 10,000	54.0	−65 to +125
DU 100	0.125	10 to 10,000	9.0	−65 to +125
UNIT	WATTS	Ohms	Sec. Max	°C

STANDARD RESISTANCE VALUES

10	27	56	150	390	820	2200	5000
12	33	68	180	470	1000	2700	5600
15	39	82	220	500	1200	3300	6800
18	47	100	270	560	1500	3900	8200
22	50	120	330	680	1800	4700	10,000

Matched pairs or other resistance values available as special devices.

MINI-SENSOR™ HERMETICALLY SEALED NTC THERMISTORS



NOTE: Lead diameter uncontrolled within this area, typical.

DESCRIPTION:

Rodan® Mini Sensor thermistors are small, rugged, hermetically sealed, glass encapsulated (DO-35) devices which are especially useful in applications where extreme temperatures and severe environmental conditions are encountered.

Their high sensitivity makes them especially useful in applications such as temperature measurement, temperature control, liquid level indication, flow measurement and temperature compensation.

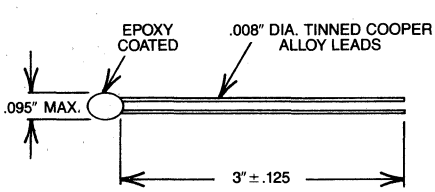
These low cost devices exhibit excellent long term stability and repeatability.

Please contact the factory for additional information.

ACCU-CURVE™ INTERCHANGEABLE THERMISTORS R-T CURVE MATCHED

DESCRIPTION

Rodan's Accu-Curve thermistors are small, high quality, low cost, epoxy encapsulated, precision curve matched devices which are available in a variety of electrical parameters. They offer true interchangeability over wide temperature ranges and eliminate the need for individual circuit adjustments or padding. These thermistors provide highly accurate and stable temperature sensing capability for applications such as temperature measurement or compensation.



SPECIFICATIONS

Part Number	Resistance* @ 25°C	Temp. Tolerance Over Temp. Range (±°C)	Temp. Range °C	D.C.* Min.	T.C.**
ACC-001	2,252	±0.2	0-70°C	1	10
ACC-002	3,000	±0.2	0-70°C	1	10
ACC-003	5,000	±0.2	0-70°C	1	10
ACC-004	10,000	±0.2	0-70°C	1	10
ACW-005	30,000	±0.2	0-70°C	1	10
ACW-006	50,000	±0.2	0-70°C	1	10
ACW-007	100,000	±0.2	0-70°C	1	10

The above device can be supplied to a wider range of specifications. Please contact the factory for requirements not listed.

***DISSIPATION CONSTANT** represents the amount of power required to raise the temperature of a thermistor 1°C above its ambient, expressed in milliwatts.

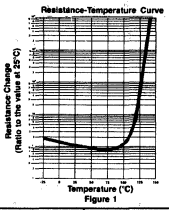
****TIME CONSTANT**, expressed in seconds, is the time required for a thermistor dissipating zero power to change 63% of the difference between its initial temperature value and that of a new impressed temperature environment.

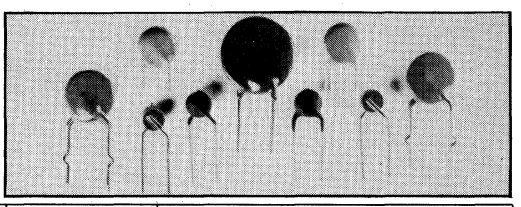
KETEMA RODAN DIVISION 2900 Blue Star Street, Anaheim, CA 92806 • (714) 630-0081 • FAX: 714-630-4131

STANDARD PTC THERMISTORS

TYPICAL APPLICATIONS

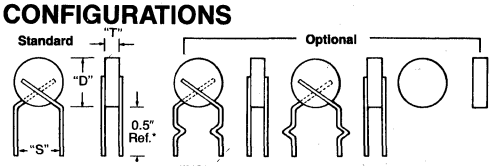
- Over-temperature Protection • Temperature Compensation
- Arc Suppression • Time Delay • Liquid Level Sensing
- Air Flow Sensing • Automatic Color TV Degaussing
- Non-Destructive Fusing • Self-Regulating Heaters
- Single Phase Motor Starting





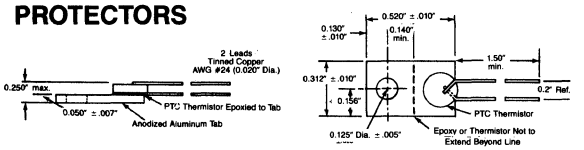
Part Number	Base Resistance R_0 @ 25°C (Ω) ±30%	Switch Temp. Ts (°C)	Maximum Operating Voltage V_{max}	Dissipation Constant Dc (mW/°C)	Time Constant (Sec.)	Heat Capacity Hc (Watt-Sec./°C)	Reference Dimension (In.)			
							D	T	S	Lead Dia. (In.)
SL5003D-1R8-120	1.8	120	20	12	50	.29	0.50	0.03	0.30	0.025
SL5004D-2R0-120	2	120	25	14	50	.39	0.50	0.04	0.30	0.032
SL4005D-5R0-110	5	110	25	10	45	.31	0.40	0.05	0.30	0.025
SL3505D-7R5-120	7.5	120	50	9	40	.24	0.35	0.05	0.25	0.020
SL5510D-100-110	10	110	132	16	90	1.19	0.55	0.10	0.30	0.025
SL2505D-200-120	20	120	50	7	30	.12	0.25	0.05	0.20	0.020
SL5010D-250-065	25	65	132	15	80	.98	0.50	0.10	0.30	0.025
SL4010D-500-110	50	110	132	12	60	.63	0.40	0.10	0.30	0.025
SL2005D-101-040	100	40	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-050	100	50	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-060	100	60	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-070	100	70	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-080	100	80	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-090	100	90	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-100	100	100	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-110	100	110	50	6	30	.08	0.20	0.05	0.20	0.020
SL3010D-101-110	100	110	132	8	45	.35	0.30	0.10	0.25	0.020
SL2005D-101-120	100	120	50	6	30	.08	0.20	0.05	0.20	0.020
SL2008D-251-120	250	120	150	6	30	.13	0.20	0.08	0.20	0.020
SL2010D-501-120	500	120	250	6	30	.16	0.20	0.10	0.20	0.020
SL2010D-102-110	1000	110	300	6	30	.16	0.20	0.10	0.20	0.020
SL2012D-152-110	1500	110	350	6	30	.19	0.20	0.12	0.20	0.020

CONFIGURATIONS



The values for dissipation constant and time constant are for reference only. Mounting method and environmental conditions can affect these parameters.

PTC SURFACE MOUNT OVERTEMPERATURE PROTECTORS



OVER CURRENT PROTECTORS

The PTC over current protector is connected in series with the load which is to be protected. During normal operating conditions, the PTC remains in its low resistance state resulting in negligible attenuation to current flow. When a short circuit or over-current condition occurs, the PTC will switch into its high resistance state thereby limiting the current flow in the circuit to a point well below the normal operating level. When the fault condition is removed, the PTC will return to its low resistance state allowing the current flow to recover to its normal level. Ketema-Rodan Division produces over-current protectors for a whole range of load protection applications.

TYPICAL APPLICATIONS

• Telephone Line Fault Protection • Transformer Protection • FHP Motor Protection • Transistor Protection • Speaker Protection

FEATURES

- Fast Switching
- No Electrical Noise
- Virtually Unlimited Life
- Self Resetting
- No Contacts
- Automatic Operation
- Efficient

Part Number	Base Resistance (Ohms)	Base Resistance Tolerance (±)	Maximum Voltage	Maximum* Continuous Current (Amps)	Minimum** Switching Current (Amps)	Switch Temp. (°C)	Heat Capacity (Watt-Sec./°C)	Dissipation Constant (mW/°C)	Maximum Dia. (In.)	Lead Dia. (In.)
SP5504D-1R0-120	1	20%	15	0.60	1.30	120	.48	13	0.60	.032
SP5004D-2R0-120	2	20%	25	0.44	.900	120	.39	12	0.55	.032
SP4004D-3R3-120	3.3	30%	25	.300	.690	120	.25	10	0.45	.025
SP6709D-4R7-110	4.7	20%	132	.290	.650	110	1.59	16	0.70	.032
SP4004D-5R0-110	5	20%	25	.220	.500	110	.25	10	0.45	.025
SP3505D-7R5-120	7.5	30%	50	.180	.400	120	.24	8	0.40	.020
SP5510D-100-110	10	30%	132	.170	.430	110	1.19	13	0.60	.025
SP3505D-100-120	10	30%	50	.150	.350	120	.24	8	0.40	.020
SP2505D-200-120	20	30%	50	.095	.215	120	.12	6	0.30	.020
SP3510D-300-110	30	30%	132	.075	.190	110	.48	8	0.40	.020
SP3010D-500-110	50	30%	132	.055	.140	110	.35	7	0.35	.020
SP3010D-101-110	100	30%	132	.040	.100	110	.35	7	0.35	.020
SP2008D-251-120	250	30%	150	.028	.070	120	.13	7	0.25	.020
SP2010D-501-120	500	30%	250	.020	.050	120	.16	7	0.25	.020
SP2010D-102-110	1000	30%	300	.012	.032	110	.16	7	0.25	.020
SP2012D-152-110	1500	30%	350	.010	.026	110	.19	7	0.25	.020

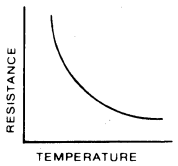
*Maximum Continuous Current (I_{cc})—The maximum amount of current, expressed in AMPS, the PTC must be capable of passing without switching into its high resistance state.

**Minimum Switching Current (I_s)—The minimum amount of current, expressed in AMPS, required to switch the PTC into its high resistance state.

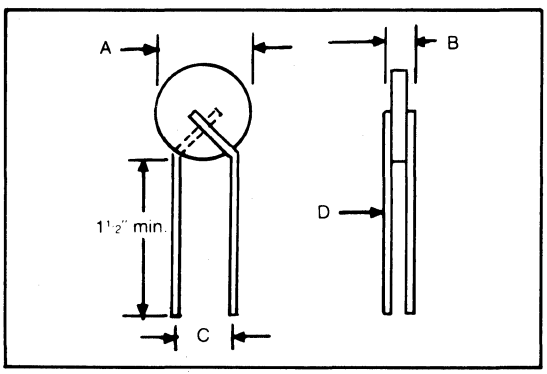
The values for minimum switching current and maximum continuous current are for reference only. Mounting method and environmental conditions can affect these parameters.

Keystone
CARBON COMPANY

DISC TYPE THERMISTORS WITH CROSSED LEADS



NTC (Negative Temperature Coefficient) thermistors decrease in resistance as temperature increases. Their maximum operating temperature is 125° C. Zero-power resistance values at 25° C range from 10 Ω to 250K Ω ; other values upon request. Disc thermistors are available with various coatings, lead styles, and resistance tolerances. Contact Keystone Thermistor Engineering or write for catalog T787.



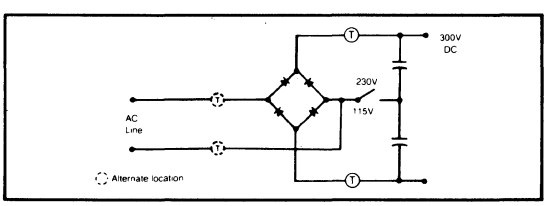
Keystone Thermistors are distributed by

Allied Electronics	1-800-228-6705	Newark Electronics	312-638-4411
SIN-TEC Electronics	1-800-526-5960	Digi-Key Corp.	1-800-344-4539
(In N.J.)	201-996-4093		

KCC TYPE	R_0 @ 25°C (Ω)	Tol. ±%	A (in.)	B (in.)	C (in.)	D (AWG)	Dissipation Constant (mW/°C)	Resist.† Ratio	Temp. Coef. @ 25°C (%/°C)
RL1004-65.6-59-D1	100	20	0.110	0.120	0.100	26	2.5	5.6	-3.42
RL1003-312-73-D1	500	10	0.110	0.110	0.100	26	2.5	6.9	-3.83
RL1007-624-73-D1	1,000	10	0.110	0.150	0.100	26	2.8	6.9	-3.83
RL1003-1157-95-D1	2,000	10	0.110	0.110	0.100	26	2.8	9.2	-4.43
RL1003-1746-97-D1	3,000	10	0.110	0.110	0.100	26	2.5	9.1	-4.40
RL1004-2910-97-D1	5,000	10	0.110	0.120	0.100	26	2.5	9.1	-4.40
RL1009-5820-97-D1	10,000	10	0.110	0.170	0.100	26	3.0	9.1	-4.40
RL1005-5744-103-D1	10,000	10	0.110	0.130	0.100	26	2.5	9.6	-4.49
RL1007-13.8K-120-D1	25,000	10	0.110	0.150	0.100	26	2.8	11.4	-4.84
RL1003-26.7K-140-D1	50,000	10	0.110	0.110	0.100	26	2.5	12.9	-5.08
RL1006-53.4K-140-D1	100,000	10	0.110	0.140	0.100	26	2.7	12.9	-5.08
RL1004-104.7K-155-D1	200,000	10	0.110	0.120	0.100	26	2.5	13.8	-5.23
RL1006-135.2K-138-D1	250,000	10	0.110	0.140	0.100	26	2.7	12.1	-4.96
RL2004-16.4-59-D1	25	20	0.220	0.130	0.156	24	6.5	5.6	-3.42
RL2007-32.8-59-D1	50	20	0.220	0.160	0.156	24	6.5	5.6	-3.42
RL2003-62.4-73-D1	100	10	0.220	0.120	0.156	24	6.5	6.9	-3.83
RL2006-125-73-D1	200	10	0.220	0.150	0.156	24	6.5	6.9	-3.83
RL2008-187-73-D1	300	10	0.220	0.170	0.156	24	6.5	6.9	-3.83
RL2003-289-95-D1	500	10	0.220	0.120	0.156	24	6.0	9.2	-4.43
RL2004-582-97-D1	1,000	10	0.220	0.130	0.156	24	6.5	9.1	-4.40
RL2007-1164-97-D1	2,000	10	0.220	0.160	0.156	24	6.5	9.1	-4.40
RL2006-1600-103-D1	2,786	10	0.220	0.150	0.156	24	6.5	9.6	-4.49
RL2005-2203-120-D1	4,000	10	0.220	0.140	0.156	24	6.5	11.4	-4.84
RL2006-2753-120-D1	5,000	10	0.220	0.150	0.156	24	6.5	11.4	-4.84
RL2012-5506-120-D1	10,000	10	0.220	0.210	0.156	24	7.2	11.4	-4.84
RL2006-13.3K-140-D1	25,000	10	0.220	0.150	0.156	24	6.5	12.9	-5.08
RL2005-27K-138-D1	50,000	10	0.220	0.140	0.156	24	6.5	12.1	-4.96
RL2008-52.3K-155-D1	100,000	10	0.220	0.170	0.156	24	6.5	13.8	-5.23
RL3004-6.56-59-D1	10	20	0.320	0.130	0.250	24	7.0	5.6	-3.42
RL3504-31.2-73-D1	50	10	0.370	0.130	0.250	24	7.5	6.9	-3.83
RL3006-59.4-85-D1	100	10	0.320	0.150	0.250	24	7.2	8.4	-4.23
RL3004-144-95-D1	250	10	0.320	0.130	0.250	24	7.0	9.2	-4.43
RL3004-291-97-D1	500	10	0.320	0.130	0.250	24	7.0	9.1	-4.40
RL3005-574-103-D1	1,000	10	0.320	0.130	0.250	24	7.0	9.6	-4.49

†Resistance Ratio: Ratio of zero-power resistance @ 0°C to zero-power resistance @ 50°C.

INRUSH CURRENT LIMITERS



The circuit diagram above displays a typical way to limit inrush current.

Protection against extremely high peak inrush current, especially in AC/DC switching power supplies, is now available with Keystone Inrush Current Limiters. These special NTC thermistors effectively control surge currents because the thermal time constant of the current limiter is longer than the electrical time constant (RC) of the thermistor and the capacitor.

All inrush current limiters are insulated with a protective coating.

Type	R_t @ 25°C ± 25% (Ω)	Max.* Steady State Current (amps)	Nominal Resistance @ I_{max} (Ω)	A max. (in.)	B max. (in.)	C ref. (in.)	D (AWG)
CL-10	0.7	12	0.03	0.770	0.220	0.328	18
CL-20	1.3	8	0.04	0.550	0.210	0.328	18
CL-30	2.5	8	0.06	0.770	0.220	0.328	18
CL-40	5	6	0.11	0.770	0.220	0.328	18
CL-50	7	5	0.16	0.770	0.260	0.328	18
CL-60	10	5	0.18	0.770	0.220	0.328	18
CL-70	16	4	0.27	0.770	0.220	0.328	18
CL-80	47	3	0.49	0.770	0.220	0.328	18
CL-90	120	2	1.18	0.930	0.220	0.328	18
CL-100	0.5	16	0.02	0.930	0.220	0.328	18
CL-110	10	3.2	0.18	0.400	0.170	0.250	24
CL-120	10	1.7	0.34	0.400	0.170	0.250	24
CL-130	50	1.6	0.76	0.450	0.170	0.250	24
CL-140	50	1.1	0.89	0.450	0.170	0.250	24
CL-150	5	4.7	0.11	0.550	0.180	0.328	22
CL-160	5	2.8	0.20	0.550	0.180	0.328	22
CL-170	16	2.7	0.33	0.550	0.180	0.328	22
CL-180	16	1.7	0.49	0.550	0.180	0.328	22
CL-190	25	2.4	0.41	0.550	0.180	0.328	22
CL-200	25	1.7	0.49	0.550	0.180	0.328	22

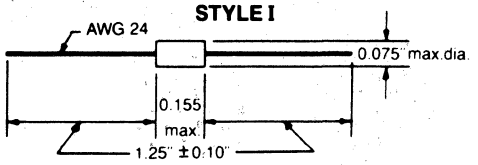
*These values are *suggested* maximums based upon a 25° C ambient, no air flow environment with the thermistor mounted ⅛" from the circuit board. Contact Keystone Engineering to discuss Iss ratings with air flow.

Keystone CARBON COMPANY
Thermistor Division, St. Marys, PA 15857
814-781-1591 • Telex 91-4517 • FAX 814-781-7648

Keystone CARBON COMPANY

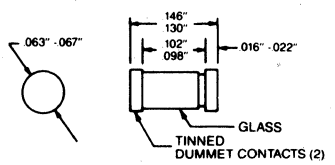
GLASS ENCAPSULATED THERMISTORS

STYLE I



Temperature Range: -50°C to +204°C
Dissipation Constant: 2.0 mW/°C
Time Constant: 3 sec.
Tolerance: ±10% @ 25°C

STYLE II (SURFACE MOUNT)



NOTE: FOR KCC TYPE FOR STYLE II DELETE AL PREFIX AND ADD G100 SUFFIX

Keystone glass encapsulated NTC thermistors are tiny pellets of thermistor material hermetically sealed in glass bodies with a controlled amount of selected atmosphere. The hermetic seal makes these parts extremely stable in applications up to 204°C (400°F).

RESISTANCE/TEMPERATURE CHARACTERISTICS

Type	R_o @ 25°C Ω	Temp. Coef. @25°C (%/°C)	Material
AL03006-624-73-G1	1K	-3.83	GE73
AL03006-1248-73-G1	2K	-3.83	GE73
AL03006-1847-76-G1	3K	-3.85	GE76
AL03006-2463-76-G1	4K	-3.85	GE76
AL03006-3079-76-G1	5K	-3.85	GE76
AL03006-5818-97-G1	10K	-4.41	GE97A
AL03006-11.7K-98-G1	20K	-4.34	GE98
AL03006-17.53K-98-G1	30K	-4.34	GE98
AL03006-29.1K-97-G1	50K	-4.32	GE97B
AL03006-58.2K-97-G1	100K	-4.32	GE97B
AL03006-269.8K-138-G1	500K	-4.99	GE138
AL03006-535K-145-G1	1M	-5.07	GE145
AL03006-2.6M-164-G1	5M	-5.26	GE164

PTC SURFACE-MOUNT OVERTEMPERATURE PROTECTORS

Positive Temperature Coefficient (PTC) thermistors — act as solid-state switches. A typical application of these surface mount units is to prevent destruction of a power transistor.

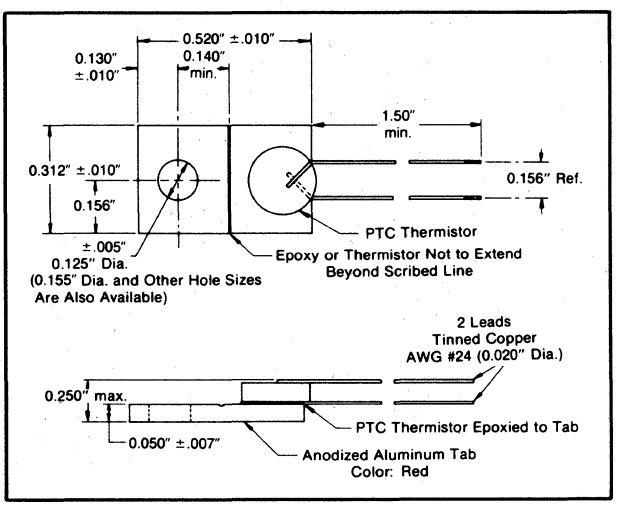
The PTC Sensor is mechanically mounted to the power transistor package. The PTC thermistor measures the surface temperature of the transistor. When the temperature of the transistor case reaches a critical point, the PTC switches and turns off the drive circuitry for the transistor. This action prevents its destruction. Then, as the transistor cools, so does the thermistor, automatically resetting itself to once again guard the power transistor.

Specifications

1. Resistance @ 25°C: 100Ω ± 30% (70Ω — 130Ω).
2. Transition temperature per table is defined as the temperature at which the measured resistance is two times the minimum resistance.
3. Maximum voltage that can be applied to the device in DC or 60Hz sinusoidal wave form AC is 30 volts.
4. Maximum operating temperature 140°C.
5. Dielectric withstand between PTC element and aluminum tab is 50 VDC min.
6. Basic construction: .200" dia. x .060" thk. PTC disc with radial leads attached to an anodized aluminum tab.
7. Physical design — per drawing.
8. Optional resistance values, switch temperatures and physical designs are available upon request.

PTC SURFACE TEMPERATURE SENSORS

Type Number	Transition Temp. °C (Ref.)
RL2006-100-30-30-PT1	30
RL2006-100-40-30-PT1	40
RL2006-100-50-30-PT1	50
RL2006-100-60-30-PT1	60
RL2006-100-70-30-PT1	70
RL2006-100-80-30-PT1	80
RL2006-100-90-30-PT1	90
RL2006-100-100-30-PT1	100
RL2006-100-110-30-PT1	110
RL2006-100-120-30-PT1	120



Keystone also manufactures:

Thermistor Probes • Linistor® Assemblies • Glass Beads • Glass Probes • Rod-type, Surface-mount, Hi-Temp, Cryogenic and Precision Thermistors

Phone for information.

Keystone CARBON COMPANY
Thermistor Division, St. Marys, PA 15857
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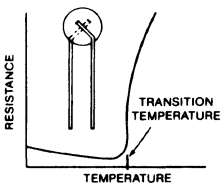
Keystone CARBON COMPANY

PTC — POSITIVE TEMPERATURE COEFFICIENT THERMISTORS



Positive Temperature Coefficient (PTC) thermistors are characterized by an extremely large resistance change in a small temperature span. The figure at left depicts a generalized resistance temperature plot for a PTC. The temperature at which the resistance begins to increase rapidly is referred to as the transition temperature. This point can be changed from below 0° C to above 160° C.

TYPICAL PTC APPLICATIONS

• Automatic Color TV Degaussing • Air Flow Measurement • Non-Destructive Fuse • Single Phase Motor Starting • Liquid Level Sensing • Combination Heater-Thermostat • Arc Suppression • Time Delay Fusing.

For detailed application notes, write for Catalog T787.

Operating Voltage V_{OP}	Type Number	R_o @25°C ±30% (Ω)	Transition Temperature T_{TR} (°C)	Reference Dimensions (In.) A	B	C	D	E	Dissipation† Constant δ (mW/°C)	Time† Constant τ (Sec.)	Fig. No. *
12	RL5505-1-120-12-PTO	1	120	0.55	0.05	1.5	0.33	0.032	14.0	50	A
	RL5305-2-120-12-PTO	2	120	0.53	0.05	1.5	0.33	0.032	14.0	50	A
	RL3005-10-120-12-PTO	10	120	0.30	0.05	1.5	0.25	0.020	7.0	35	A
	RL3005-25-120-12-PTO	25	120	0.30	0.06	1.5	0.25	0.020	7.0	35	A
20	RL5505-2.5-120-20-PTO	2.5	120	0.55	0.05	1.5	0.33	0.032	14.0	50	A
	RL5505-5-120-20-PTO	5.0	120	0.55	0.05	1.5	0.33	0.032	14.0	50	A
25	RL3006-20-120-25-PTO	20	120	0.30	0.06	1.5	0.25	0.025	7.0	35	A
	RL3006-50-30-25-PTO	50	30	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-40-25-PTO	50	40	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-50-25-PTO	50	50	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-60-25-PTO	50	60	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-70-25-PTO	50	70	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-80-25-PTO	50	80	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-90-25-PTO	50	90	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-100-25-PTO	50	100	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-110-25-PTO	50	110	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-120-25-PTO	50	120	0.30	0.06	1.5	0.25	0.020	7.0	35	A
50	RL5506-5-65-50-PTO	5	65	0.55	0.06	1.5	0.33	0.032	14.0	50	A
	RL5506-10-110-50-PTO	10	110	0.55	0.06	1.5	0.33	0.032	14.0	50	A
	RL5510-20-110-50-PTO	20	110	0.55	0.10	1.5	0.33	0.032	15.0	80	A
	RL4010-50-110-50-PTO	50	110	0.40	0.10	1.5	0.33	0.025	12.0	60	A
120	RL7510-10-120-120-PTO	10	120	0.75	0.10	1.5	0.33	0.020	20.0	90	A
	RL6010-20-120-120-PTO	20	120	0.60	0.10	1.5	0.33	0.032	18.0	90	A
	RL5510-25-65-120-PTO	25	65	0.55	0.10	0.5	0.33	0.025	15.0	90	B
	RL4510-50-120-120-PTO	50	120	0.45	0.10	1.5	0.33	0.025	12.0	70	A
240	RL5515-50-65-240-PTO	50	65	0.55	0.15	1.5	0.33	0.032	17.0	80	A
	RL6015-100-120-240-PTO	100	120	0.60	0.15	1.5	0.33	0.032	18.0	90	A
	RL3020-1500-100-240-PTO	1500	100	0.30	0.20	1.5	0.25	0.020	12.0	60	A

† The values for dissipation constant and time constant are for reference only. Actual values are a function of method of mounting, air flow, and other factors which affect the PTCs ability to dissipate heat. Contact Keystone Engineering for further information.
* Represents standard lead configurations. Other lead styles shown are available for custom made thermistors.

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Keystone Thermistors are distributed by

Allied Electronics	1-800-228-6705	Newark Electronics	312-638-4411
SIN-TEC Electronics	1-800-526-5960	Digi-Key Corp.	1-800-344-4539
(In N.J.)	201-996-4093		

TYPICAL CONFIGURATIONS

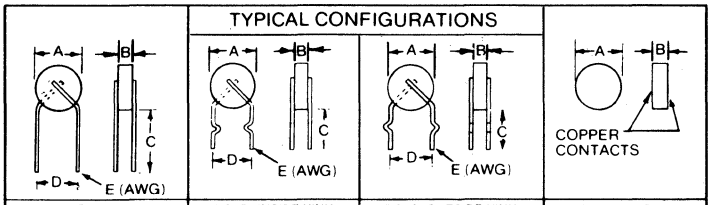


FIG. A (STRAIGHT LEAD) | FIG. B (INSIDE KINK) | FIG. C (OUTSIDE KINK) | FIG. D (NO LEADS)

NOTE: 1. Operating Voltage: D.C. or 60Hz A.C. (for higher voltage req. — contact factory).
2. The specifications and configurations shown above are typical of standard items. Special characteristics, designs and alternate physical sizes are available upon request.

PTC RESETTABLE FUSES

Typical applications for PTC fuses:

- Telephone line fault protection
- Fuse for intermittent solenoids
- Over-current protection for transformers
- Locked rotor protection for FHP motors

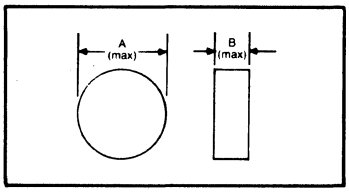
Minimum Limit Current — The minimum amount of current required by the PTC to guarantee switching at the minimum ambient temperature.

Maximum Limit Current — The maximum amount of current the PTC must be able to pass without switching at the maximum ambient temperature.

Operating Voltage V_{op}	No Load Resistance @ 25°C (±20%) (Ω)	Type Number	Minimum Limit† Current (amps) 0°C	20°C	Maximum Limit† Current (amps) 30°C	55°C	T_{TR} (Ref.) (°C)	Heat Capacity (Watt-Sec/°C)	Diss.† Const. (mW/°C)	Max. Dia. (In.)
12	1	RL5305-1-110-12-PTF	1.30	1.20	0.80	0.60	110	0.5	14.0	0.60
	5	RL4005-5-110-12-PTF	0.44	0.37	0.29	0.20	110	0.3	10.0	0.45
	10	RL3005-10-110-12-PTF	0.33	0.30	0.20	0.16	110	0.2	7.0	0.35
	25	RL2505-25-110-12-PTF	0.23	0.19	0.13	0.09	110	0.1	6.0	0.32
50	5	RL5506-5-110-50-PTF	0.55	0.50	0.30	0.25	110	0.7	14.0	0.60
	10	RL4006-10-110-50-PTF	0.30	0.27	0.18	0.16	110	0.4	10.0	0.45
	50	RL5310-50-110-50-PTF	0.23	0.20	0.11	0.10	110	1.1	15.0	0.60
	100	RL3810-100-110-50-PTF	0.10	0.09	0.06	0.05	110	0.5	12.0	0.42
120	10	RL7510-10-110-120-PTF	0.39	0.36	0.25	0.17	110	2.2	20.0	0.80
	50	RL4510-50-110-120-PTF	0.16	0.15	0.09	0.07	110	0.7	14.0	0.50
	100	RL3510-100-110-120-PTF	0.09	0.08	0.06	0.04	110	0.5	11.0	0.40

†The values for minimum and maximum limit current and dissipation constant are for reference only. Actual values are a function of method of mounting, air flow, and other factors which affect the PTCs ability to dissipate heat. Contact Keystone engineering for further information.

PTC HEATERS



Typical applications for PTC heaters:

- Contact lens cleaner kits
- Medical equipment
- In-line diesel fuel heaters
- Temperature stabilization of electronic components

Operating Voltage V_{OP}	Type Number	No Load Resistance @ 25 C (Ref.) (Ω)	Transition Temperature (Ref.) (C)	A (In.)	B (In.)	Typical Operating Temperature Minimum Heat Sinking† C
24	6306-200-15-24-PTH	200	15	0.68	0.08	50
	5506-20-120-24-PTH	20	120	0.60	0.08	160
	5506-20-140-24-PTH	20	140	0.60	0.08	180
	5506-40-110-24-PTH	40	110	0.60	0.08	130
120	5510-100-120-120-PTH	100	120	0.60	0.12	160
	5510-200-110-120-PTH	200	110	0.60	0.12	140
	5510-150-140-120-PTH	150	140	0.60	0.12	180
240	6315-250-120-240-PTH	250	120	0.68	0.18	160
	5520-250-140-240-PTH	250	140	0.60	0.23	180
	6315-500-110-240-PTH	500	110	0.68	0.18	140

†Measured at 25°C ambient. PTC mounted in small spring clip.

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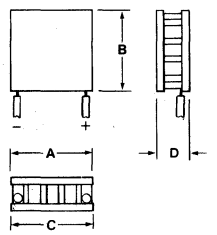
SOLID STATE COOLING WITH THERMOELECTRICS

Thermoelectric (Peltier) Heat Pump Module Specifications

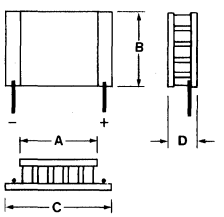
Thermocouples constructed of N & P elements of highest grade bismuth telluride in form of oriented polycrystalline ingots. Ingot ends soldered to copper bus bars interfaced with ceramic plates, affording good mechanical integrity, high dielectric strength and thermal conduction. Temperature range, −150°C to +80°C. Solid state construction. Both hot and cold faces lapped flat, TYPE L. Both faces metallized and tinned, TYPE TT. Hybrid, hot face tinned, cold face lapped, TYPE TL.

	Catalog Number	I Max Amps	Hot Face Th = 25°C Q Max Watts	V Max Volts	ΔT Max °C	Universal Multipliers N No. of Couples	G Geometry Factor	G x N	Dimensions, mm A	B	C	D(5)
CP SERIES	CP 1.0- 7-06L	3.0	1.4	0.85	67	7	0.060	0.42	8	8		3.6
	CP 1.0- 17-06L	3.0	3.4	2.06	67	17	0.060	1.02	12	12		3.6
	CP 1.0- 31-06L	3.0	6.3	3.75	67	31	0.060	1.86	15	15		3.6
	CP 1.0- 63-06L	3.0	12.7	7.62	67	63	0.060	3.78	15	30		3.6
	CP 1.0- 71-06L	3.0	14.4	8.60	67	71	0.060	4.26	23	23		3.6
	CP 1.0-127-06L	3.0	25.7	15.4	67	127	0.060	7.62	30	30		3.6
	CP 1.0- 7-05L	3.9	1.8	0.85	67	7	0.078	0.55	8	8		3.2
	CP 1.0- 17-05L	3.9	4.5	2.06	67	17	0.078	1.33	12	12		3.2
	CP 1.0- 31-05L	3.9	8.2	3.75	67	31	0.078	2.42	15	15		3.2
	CP 1.0- 63-05L	3.9	16.6	7.62	67	63	0.078	4.91	15	30		3.2
	CP 1.0- 71-05L	3.9	18.7	8.60	67	71	0.078	5.54	23	23		3.2
	CP 1.0-127-05L	3.9	33.4	15.4	67	127	0.078	9.90	30	30		3.2
	CP 1.4-127-10L(1)	3.9	33.4	15.4	70	127	0.078	9.90	40	40		4.7
	CP 1.4- 3-06L	6.0	1.2	0.36	67	3	0.12	0.36	5	10		3.8
	CP 1.4- 7-06L	6.0	2.8	0.85	67	7	0.12	0.84	10	10		3.8
	CP 1.4- 11-06L	6.0	4.4	1.33	67	11	0.12	1.32	10	15		3.8
	CP 1.4- 17-06L	6.0	6.9	2.06	67	17	0.12	2.04	15	15		3.8
	CP 1.4- 31-06L	6.0	12.5	3.75	67	31	0.12	3.72	20	20		3.8
	CP 1.4- 35-06L	6.0	14.2	4.24	67	35	0.12	4.20	15	30		3.8
	CP 1.4- 71-06L	6.0	28.7	8.60	67	71	0.12	8.52	30	30		3.8
	CP 1.4-127-06L	6.0	51.4	15.4	67	127	0.12	15.24	40	40		3.8
	CP 1.4- 3-045L	8.5	1.6	0.36	65	3	0.17	0.51	5	10		3.3
	CP 1.4- 7-045L	8.5	3.8	0.85	65	7	0.17	1.19	10	10		3.3
	CP 1.4- 11-045L	8.5	5.6	1.33	65	11	0.17	1.87	10	15		3.3
	CP 1.4- 17-045L	8.5	9.2	2.06	65	17	0.17	2.89	15	15		3.3
	CP 1.4- 31-045L	8.5	16.8	3.75	65	31	0.17	5.27	20	20		3.3
	CP 1.4- 35-045L	8.5	19.0	4.24	65	35	0.17	5.95	15	30		3.3
	CP 1.4- 71-045L	8.5	38.5	8.60	65	71	0.17	12.07	30	30		3.3
	CP 1.4-127-045L	8.5	68.8	15.4	65	127	0.17	21.60	40	40		3.3
	CP 2 - 71-10L(1)	9.0	43.1	8.60	70	71	0.18	12.78	44	44		5.6
	CP 2 - 3-06L	14.0	2.8	0.36	67	3	0.28	0.84	8	15		4.6
	CP 2 - 7-06L	14.0	6.6	0.85	67	7	0.28	1.96	15	15		4.6
	CP 2 - 15-06L	14.0	14.2	1.82	67	15	0.28	4.20	15	30		4.6
	CP 2 - 17-06L	14.0	16.0	2.06	67	17	0.28	4.76	22	22		4.6
	CP 2 - 31-06L	14.0	29.3	3.75	67	31	0.28	6.86	30	30		4.6
	CP 2 - 49-06L	14.0	46.2	5.93	67	49	0.28	13.72	36	36		4.6
	CP 2 - 71-06L	14.0	67.0	8.60	67	71	0.28	19.88	44	44		4.6
	CP 2.8- 32-06L	24.0	51.8	3.87	67	32	0.48	15.36	40	40		5.0
	CP 5 - 31-10L	39.0	81.5	3.75	70	31	0.78	24.18	55	55		5.8
	CP 5 - 31-06L	60.0	125.	3.75	67	31	1.20	37.20	55	55		4.9
FC SERIES	FC 0.45- 4-05L	0.8	0.22	0.48	67	4	0.016	0.06	1.8	3.4	3.4	2.4
	FC 0.45- 8-05L	0.8	0.43	0.97	67	8	0.016	0.13	3.4	3.4	5.0	2.4
	FC 0.45-12-05L	0.8	0.65	1.45	67	12	0.016	0.19	3.4	5.0	5.0	2.4
	FC 0.45-18-05L	0.8	0.97	2.18	67	18	0.016	0.29	5.0	5.0	6.6	2.4
	FC 0.45-32-05L	0.8	1.72	3.87	67	32	0.016	0.51	6.6	6.6	8.3	2.4
	FC 0.45-66-05L	0.8	3.56	7.98	67	66	0.016	1.06	9.9	9.1	11.5	2.4
	FC 0.6- 4-06L	1.2	0.32	0.48	67	4	0.024	0.10	2.2	4.2	4.2	2.7
	FC 0.6- 8-06L	1.2	0.65	0.97	67	8	0.024	0.19	4.2	4.2	6.2	2.7
	FC 0.6- 12-06L	1.2	0.97	1.45	67	12	0.024	0.29	4.2	6.2	6.2	2.7
	FC 0.6- 18-06L	1.2	1.46	2.18	67	18	0.024	0.43	6.2	6.2	8.3	2.7
	FC 0.6- 32-06L	1.2	2.59	3.87	67	32	0.024	0.77	8.3	8.3	10.3	2.7
	FC 0.6- 66-06L	1.2	5.34	7.98	67	66	0.024	1.58	12.3	11.3	14.4	2.7
	FC 0.6- 4-05L	1.5	0.40	0.48	67	4	0.030	0.12	2.2	4.2	4.2	2.4
	FC 0.6- 8-05L	1.5	0.81	0.97	67	8	0.030	0.24	4.2	4.2	6.2	2.4
	FC 0.6- 12-05L	1.5	1.21	1.45	67	12	0.030	0.36	4.2	6.2	6.2	2.4
	FC 0.6- 18-05L	1.5	1.82	2.18	67	18	0.030	0.54	6.2	6.2	8.3	2.4
	FC 0.6- 32-05L	1.5	3.23	3.87	67	32	0.030	0.96	8.3	8.3	10.3	2.4
	FC 0.6- 66-05L	1.5	6.67	7.98	67	66	0.030	1.98	12.3	11.3	14.4	2.4
	FC 0.7- 4-05L	2.0	0.54	0.48	67	4	0.040	0.16	2.4	4.7	4.7	2.4
	FC 0.7- 8-05L	2.0	1.08	0.97	67	8	0.040	0.32	4.7	4.7	7.0	2.4
	FC 0.7- 12-05L	2.0	1.62	1.45	67	12	0.040	0.48	4.7	7.0	7.0	2.4
	FC 0.7- 18-05L	2.0	2.43	2.18	67	18	0.040	0.72	7.0	7.0	9.3	2.4
	FC 0.7- 32-05L	2.0	4.31	3.87	67	32	0.040	1.28	9.3	9.3	11.6	2.4

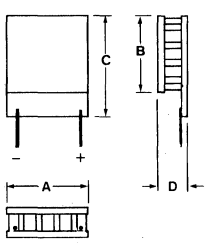
DIMENSIONS



CP Series
FC Series — Option One (2) (4)



FC Series — Standard



FC Series — Option Two (3)

Notes:

(1) Shown in largest size. Also available in all smaller sizes listed in group that follows.

(2) Option 1: Disregard Dim.C from table. Use Dim.C = Dim.A

(3) Option 2: Dim.C = Dim.B + 1.7 mm (FC 0.45); + 2.1 mm (FC 0.6); + 2.3 mm (FC 0.7)

(4) Option 1: Each size listed contains one less thermocouple, "N." Decrease N, GXN, Q and V accordingly.

(5) Thickness (D,mm) for Type L only.

WIRE STANDARDS

Module Type	Wire Gauge (AWG)	Length (mm/in.)	Insulation
FC 0.45-ALL	32 (SOLID)	50/2.0	None
FC 0.6-ALL	30 (SOLID)	50/2.0	None
FC 0.7-ALL	30 (SOLID)	50/2.0	None
CP 1.0-ALL	24 (STRANDED)	114/4.5	PVC
CP 1.4-ALL	18 (STRANDED)	114/4.5	PVC

Module Type	Wire Gauge (AWG)	Length (mm/in.)	Insulation
CP 2-ALL	18 (STRANDED)	114/4.5	PVC
CP 2.8-ALL	16 (STRANDED)	114/4.5	PVC
CP 5-XX-10	14 (STRANDED)	114/4.5	PVC
CP 5-XX-06	12 (STRANDED)	114/4.5	PVC

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How To Use Universal Performance Graphs:

APPROACH #1: Convert universal scale values to those of specific module selected:

1. Convert Q_c/GxN (scale values) to Q_c (watts heat pumped): Multiply Q_c/GxN values by module GxN (from table in module specifications chart).

2. Convert V/N values to V (volts input): Multiply V/N values by module N from table.

3. Convert 50 G, 40 G, etc. to I (amps input) values: Multiply 50 by module G, etc.

APPROACH #2: From application, knowing required Q_c, T_c and T_h, select appropriate module:

1. Calculate $\triangle T = T_h - T_c$; select operating current I (I max = 50 G).

2. From universals, obtain Q_c/GxN. Calculate GxN.

3. Select appropriate module from GxN table in module specifications chart.

EXAMPLE: Required Q_c = 31 Watts, T_c = +5°C, T_h = +35°C

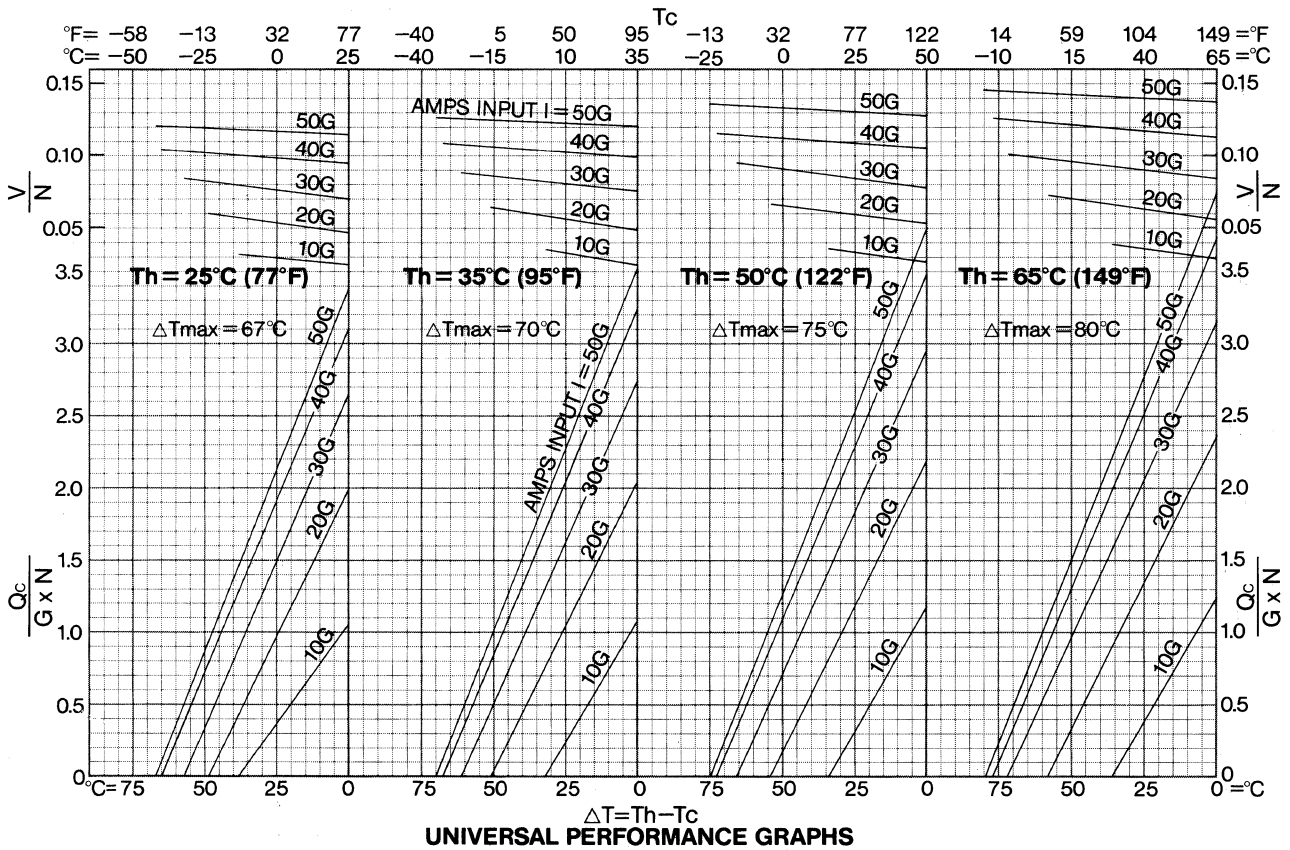
1. $\triangle T$ = 35° − 5° = 30°C. Choose operating current (typically from 30 G to 40 G) at 35 G (equals 35/50 = 70% of I max.)

2. From T_h = 35°C graph ($\triangle T$ = 30°, I = 35 G), obtain Q_c/GxN = 1.65; Then GxN = $Q_c/1.65$ = 31/1.65 = 18.8.

3. Choose module with GxN ≥ 18.8; choose CP1.4-127-045 (GxN = 21.6) or CP2-71-06 (GxN = 19.9).

If desired, approach #1 may now be followed for module selected.

Model CP1.4 – 127 – 06L
CP Series, Type L
1.4 x 1.4mm Thermoelement Cross Section
127 Thermocouples
.06″ Thermoelement Height

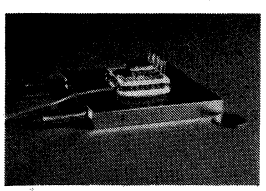


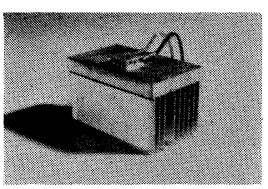
UNIVERSAL PERFORMANCE GRAPHS

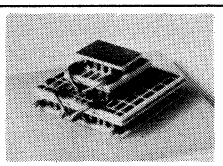
Tc = Cold Face Temperature; Th = Hot Face Temperature; I = Module Current, Amps; V = Module Voltage, Volts; Qc = Watts Heat Pumped; N = Number of Thermocouples; G = Thermoelement Geometry Factor

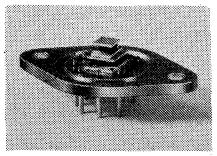
Special Heat Pump Assemblies

Special assemblies are available in O.E.M. quantities, designed to customer requirements using heat exchangers furnished by customer or by Melcor. Multistage cascades also available in standard and custom configuration, with temperatures to −95°C (6 stage). Ceramic construction with solder interfacing between stages.









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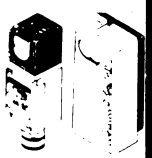
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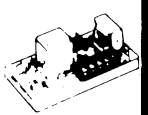
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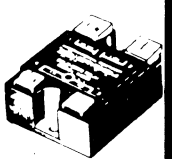
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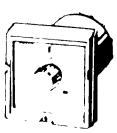
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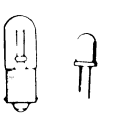
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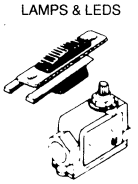
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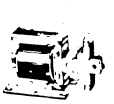
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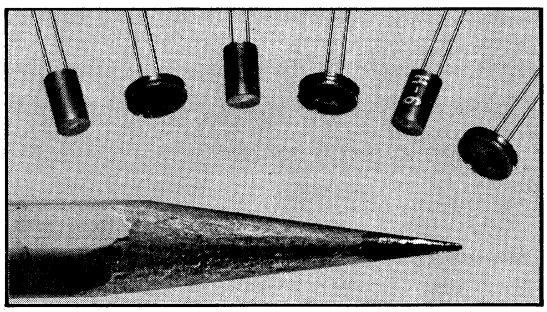

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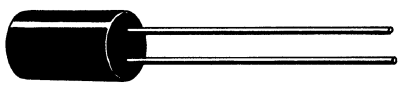

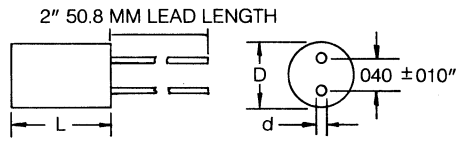

SPECIFICATIONS

Part No.	Rated Watt 70°C	Temp. Coeff.	Resistance Range (ohms)	Resistor tolerance	T.C.R. tolerance	Dimensions L ±.032	Dimensions D ±.015	Dimensions d	Max volts D.C.
401E	0.05W	0+20ppm	.5-30K	.05% to 10%	7%	.175	.105	28awg	75
401B	0.05W	0+4500ppm	.5-5K	*1% to 20%	7%	.175	.105	28awg	75
401N	0.05W	0+6000ppm	1-1.5K	*1% to 20%	7%	.175	.105	28awg	75

* 1% tolerance available only on values over 10 ohms
Also available in axial lead configuration — order as type 110.

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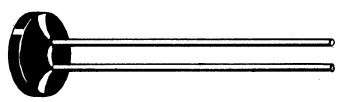
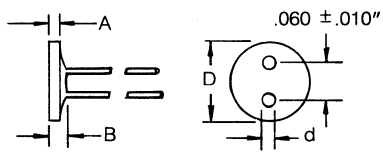
Flat surface facilitates bonding for excellent response time





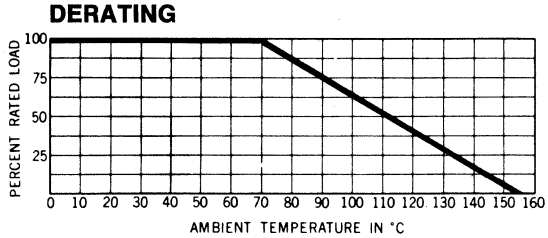
SPECIFICATIONS

Part No.	Rated Watt 70°C	Temp. Coeff.	Resistance Range (ohms)	Resistor tolerance	T.C.R. tolerance	Dimensions A ±.010	Dimensions B ±.032	Dimensions D ±.015	Dimensions d	Max Volts
D-100E	.05W	+20ppm	40-25K	1% to 10%	7%	.045	.100	.200	30awg	75
D-100B	.05W	+4500ppm	10-2K	1% to 20%	7%	.045	.100	.200	30awg	75
D100-N	.05W	+6000ppm	10-350	5% to 20%	7%	.045	.100	.200	30awg	75

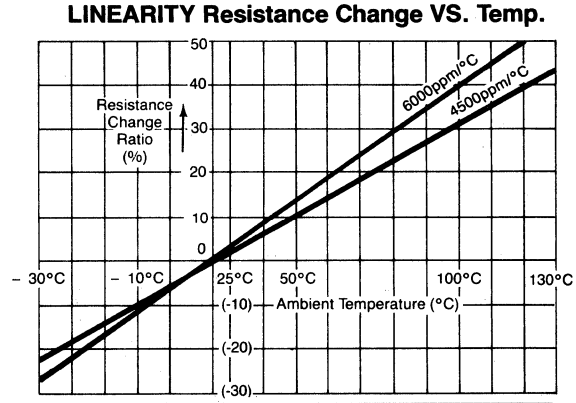
FEATURES:
- Wirewound for accuracy/Epoxy construction.
- Matching temperature coefficient available.
- Ratio match resistance available.
- Excellent repeatability/Quick response time.
- High positive temperature coefficient.
- Linear Resistance Change with Temperature.
- High Ohmic Values.
- Wide Operating Temperature Range.
- Guaranteed Part-to-Part Interchangeability.

APPLICATIONS:
- Load Cell compensating & trimming.
- Temperature control, detection and indication.
- Temperature protection indication.
- Measuring and testing equipment.
- Liquid temperature sensors.

DERATING



LINEARITY Resistance Change VS. Temp.



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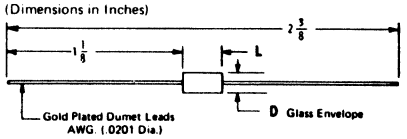
The leadless SMS™ Thermistor is designed for applications where surface mounting is required. Both sensors are available on tape and reel for automatic mounting.

H-SERIES LEADED SENSOR

Typical Characteristics		Catalog Number				
Specification	Test Condition	1H	PIH	UH	2H	4H
Resistance @ 25° C. (OHMS)	Zero Power	3K-100K	3K-100K	3K-100K	2K-5K	200K-1M
Resistance Ratio $\frac{R_{25C}}{R_{125C}}$		29.85	29.85	29.85	19.80	48.78
Maximum Withstand Temperature. °C		-55 to 400	-55 to 400	-55 to 400	-55 to 400	-55 to 400
Operating Temperature Range. °C		-50 to 400	-50 to 400	-50 to 400	-50 to 400	-50 to 400
Interchangeability °C (see curve reverse side)	0-100°C	N/A	1°C	.2°C	N/A	N/A
Stability (change in resistance)	1000 Hours at 100°C	< .1%	< .1%	< .1%	N/A	N/A

OUTLINE DRAWING

(Dimensions in Inches)



GRADE	D	L	AWG
1H (3K-3K)	.095	.170	20
1H (10K-100K)	.070	.150	24
2H (2K-5K)	.070	.150	24
4H (200K-1M)	.070	.150	24

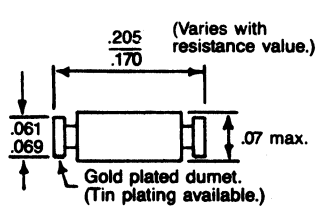
*Dissipation Constant—Free Air
1H (3K-9K)—5mw/°c
1H (10K-100K) 2H-4H—2mw/°c

**Time Constant—Stirred Oil
1H (3K-9K)—1.5 sec. max.
1H (10K-100K)—2H-4H—1 sec. max.

SMS™ - SURFACE MOUNT SENSOR

Typical Characteristics	Catalog Number 2S202	2S502	1S103	1S203	1S503	1S104	4S204	4S504	4S105
Zero Power Resistance @ 25°C: OHMS ± 10%	2,000	5,000	10,000	20,000	50,000	100,000	200,000	500,000	1,000,000
Resistance Ratio: $\frac{R_{25°C}}{R_{125°C}}$	19.80	19.80	29.41	29.41	29.41	29.41	48.78	48.78	48.78
*Dissipation Constant (∂): $\frac{\text{milliwatts}}{°C}$	2	2	2	2	2	2	2	2	2
**Thermal Time Constant (τ):(sec.)	8	8	8	8	8	8	8	8	8
Time Constant with Stirred Oil (sec.)	1	1	1	1	1	1	1	1	1
Maximum Operating Temperature: (°C)	400	400	400	400	400	400	400	400	400
(°F)	752	752	752	752	752	752	752	752	752

OUTLINE DRAWING



*The ratio in a 25°C still air ambient, of the power input to raise the Thermistor temperature to 125°C and its temperature rise (125°C-25°C) above ambient.

**Time required for a Thermistor to change 63.2% of the temperature difference between its initial and final body temperature when subjected to a step function change in temperature under zero-power conditions.

Temperature		Resistance Ratio Characteristics		
°C	°F	R_T/R_{25} MULTIPLIER 1H-	2H-	4H-
-55	-67	95	54	131
-40	-40	34	21.7	45.5
-21.5	-6.7	10.5	8.0	13.2
0	32	3.3	2.82	3.71
25	77	1.00	1.00	1.00
37.8	100	.58	.62	.543
50	122	.36	.41	.32
75	167	.148	.182	.114
104.4	220	.0595	.082	.0399
125	257	.0335	.505	.0205
150	302	.0180	.0300	.0101
200	392	.00670	.0116	.00285
250	482	.00280	.00555	.00110
300	572	.00140	.00291	.000454
350	662	.000800	.00178	.000113
400	752	.000450	.00104	.000113

To find the resistance of a particular H-Series Thermistor at any temperature in this table, multiply its 25°C resistance by the multiplier for that temperature.

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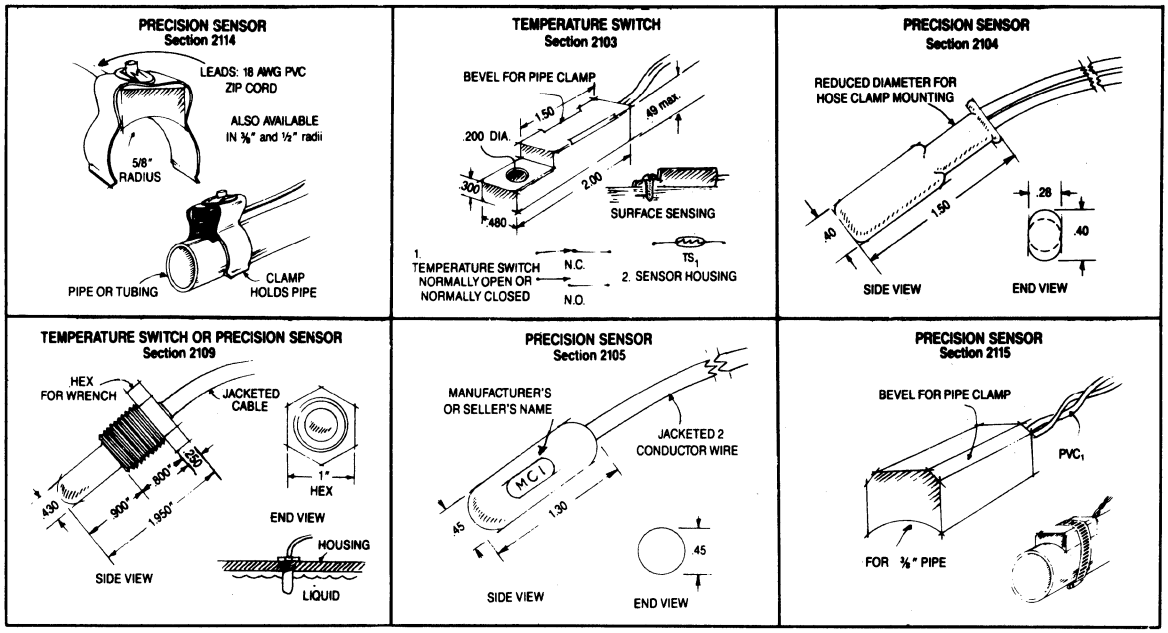
TEMPERATURE SENSORS INCAPSULATED IN THERMOPLASTIC
MANUFACTURED BY MIDWEST COMPONENTS, INC.

TUFF-SENSORS™, a family of thermoplastic molded probes, provide reliable protection against environmental extremes for our line of temperature sensors and switches. Use of high performance plastics creates a temperature probe that resists temperature variations, humidity, chemicals and rough handling.
Many standard sizes and shapes are available, with selection of type based on conditions of use.
Custom designs available to your specifications.

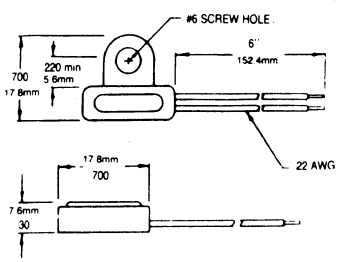


NTC THERMISTORS

MANUFACTURED BY MIDWEST COMPONENTS, INC.

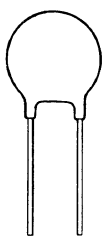
TAB MOUNTED PROTECTORS

Midwest Components' Over Temperature Protectors provide shutoff or regulation of expensive Power Transistors and protect against over-heating that occurs from component failure or short conditions. The sensor is an NTC (Negative Temperature Coefficient) device. Unlike fuses or bi-metal elements its action is recyclable and has no hysteresis effect. Available in resistance packages from 100Ω to 100K in tolerances of .8% to 40%.



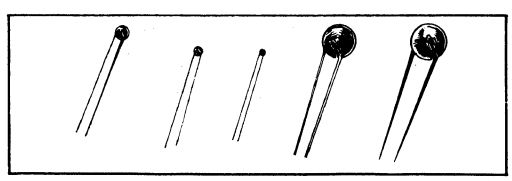
INRUSH CURRENT SUPPRESSORS FOR SWITCHING POWER SUPPLIES.

Switching power supplies present high initial currents due to filter capacitor impedance upon turn-on. The use of Midwest's NTC (Negative Temperature Coefficient) devices limits this current to a low value. After current flow their resistance becomes negligible and offers little voltage drop.



• TEMPERATURE COMPENSATION AND SENSING

Disc Series Thermistors are small rugged Thermistors with close electrical tolerances. Their small mass gives short thermal time constants, yet they are not so small that it is difficult to handle them. The tinned copper leads are easily soldered into electrical circuits.



MIDWEST COMPONENTS INC.
MIDWEST COMPONENTS INC.
P.O. Box 787/1981 Port City Boulevard
Muskegon, MI 49443/(616) 777-2602/TWX 510-394-4130

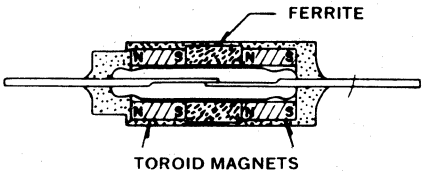
TEMPERATURE SENSING SWITCHES

MANUFACTURED BY MIDWEST COMPONENTS, INC.

CONVENIENT AND RELIABLE TEMPERATURE CONTROL

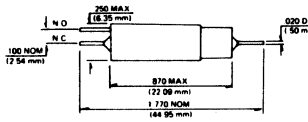
Miniature temperature switches use an electro-ceramic element instead of a bimetallic switch. The Reed Switch Temperature Sensor works on these two principles: a reed switch actuation occurs because of changes in strength of a magnetic field in the vicinity of the contact gap; and certain materials exhibit great changes in magnetic reluctance when the temperature is varied in the vicinity of the material's curie temperature.

The unit has good response time, and is operable in a variety of atmospheres and solutions. Variations in configurations suitable for installation in automotive engine crankcases and automatic transmissions, or mountings for use in computer cabinets are possible. Other applications include oven over-heat alarms, corrosive liquid temperature control, food freezer thaw warning and cooling fan stop indication. This switch replaces many thermally actuated devices now used where increased life is required or protection of the switching contacts from adverse environments is deemed desirable.

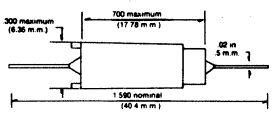


MOLDED SWITCHES

Switches feature small size for fast response. epoxy package resists most chemicals and is good for use up to 115°C. Standard units from 0° to 115°C are available in five degree nominal increments.



SPDT Form C



SPST Form B (NC)
SPST Form A (NO)

SPECIFICATIONS

	ST Form B (NC) SPST Form A (NO)	SPDT Form C
CONTACT RATING	Watts – 10W maximum Volt Amps – 12 V.A. maximum	Watts – 10W maximum Volt Amps – 12 V.A. maximum
VOLTAGE	Volts D.C. – 100 VDC maximum Volts A.C. – 120 VAC maximum	Volts D.C. – 100 VDC maximum Volts A.C. – 120 VAC maximum
CURRENT	Carry – 1 amp maximum Break – 1 amp maximum Make – .5 amp maximum	Carry – 1 amp maximum Break – 1 amp maximum Make – .500 amp maximum
OPEN TEMPERATURE – NOMINAL	5° increments starting at 0°C	5° increments starting at 0°C
TOLERANCE	±5°C	±5°C
RESET DIFFERENTIAL	10°C maximum	10°C maximum

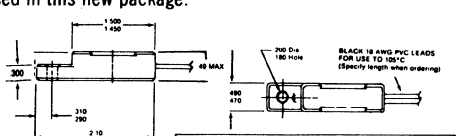
KEY TO ORDERING:
MTS (Temp. Switch) *XXX* (Temp. in °C) *A or B* (Form)
EXAMPLE: MTS 50B

REED SWITCHES—PMS SERIES

Midwest Components, Inc. has now packaged the reliable temperature sensing reed switch in a convenient and easy to use housing. The molded plastic body offers the additional advantages of complete moisture and dust protection at an economical price.

This rugged switch can be quickly mounted with a screwdriver. An indentation on the housing also facilitates attachment by ordinary hose clamps or clip hardware supplied by the user. Type A (normally open) or Type B (normally closed) switches may be used in this new package.

CONTACT ARRANGEMENT	SPST Form B (NC)	SPST Form A (NO)
CONTACT RATING	Watts — 10W maximum Volt Amps. — 12 V.A. maximum	Watts — 10W maximum Volt Amps — 12 V.A. maximum
VOLTAGE	Volts D.C. — 100 VDC maximum Volts A.C. — 120 VAC maximum	Volts D.C. — 100 VDC maximum Volts A.C. — 120 VAC maximum
CURRENT	Carry — 1 amp maximum Break — 1 amp maximum Make — .5 amp maximum	Carry — 1 amp maximum Break — 1 amp maximum Make — .5 amp. maximum
SWITCH TEMPERATURE — NOMINAL	5° increments starting at 0°C	5° increments starting at 0°C
TOLERANCE	±5°C	±5°C
RESET DIFFERENTIAL	10°C maximum	10°C maximum

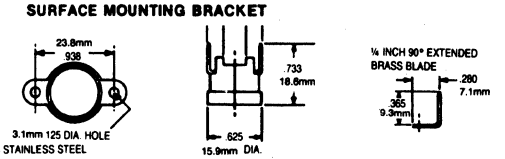


KEY TO ORDERING:
PMS (Temp. Switch) XXX (Temp. In °C) A or B (Form) XX (Lead Length in Inches)

SNAP-ACTION BI-METAL SWITCHES

The electrical switch of the SAS is operated by a thermally-responsive ½inch diameter bimetal disc. The switch is used as a temperature limiting or regulating thermostat. Because of its relatively small size and inexpensive design, it is suitable for a vast array of applications.

SURFACE MOUNTING BRACKET



Features

Impact Action: The bimetal disc of the SAS is factory calibrated at both its top and bottom temperatures. When the disc, which is dished like a saucer, reaches its calibrated temperature it suddenly snaps through and imparts its kinetic energy to the bumper, then to the contacts. The resulting high speed of contact separation insures long life at high electrical loads, and a minimum of radio and TV interference.

SPECIFICATIONS

CONTACT ARRANGEMENT	SPST Form A (NO) or Form B (NC)
CONTACT RATING—AC	Watts—2400 maximum AC Volt Amps—125 V.A. maximum AC
CONTACT RATING—DC	Volts Amps—30 V.A. maximum DC
VOLTAGE	Volts D.C.—120 VDC maximum Volts A.C.—240 VAC maximum
CURRENT—RESISTIVE LOAD	Carry—10 amp maximum AC Carry—.25 amp maximum DC
OPEN TEMPERATURE—NOMINAL	5° increments starting at 0°C
TOLERANCE	±5°C
RESET DIFFERENTIAL	25° maximum

KEY TO ORDERING:
SAS (Temp Switch) *XXX* (Temp in °C) *A* (Form)
EXAMPLE: SAS 50A

MIDWEST COMPONENTS INC.
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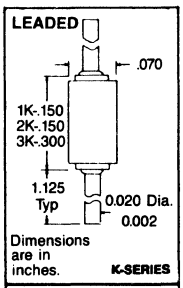
Muskegon, MI 49443 / (616) 777-2602 / TWX 510-394-4130

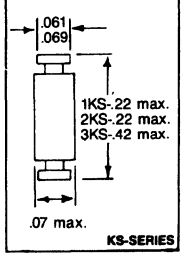
TEMPSISTOR

TEMPSISTOR* TEMPERATURE COMPENSATOR*

MANUFACTURED BY MIDWEST COMPONENTS, INC.



SMS™ - SURFACE MOUNT SENSOR



The Tempsistor® manufactured by MIDWEST COMPONENTS INC. is a temperature compensator designed to offset the temperature drift of metallic and semi-conductors. Applications include pressure transducers, opto amplifiers, inductive motor controllers, and automatic gain controls. Small size can replace ⅛ watt or resistors.

The Tempsistor® is available in resistances from 10 to 12K ohms at 25°C.

Both devices are available on tape and reel for automated assembly.

TEMPSISTOR® SPECIFICATIONS

Resistance Ratio Temperature Characteristics					
Temp.		R / R Multiplier			
		RESISTANCE VALUE (Ohms)			
°C	°F	10-56 Ω	68-820 Ω	1-2.7K Ω	3.3-39K Ω
-25	-13	.73	.65	.65	.61
0	32	.86	.82	.81	.83
25	77	1.00	1.00	1.00	1.00
50	122	1.15	1.21	1.19	1.19
75	167	1.32	1.44	1.39	1.37
100	212	1.49	1.68	1.58	1.52
125	257	1.68	1.94	1.75	
150	302	1.89	2.21		

DISSIPATION CONSTANT - Style 1K and 2K = 2.5 MW/°C Style 3K = 5 MW/°C

TIME CONSTANT - Style 1K and 2K = 8 sec. in still air, 1 sec in rapidly stirred oil. Style 3K = 19 sec. in still air, 2.2 sec. in rapidly stirred oil.

STANDARD ZERO-POWER RESISTANCE VALUES (Ohms) at 25°C AMBIENT TEMPERATURE

10	11	12	13	15	16	18	20	22	24	27	30
100	110	120	130	150	160	180	200	220	240	270	300
1000	1100	1200	1300	1500	1600	1800	2000	2200	2400	2700	3000
10000	11000	12000									
33	36	39	43	47	51	56	62	68	75	82	91
330	360	390	430	470	510	560	620	680	750	820	910
3300	3600	3900	4300	4700	5100	5600	6200	6800	7500	8200	9100

PART NUMBER DESIGNATION: XXX—XXX—X

LEADED DEVICE

SPECIFY ONE OF THREE CHOICES FOR FIRST 2 DIGITS

1K — Resistance range 10-820 Operate Temp. 150°C
2K — Resistance range 1K-3.0 K Operate Temp. 125°C
3K — Resistance range 3.3K-12K Operate Temp. 100°C

SMS™ - SURFACE MOUNT SENSOR

SPECIFY ONE OF THREE CHOICES FOR FIRST 3 DIGITS

1KS — Resistance range 10-820 Operate Temp. 150°C
2KS — Resistance range 1K-3.0K Operate Temp. 125°C
3KS — Resistance range 3.3K-12K Operate Temp. 100°C

NEXT 3 DIGITS DENOTE RESISTANCE VALUE AT 25°C.

1st digit denotes 1st significant figure
2nd digit denotes 2nd significant figure
3rd digit denotes multiplier by the power of 10

LAST DIGIT OF PART NUMBER DENOTES TOLERANCE AT 25°C.

L — ±20% K — ±10% (standard) J — ±5%

EXAMPLE OF PART NUMBER SPECIFICATION (FOR LEADED DEVICE)

2K — 272 — K

Part would be a .150" long body, 2.7 K ±10% @25°C.

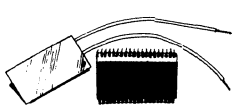
SPECIALTY CERAMICS

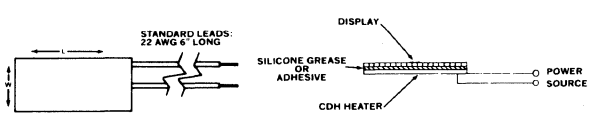
MANUFACTURED BY MIDWEST COMPONENTS INC

SELF REGULATING DISPLAY HEATER

The unique self-regulating heating effects of specially doped ceramics are utilized to create a new type heater for liquid crystal or other temperature sensitive displays. These devices produce heat at cold temperatures and curtail heating at normal or high temperatures. This feature allows its use in battery operated instruments due to low normal current drain. Use of this heater allows a broader application of displays by removing the adverse effects of temperature.

Heater is attached to reverse side of display with thermally conductive epoxies or silicone adhesives depending upon display's thermal coefficient of expansion or temperature to which it may be subjected. Actual performance of the display will depend upon manufacturers specifications.





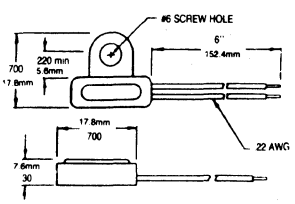
ORDER NUMBER	SIZE* L X W	OPERATING VOLTAGE**	NOMINAL RESISTANCES R@ - 35°C	R@ 50°C
CDH001	2.0" x .9"	12-28 AC or DC	5 OHMS	1500 OHMS MIN.
CDH002	3.1" x 1.1"	12-28 AC or DC	3 OHMS	1000 OHMS MIN.
CDH003	3.6" x 1.1"	12-28 AC or DC	2.5 OHMS	750 OHMS MIN.

*Other sizes available — consult factory

POSITIVE OVER TEMPERATURE PROTECTORS

MIDWEST COMPONENTS' Over Temperature Protector provides shutoff or regulation of expensive RF or AF Power Transistors. Protects against over heating that occurs from output stage component failure, antenna breakage, or short conditions.

Unlike fuses or bi-metal elements its action is recyclable and has no hysteresis effect.

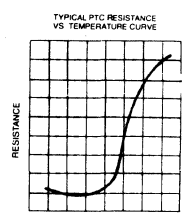


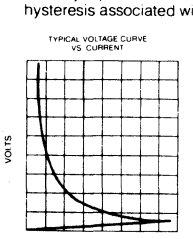
PTC SWITCHING THERMISTORS

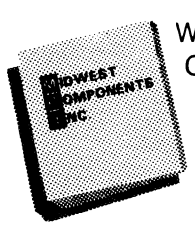
MANUFACTURED BY MIDWEST COMPONENTS, INC.

THE POSITIVE WAY TO SENSE, MEASURE, CONTROL, REGULATE AND PROTECT.

MIDWEST COMPONENTS INC. PTC **switching thermistors** are thermally sensitive resistors which exhibit large positive increases in resistance with temperature. At customer specified temperatures the resistance rises abruptly from a low value to a high value. This resistance shift is infinitely repeatable and has no hysteresis associated with its action.







Write for your FREE PRODUCT CATALOG or for immediate answers, call one of our application engineering specialists at 616-777-2602.

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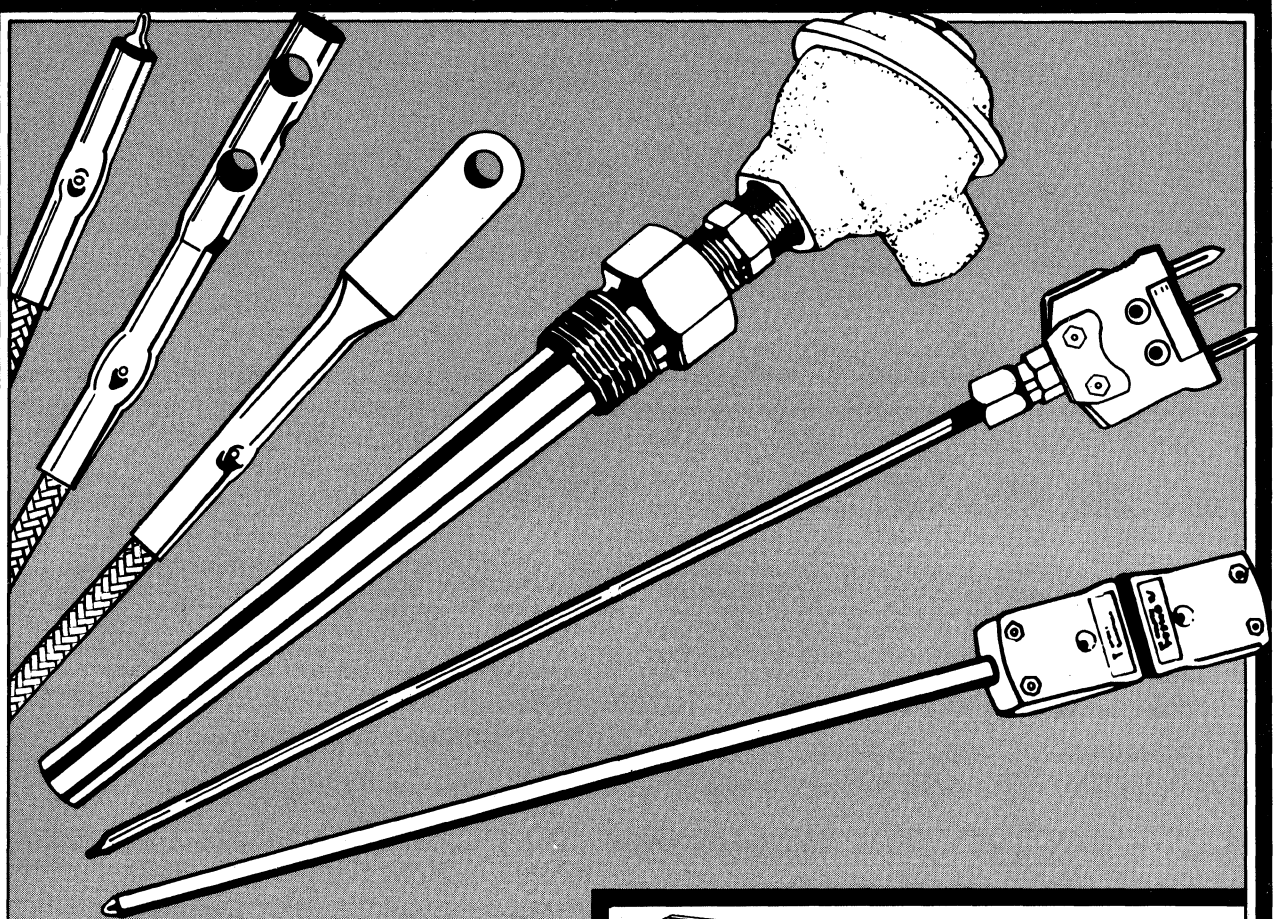
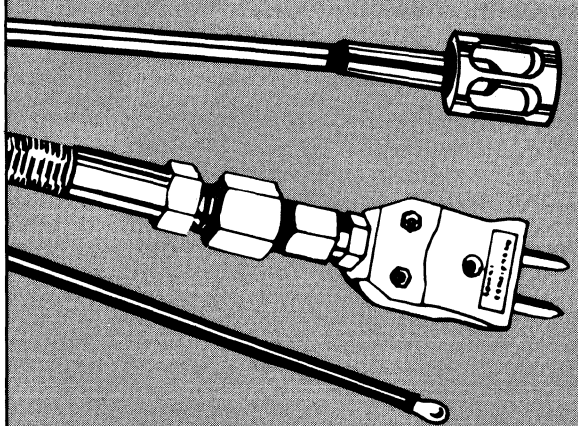
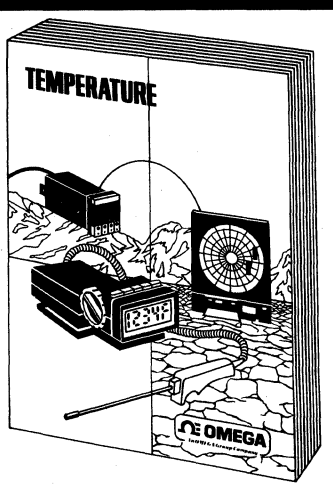
THERMOCOUPLE, RTD, THERMISTOR PROBES







TEMPERATURE MEASUREMENT HANDBOOK AND ENCYCLOPEDIA™

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- Over 15,000 Products

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1-800-TC-OMEGA

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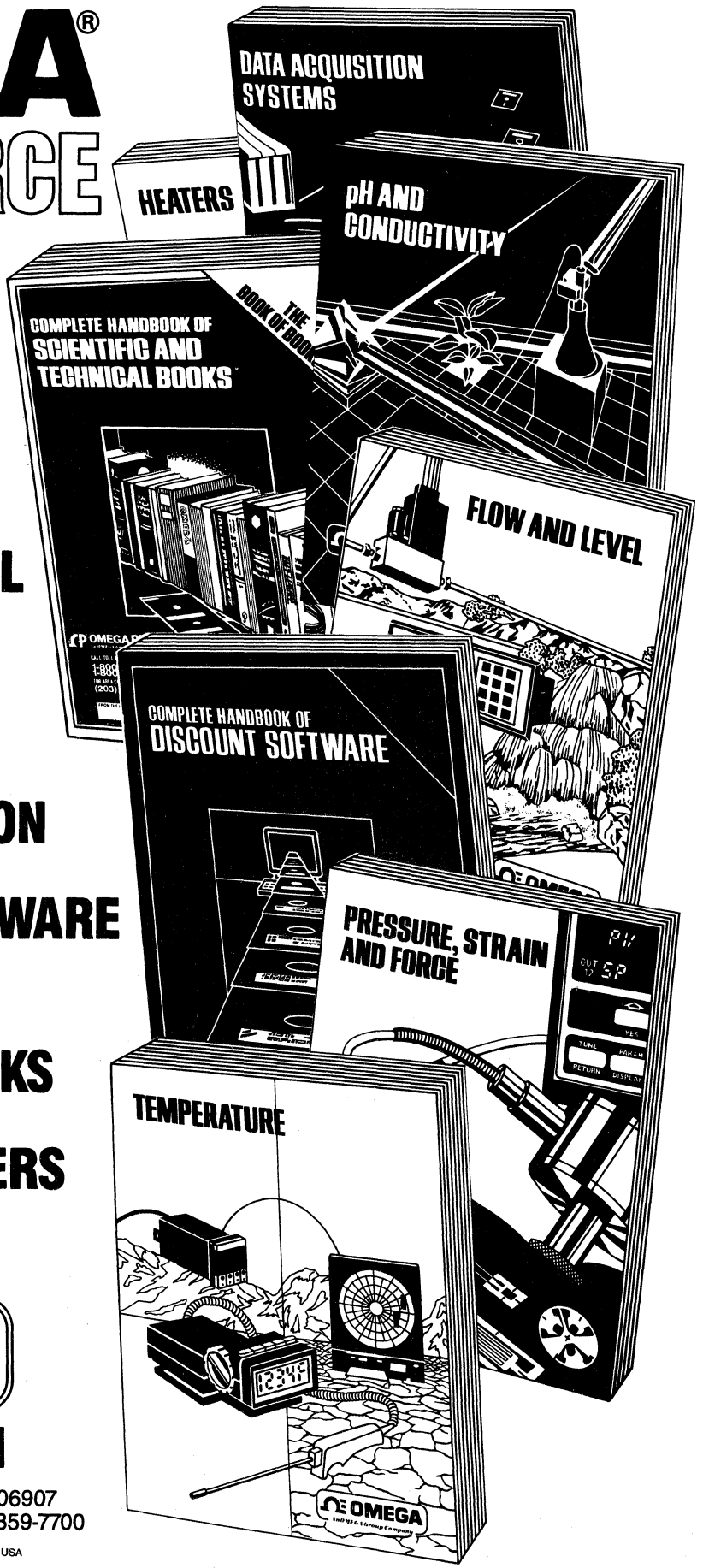

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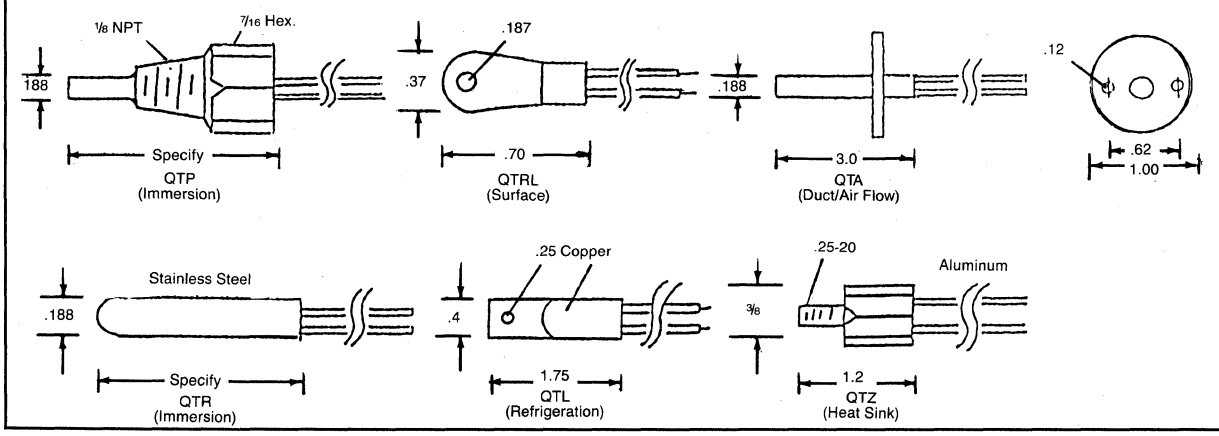
QUALITY THERMISTOR, INC.

2147 CENTURION PLACE/BOISE, ID 83709/PHONE (208) 377-3373 FAX (208) 376-4754

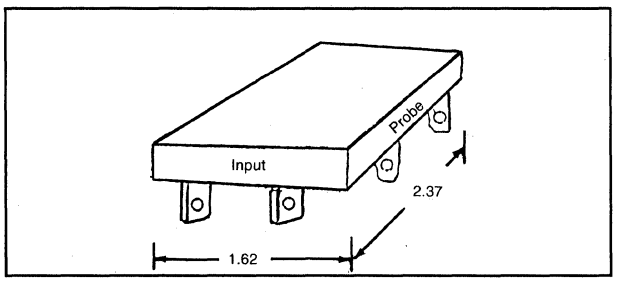
TEMPERATURE SPECIALTY PRODUCTS & SERVICES

THERMISTOR PROBE ASSEMBLIES



THERMISTOR DIRECT CURRENT MUFFIN FAN CONTROLLER "DC-100"

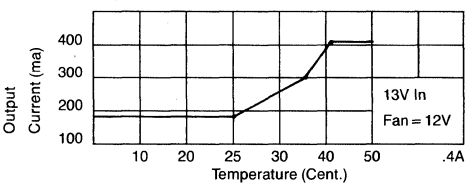
Designed for speed control of D.C. muffin fans, the versatile DC-100 can be used in any application where a biased output voltage is required as a function of temperature.



SPECIFICATIONS
Electrical Characteristics at 25C.

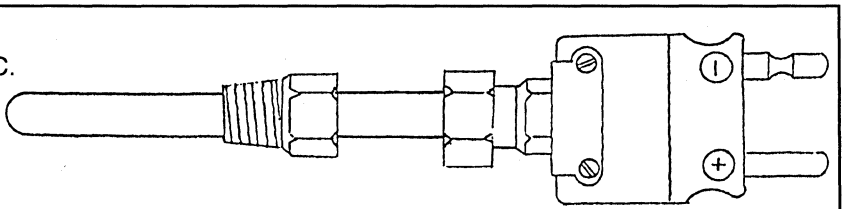
Parameter	Min.	Max.
Input Voltage	—	18V
Output Voltage	—	17V
Output Current	—	2A
Output Power	—	10W
Operating Temp.	0C	70C

Current vs. Temperature



THERMOCOUPLES:
NORTHWEST THERMOCOUPLE, INC.

2161 Centurion Place
Boise ID 83709
Phone (208) 376-0842
Fax (208) 376-4754



Elements: All Industry Standard ANSI Calibrations Available

Type	Max. Temp.	Error	Wire Gauges (AWG)
J	1400 F	+/– 4 F	#16 to #30
K	2300 F	+/– 4 F	#16 to #30
T	700 F	+/– 4 F	#16 to #30
E	1600 F	+/– 3 F	#16 to #30
R	3000 F	+/– 5 F	#16 to #30
S	3000 F	+/– 5 F	#16 to #30

SEE OUR PAGES IN SECTION 4800

QUALITY THERMISTOR, INC.

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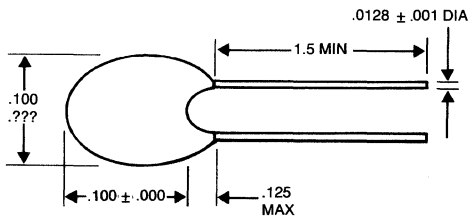
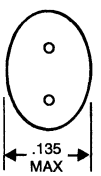
LOOK WHAT'S NEW ON THE MILITARY QUALIFIED PRODUCTS LIST

NTC THERMISTORS QUALIFIED TO MIL-T-23648/20
STYLE RTH44



INCHES	mm
.001	0.33
.0126	0.032
.030	0.76
.100	2.54
.125	3.18
.135	3.43

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.



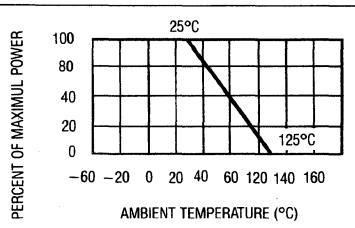


FIGURE 2: Durating curve for high ambient temperatures.

Ratio 19.8(A)	Ratio 29.4(B)	Ratio 48.7(C)
Ohms	Ohms	Ohms
200 minimum	100 minimum	15K minimum
3K maximum	ICK maximum	500K maximum

TABLE II. Minimum and maximum resistance values (at 25°C) for each available resistance ratio.

Temperature (°C)	Ratio 19.8(A)	Ratio 29.4(B)	Ratio 48.7(C)
−55	54.7800	100	—
−15	9.7770	7.38	8.80
0	2.8480	3.27	3.55
25	1.0000	1.00	1.00
50	.4045	.300	3.20
75	.1841	.145	.116
100	.0023	.0675	.047
125	.0504	.0340	0.05

TABLE III. Resistance temperature characteristic factors.

Electrical Parameters:

Thermal time constant. The thermal time constant shall be 25 seconds maximum.

Dissipation constant. The dissipation constant shall be 2 milliwatts per °C minimum.

Power rating. Ther thermistor shall be capable of dissipating a maximum of .20 watt at 25°C. Thermistors shall be derated in accordance with figure 2.

Resistance at 25°C. Zero-power resistance values at 25°C. Minimum and maximum resistance values for each available resistance ratio shall be in accordance with table II.

ORDERING INFORMATION

RTH44 A S 15 2 F (1500 OHMS, 1%)

- RTH44 — Style
- A — Ratio Per Table II
- S — S = Solderable Leads, W = Weldable Leads
- 15 — First Two Resistance Digits
- 2 — Number of Zeros
- F — Tolerance

F = 1%	
G = 2%	
J = 5%	
K = 10%	

SEE OUR PAGES IN SECTION 4800

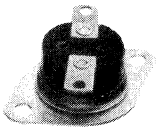
THERMAL CONDUCTIVITY OF DIELECTRICS AT ROOM TEMPERATURE

Material	Thermal Conductivity, J/ (m.K)
Diamond	658
BeO	167
Graphite	117-200
Bonded SiC	42
MgO	42
Al_2O_3	33
TiC	33
BN	28
Mullite	6.3
Titania	3.3-4.2
Porcelain	1.7
Fused silica glass	1.5
Soda-lime glass	0.8
Cast epoxies	0.17-1.3
Wood	0.5-2.5
Melamines	0.3-0.7
Mica	0.3-0.7
Phenolics (molded)	0.17-0.67
Polyethylenes	0.33
Nylons	0.17-0.25
TFE fluorocarbons	0.25
Elastomers	0.08-0.17
Foams	0.003-0.04

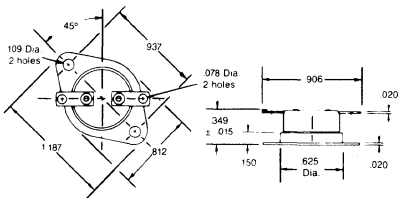
Selco Products Co.
7580 Stage Road • Buena Park, CA 90621
Tel. (213) 921-0681 • (714) 521-8673 • TELEX 655457 • 1-800-25-SELCO • FAX 714-739-1507

STOCK ½" DISC THERMOSTATS

SC/SO



These compact thermostats are the industry standard. As with all of our snap-action thermostats, a C in the part number means the circuit will close when the temperature rises and an O in the part number means the circuit will open when the temperature rises. Snap-action means reliability. A high-force bimetallic disc inside these thermostats keeps the circuit the way you want it. The thermostats respond instantly to temperature change—not shock, vibration or anything else.

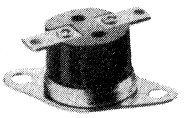


ELECTRICAL
120 VAC, 8 Amps, Resistive
100,000 Cycles
1/16" clearance through air and over surface

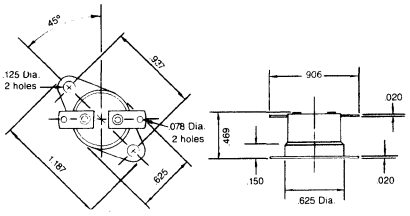
TEMPERATURE RANGE
60 Degrees F. to 325 Degrees F.

APPROVALS
UL File no. E36103, Guide XAPX2
CSA File No. 21048, Guide 400-E-0

SC-A/SO-A



Designed for applications requiring a higher electrical rating, our newest thermostats have the same dimensions as SC and SO thermostats, except they are .12" taller, the mounting holes are .016" larger and the bracket is .187" narrower. The slightly taller thermostat puts more space between the terminals and the base, giving the A model its higher electrical rating and all International Specification Approvals.



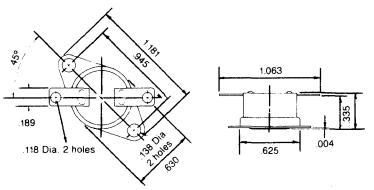
ELECTRICAL
120 VAC, 15 Amps, Resistive
240 VAC, 8.3 Amps, Resistive
100,000 Cycles
¼" clearance through air and over surface

TEMPERATURE RANGE
60 Degrees F. to 500 Degrees F.

APPROVALS
UL File No. MH8267, Guide MBPR2
CSA File No. 21048, Guide 400-E-0
Also has VDE and all other International Approvals

CA/OA

A breakthrough in price and technology, these thermostats perform under a wide range of operating conditions. One-piece contact construction makes the CA and OA models the most reliable in the industry. They are about the same size as the SC and SO models and are manufactured in a high-tech clean room in Japan. In fact, the CA and OA might just set a new industry standard.



ELECTRICAL
125 VAC, 10 Amp, Resistive
30,000 Cycles
1/16" clearance through air and over surface

TEMPERATURE RANGE
100 Degrees F. to 284 Degrees F.

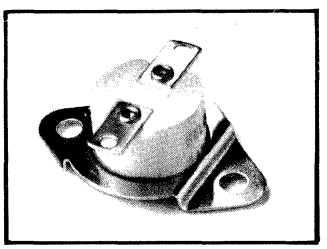
APPROVALS
UL File No. E52529 (S) Guide XAPX2
CSA Applied for.

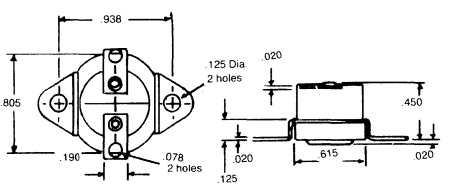
MODELS AVAILABLE FROM STOCK

SC AND SO	SC-A AND SO-A	CA AND OA	SET POINT	ACTION AT SET POINT	DIFFERENTIAL
SO-35(1)	–	–	35F. ± 5F.	open	15F.
SO-60(2)	SO-60-A(2)	–	60F. ± 5F.	open	20F.
SO-60-PCB(3)	SO-60-A-PCB(3)	–	60F. ± 5F.	open	20F.
–	SC-60-A	–	60F. ± 7F.	closes	20F.
SO-85	–	–	85F. ± 5F.	open	15F.
	SC-85-A	–	85F. ± 7F.	closes	15F.
SO-100	SO-100-A	–	100F. ± 5F.	open	30F.
SC-100	SC-100-A	–	100F. ± 7F.	closes	30F.
SO-110	–	OA-110	110F. ± 5F.	open	30F.
–	SC-110-A	–	110F. ± 7F.	closes	30F.
–	SC-110-A-PCB (3)	–	110F. ± 7F.	closes	30F.
SO-120	SO-120-A	–	120F. ± 5F.	open	30F.
SC-120	SC-120-A	CA-120	120F. ± 7F.	closes	30F.
–	SO-130-A	–	130F. ± 5F.	open	30F.
SO-140	SO-140-A	OA-140	140F. ± 5F.	open	30F.
–	SO-140-QC(4)	–	140F. ± 5F.	open	25F.
SC-140	SC-140-A	CA-140	140F. ± 7F.	closes	30F.
SC-140-RVT(5)	–	–	140F. ± 7F.	closes	20F.
SO-150	SO-150-A	OA-150	150F. ± 5F.	open	30F.
SO-150-WOB(6)	–	–	150F. ± 5F.	open	25F.
–	SO-150-AM	–	150F. ± 8F.	open	manual-reset
SO-150-QC(7)	–	–	150F. ± 5F.	open	30F.
SO-160	SO-160-A	OA-160	160F. ± 5F.	open	30F.
SC-160	SC-160-A	–	160F. ± 7F.	closes	30F.
SO-170	SO-170-A	OA-170	170F. ± 5F.	open	30F.
SC-170	SC-170-A	CA-170-QC(4)	170F. ± 7F.	closes	30F.
SO-175	SO-175-A	OA-175	175F. ± 5F.	open	15F.
SO-175-QC(7)	–	–	175F. ± 5F.	open	30F.
SO-175-ST(8)	–	–	175F. ± 5F.	open	30F.
SO-180	SO-180-A	OA-180	180F. ± 5F.	open	30F.
SO-180-QC(9)	–	–	180F. ± 5F.	open	30F.
SC-180	SC-180-A	CA-180	180F. ± 7F.	closes	30F.
SO-190	SO-190-A	OA-190	190F. ± 5F.	open	30F.
SO-190-TPZ(10)	–	–	190F. ± 6F.	open	30F.
SO-194-QC(4)	–	–	194F. ± 5F.	open	41F.
–	–	OA-190-QC(4)	190F. ± 5F.	open	18F.
–	–	CA-190-QC(4)	190F. ± 7F.	closes	18F.
–	–	OA-194M	194F. ± 7F.	open	manual-reset
–	–	CA-194-QC(11)	194F. ± 7F.	closes	30F.
–	S0-195-AM	–	195F. ± 8F.	open	manual-reset
–	SO-200-A	–	200F. ± 5F.	open	30F.
SC-200	SC-200-A	CA-200	200F. ± 7F.	closes	30F.
–	–	CA-205	205F. ± 8F.	closes	30F.
SO-210	SO-210-A	OA-210	210F. ± 6F.	open	30F.
SO-220	–	OA-220	220F. ± 6F.	open	30F.
SC-225	SC-225-A	CA-225	225F. ± 8F.	closes	30F.
SO-230	SO-230-AQC(4)	OA-230	230F. ± 6F.	open	30F.
SC-240	–	CA-240	240F. ±10F.	closes	100F.
SO-250	SO-250-A	OA-250	250F. ± 7F.	open	30F.
–	SO-250-AM	OA-250M	250F. ±10F.	open	manual-reset
SC-270	–	–	270F. ± 7F.	closes	30F.
–	SO-280-A	–	280F. ± 7F.	open	30F.
–	SO-300-A	–	300F. ± 7F.	open	30F.
–	SO-315-AQC(7)	–	315F. ± 7F.	open	25F.
SO-325	SO-325-A	–	325F. ± 7F.	open	50F.
–	SO-350-A	-	350F. ±10F.	open	60F.

HIGH TEMPERATURE CERAMIC CONSTRUCTION THERMOSTATS
MODELS AVAILABLE FROM STOCK

SC-A AND SO-A	SET POINT	ACTION AT SET POINT	DIFFERENTIAL
SC-105-AC	105F. ± 7F.	close	15F.
SO-400-AC	400F. ±25F.	open	100F.
SO-450-AC	450F. ±25F.	open	100F.
SO-500-AC	500F. ±25F.	open	100F.





Electrical Specifications
Contact type: SPST
Contact ratings:
5 amperes at 120 Volts AC
10 amperes at 240 Volts AC
Electrical Cycles: 100,000

(1.) Has .250 turned up quick connects, no bracket.
(2.) Freeze point thermostat – closes before 32F. on drop.
(3.) Printed circuit board mount.
(4.) Has .250 turned up quick connects 90° to mounting hole centerline.
(5.) Vertical solder terminals.
(6.) Has no bracket.
(7.) Has .250 turned up quick connects 45° to mounting hole centerline.
(8.) Has .250 turned up quick connects – 6-32" stud, ¼" length.
(9.) Has 3/16" horiz. quick connects – 45° to mounting hole centerline.
(10.) Has .250 turned up quick connects in line with mounting holes, open slot on one mounting hole.
(11.) Has 3/16" turned up quick connects 90° to mounting hole centerline.

Sensor Scientific, inc.

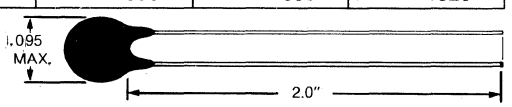
NTC THERMISTORS

INTERCHANGEABLE WAFER THERMISTORS 0-70°C

Resistance vs. Temperature Conversion Chart

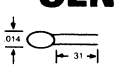
TEMP °	MATERIAL C OHMS				MATERIAL D OHMS		
	2,252	3,000	5,000	10,000	30,000	50,000	100,000
-50	151424	201720	336200	672400			
-40	75982	101220	168700	337400	1204500	2007500	4015000
-30	39928	53190	88650	177300	618900	1031500	2063000
-20	21883	29151	48585	97170	330900	551500	1103000
-10	12474	16617	27695	55390	183510	305850	611700
0	7357	9801	16335	32670	105300	175500	351000
10	4481	5970	9950	19900	62310	103850	207700
20	2813	3747	6245	12490	38010	63350	126700
25	2252	3000	5000	10000	30000	50000	100000
30	1814	2417	4029	8057	23826	39710	79420
40	1200	1598	2664	5327	15309	25515	51030
50	812	1081	1802	3604	10077	16795	33590
60	560	746	1243	2486	6777	11295	22590
70	394	525	875	1749	4647	7745	15490
80	282	376	627	1253	3243	5405	10810
90	206	274	457	913	2307	3845	7690
100	153	203	339	677	1665	2775	5550
110	115	153	255	509	1221	2035	4070
125	77	102	170	340	786	1310	2620
130	68	90	150	300	678	1130	2260
140	53	70	117	234	513	855	1710
150	42	56	93	185	396	660	1320

Sensor Scientific has developed a low cost interchangeable wafer thermistor product line. These highly reliable units provide a resistance temperature curve that can be matched within ±.2°C over a range of 0° to 70°C. This means that a matched replacement thermistor can be purchased several years from now with the identical R/T curve as the original thermistor.

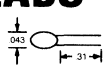


EPOXY COATED

SENSORBEADS



S14 GLASS BEAD

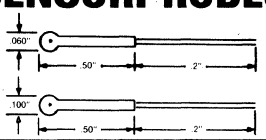


S43 GLASS BEAD

PART #	R @ 25°C	DIA	25/125°C
S14A102	1,000	.014	13.7
S14A502	5,000	.014	15.1
S14A103	10,000	.014	19.6
S14A104	100,000	.014	30.2
S14A105	1,000,000	.014	39.8
S43A102	1,000	0.43	18.6
S43A502	5,000	0.43	20.7
S43A103	10,000	0.43	27.8
S43A104	100,000	0.43	34.1
S43A105	1,000,000	0.43	51.6

These are typical units. Resistance values are available at 25°C from 100 ohms to 5 meg ohms.

SENSORPROBES



PART #	R @ 25°C	DIA	25/125°C
SP60A	1,000	.060	18.6
SP60A	10,000	.060	27.8
SP60A	100,000	.060	34.1
SP100A	1,000	.100	18.6
SP100A	5,000	.100	20.7
SP100A	10,000	.100	27.8
SP100A	100,000	.100	34.1
SP100A	1,000,000	.100	51.6

These are typical units. Resistance values are available at 25°C from 100 ohms to 5 meg ohms. Glass encapsulations are available from 1/8" to 1" in length.

CUSTOM ASSEMBLIES

Sensor Scientific recognizes the growing demand of diversified mounting and assembly requirements. Our engineers are responsive to your design criteria and will work with you to fulfill your application needs.

GENERAL APPLICATIONS

- Air temperature sensing
- Medical probes
- Corrosive solution testing
- Surface temperature probes
- Pipe and plug fitting probes
- Gas temperature measurements
- Armored cable assemblies

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CALL TOLL FREE 800-524-1610

Sensor Scientific, inc.

NTC THERMISTORS

TEMPERATURE ASSEMBLIES

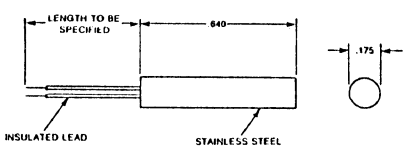
Sensor Scientific manufactures many different types of thermistor assemblies. The housing drawings in this section are offered as a guide to assist the engineer in designing a complete thermistor assembly that meets his project needs best.

The housing material specified in most of the drawings is stainless steel. If the requirements are such that other material would be preferable, brass and aluminum are also available.

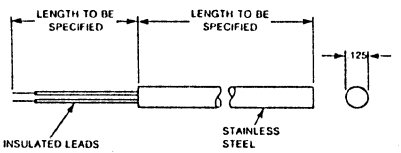
The basic element in these assemblies is the thermistor. Sensor Scientific manufactures a complete line of thermistors. The glass bead probe thermistor and the wafer or thermistor are units that are typically used in these assemblies.

Sensor Scientific has trained application engineers who will assist you in the design and selection of the thermistor assembly that meets your needs best. Our probes have been designed to maximize sensitivity and stability. They are also constructed to minimize the risk of damage due to operation and handling.

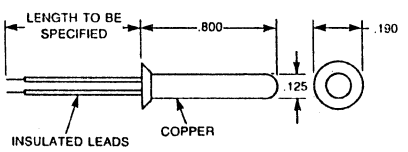
All assembly work is performed by carefully trained and supervised individuals. All units are extensively tested throughout the manufacturing process to insure that customers receive the highest quality thermistor assemblies.



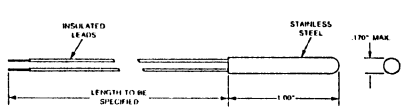
Series 100



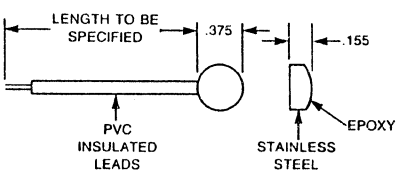
Series 110



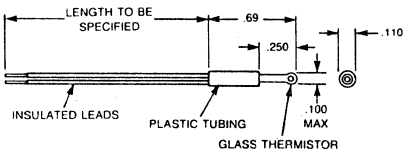
Series 200



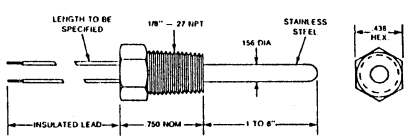
Series 210



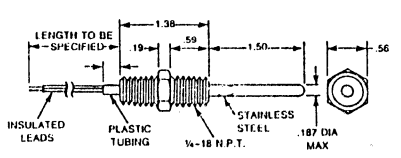
Series 300



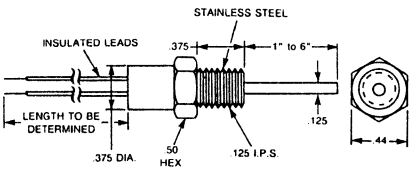
Series 400



Series 500



Series 501



Series 510

The quality control at Sensor Scientific is qualified to Mil-Q-9858A. All units are tested in carefully calibrated sensitive temperature control baths and all calibrations are traceable to the National Bureau of Standards.

Sensor Scientific, inc.

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- Argos
- Atlas
- Bogen
- Quam
- Shure
- Switchcraft
- University

BATTERIES
- Duracell
- Eveready
- Kodak

CABINETS
- BUD
- Calif. Chassis

CAPACITORS
- R.G. Allen
- E.F. Johnson
- Mallory
- Sprague

CIRCUIT BREAKERS
- Heinemann
- Potter Brumfield
- Waber Electric

CONNECTORS
- AMP
- Amphenol
- Cablewave
- E.F. Johnson
- Kulka
- Manhattan
- Paladin
- Panduit
- Pomona
- Superior
- Switchcraft

COUNTERS
- Hecon
- Kessler-Ellis
- Redington
- Stemco

FIBER OPTICS
- AMP
- Amphenol
- Belden Cable
- Madison

FILTERS
- Curtis
- J.W. Miller
- Mallory
- Stancor

FUSES
- Bussmann
- Littelfuse
- U.S.D.

HARDWARE
- 3-M
- Alta Boots
- AMP
- Ico Rally
- E.F. Johnson
- G.C. Electronics
- Harvey Hubbell
- Kulka Smith
- OK Tools
- Panduit
- Vector

LAMPS & LIGHTING
- Eveready
- Chicago Minature
- IDI
- IEE
- Ledu
- Luxo
- Leecraft
- Mag-Lite
- Stanley

OUTLET STRIPS
- Waber

POT'S & CONTROLS
- Bourns
- Clarostat
- Ohmite

POWER SUPPLIES & TRANSFORMERS
- Dormeyer
- Microtran
- Sola
- Stancor
- Superior
- Triad
- Tripp-lite
- UTC
- Waber

RELAYS
- Aleph International
- Allied Controls
- American Zettler
- Aromat
- C.P. Clare
- Crydom
- Coto
- Gordos
- Guardian
- ITT
- Line Electric
- Magnecraft
- Master Electronics
- Midtex
- Omron
- Potter & Brumfield
- Sigma
- Struthers-Dunn
- Theta-J

RESISTORS & NETWORKS
- R.G. Allen
- Bourns
- Clarostat
- Mallory
- Ohmite

SEMICONDUCTORS
- Semi Inc.
- Semitronics

SWITCHES
- Arrow Hart
- AMP
- C & K
- Cherry Electric
- G.C.
- McGill
- Omron
- Oslo
- Otto
- Switchcraft
- Unimax

TERMINAL BLOCKS
- AMP
- Buchanan
- Curtis
- Electrovert
- Magnum
- RDI
- Siemen
- USD
- Vernitron-Beau
- Weidmuller

TEST EQUIPMENT
- Fluke
- Simpson Electric
- Triplett

TIMERS
- Agastat
- Amperite
- Industrial Timer
- Magnecraft
- Master Electronics
- Midtex
- Omron
- Potter & Brumfield
- SSAC

TOOLS & SOLDER
- AMP
- Blazer
- Ersin
- Kester
- OK Machine & Tool
- Paladin
- Portasol
- Ungar
- Weller
- Xcelite
- Helper Winch

TRANSFORMERS
- Dormeyer
- Jeffersons
- Microtran
- Sola
- Stancor
- Thordarson
- Triad
- U.T.C.

TUBES
- Eimac
- G.E.
- National
- Raytheon
- R.C.A.
- Varian (Klystrons)

TUBING
- Alpha
- Electrovert
- Heli-Tube
- Panduit

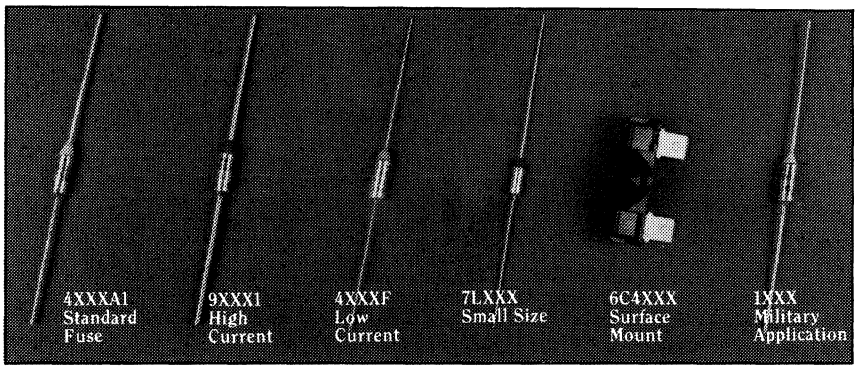
WIRE & CABLE
- Alpha
- Belden
- Cablewave
- Carol
- Iboco
- Madison
- Manhattan
- Quabbin

When your reputation's on the line
HEINEMANN ELECTRIC COMPANY

COTO CORPORATION

MICROTEMP® Thermal Cutoffs

MICROTEMP Thermal Cutoffs provide permanent over-temperature protection for motors, transformers, appliances, HVAC equipment and electronic equipment. Once a MICROTEMP Thermal Cutoff opens a circuit, it remains open until the fault is corrected and the fuse is replaced.



Thermal Cutoff Series Selection

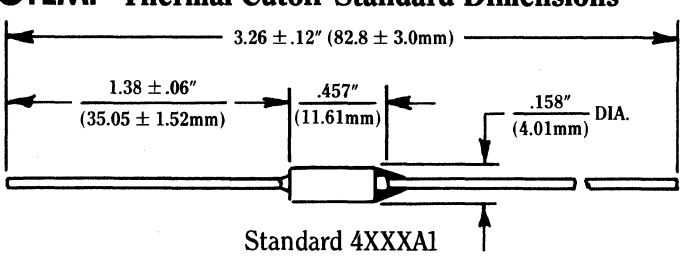
To determine which series is best for your application, remember:

- To consider the normal and abnormal electrical currents and voltages of your product.
- That the current passing through a MICROTEMP Thermal Cutoff can generate I^2R, self heating. This must be considered when selecting the proper series and opening temperature for your application.
- That the outer case of the MICROTEMP Thermal Cutoff is electrically live and may require insulation. Additionally, since insulation can reduce heat transfer, it also must be considered in selecting the final opening temperature.
- That custom configurations and packages are available.
- That a thermocoupled dummy should be installed in the product circuit to determine the correct temperature setting.

MICROTEMP® Thermal Cutoff Types

Type No.	Temp. (°C) Calibration Range	Wire Size AWG	Maximum Recommended Operating Current and Voltage (Resistive)
4XXXA1	60-240	18	15 Amp/240 VAC
9XXX1	60-240	15	25 Amp/240 VAC
4XXXF	60-240	23	5 Amp/240 VAC
7LXXX	72-184	23	6 Amp/240 VAC
6C4XXX	60-184	—	15 Amp/240 VAC
1XXX	60-240	18	15 Amp/240 VAC

MICROTEMP® Thermal Cutoff Standard Dimensions



Standard 4XXXA1

MICROTEMP® Thermal Cutoff Temperature Ratings

Reading the temperature chart.
All MICROTEMP Thermal Cutoffs are identified by their Type No. (4XXXA1, 9XXX1, etc.). The "XXX" digits are determined by the opening temperature you specify. For example: A 4136A1 is a MICROTEMP Thermal Cutoff with an opening temperature of 60°C.

Model # (XXX)	Max. Opening Temp. °C*
136	60
146	66
158	72
168	77
178	84
191	91
194	93
204	98
208	100
218	104
227	109
239	117
244	121
257	128
283	141
300	152
333	167
358	184
377	192
415	216
438	228
468	240

*Tolerance +0 -4°C

For further information on your specific design application, contact a Sales Engineer at our factory.

THERMODISC®
MICRO DEVICES PRODUCT GROUP

Thermo-O-Disc, Inc.
1320 South Main Street • Mansfield, Ohio 44907
Phone: (419) 525-8500 Telex: 987 455
Cable: TOD MFL FAX: (419) 525-8344
Therm-O-Disc, Inc. is a subsidiary of Emerson Electric Co.

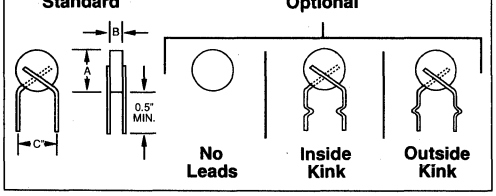
EMERSON®

Western Electronic Components Corp.

PTC SWITCHING THERMISTORS

Part Number	Base Resistance R_o @25°C (Ω) ±30%	Switch Temp. T_{SW} ±5°C (Curve)	Maximum Operating Voltage Vmax	Time Constant Tc (Sec)	Dissipation Constant Dc(mW/°C)	Reference Dimensions (In.) A	B	C	Lead Dia. (in.)
WP5504DA1R0N	1.0	120 (DA)	15	65	15	0.55	0.04	0.30	0.032
WP5004DA1R5N	1.5		20	55	14	0.50	0.04	0.30	0.032
WP5004DA2R0N	2.0		25	55	14	0.50	0.04	0.30	0.032
WP4504DA3R3N	3.3		25	45	11	0.45	0.04	0.30	0.025
WP4005DA5R0N	5.0		35	45	10	0.40	0.05	0.30	0.025
WP3005DA100N	10.0		50	35	8	0.30	0.05	0.25	0.020
WP3005DA200N	20.0		50	35	8	0.30	0.05	0.20	0.020
WP5010DA200N	20.0		132	85	16	0.50	0.10	0.30	0.032
WP2505DA250N	25.0		50	30	7	0.25	0.05	0.25	0.020
WP3006DA500N	50.0		50	35	8	0.30	0.06	0.25	0.020
WP4510DA500N	50.0		132	55	12	0.45	0.10	0.30	0.025
WP2506DA750N	75.0		50	30	7	0.25	0.06	0.20	0.020
WP2005DA101N	100.0		50	30	7	0.20	0.05	0.20	0.020
WP2008DA251N	250.0		150	30	6	0.20	0.08	0.20	0.020
WP2010DA501N	500.0		250	30	6	0.20	0.10	0.20	0.020
WP5004DB2R2N	2.2	110 (DB)	25	50	12	0.50	0.04	0.30	0.025
WP4504DB3R3N	3.3		25	45	11	0.45	0.04	0.30	0.025
WP4005DB5R0N	5.0		35	45	10	0.40	0.05	0.30	0.025
WP3505DB7R5N	7.5		50	40	9	0.35	0.05	0.25	0.020
WP3005DB100N	10.0		50	35	8	0.30	0.05	0.25	0.020
WP5010DB100N	10.0		132	75	15	0.50	0.10	0.30	0.025
WP3005DB200N	20.0		50	35	8	0.30	0.05	0.20	0.020
WP5010DB200N	20.0		132	85	16	0.50	0.10	0.30	0.032
WP3510DB350N	35.0		132	40	9	0.35	0.10	0.25	0.025
WP4510DB500N	50.0		132	55	12	0.45	0.10	0.30	0.025
WP2005DB101N	100.0		50	30	7	0.20	0.05	0.20	0.020
WP5010DB101N	100.0		265	75	15	0.50	0.10	0.30	0.025
WP2008DB251N	250.0		150	30	6	0.20	0.08	0.20	0.020
WP2010DB501N	500.0		250	30	6	0.20	0.10	0.20	0.020
WP2010DB152N	1500.0		350	30	6	0.20	0.10	0.20	0.020
WP4005DC5R0N	5.0	100 (DC)	35	45	10	0.40	0.05	0.30	0.025
WP3505DC7R5N	7.5		50	40	9	0.35	0.05	0.25	0.020
WP3005DC100N	10.0		50	35	8	0.30	0.05	0.25	0.020
WP5010DC100N	10.0		132	75	15	0.50	0.10	0.30	0.025
WP3005DC200N	20.0		50	35	8	0.30	0.05	0.20	0.020
WP5010DC200N	20.0		132	85	16	0.50	0.10	0.30	0.032
WP3006DC500N	5.0		50	35	8	0.30	0.06	0.25	0.020
WP4515DC500N	50.0		132	55	12	0.45	0.10	0.30	0.025
WP2005DC101N	100.0		50	30	7	0.20	0.05	0.20	0.020
WP3005DD200N	20.0	90 (DD)	50	35	8	0.30	0.05	0.20	0.020
WP3006DD500N	50.0		50	35	8	0.30	0.06	0.25	0.020
WP2005DD101N	100.0		50	30	7	0.20	0.05	0.20	0.020
WP3005DE200N	20.0	80 (DE)	50	35	8	0.30	0.05	0.20	0.020
WP5010DE200N	20.0		132	85	16	0.50	0.10	0.30	0.032
WP3006DE500N	50.0		50	35	8	0.30	0.06	0.25	0.020
WP4510DE500N	50.0		132	55	12	0.45	0.10	0.30	0.025
WP2005DE101N	100.0		50	30	7	0.20	0.05	0.20	0.020
WP3005DF200N	20.0	70 (DF)	50	35	8	0.30	0.05	0.20	0.020
WP3006DF500N	50.0		50	35	8	0.30	0.06	0.25	0.020
WP2005DF101N	100.0		50	30	7	0.20	0.05	0.20	0.020
WP3005DG200N	20.0	60 (DG)	50	35	8	0.030	0.05	0.20	0.020
WP5010DG200N	20.0		132	85	16	0.50	0.10	0.30	0.032
WP3006DG500N	50.0		50	35	8	0.30	0.06	0.25	0.020
WP4510DG500N	50.0		132	55	12	0.45	0.10	0.30	0.025
WP5510DG500N	50.0		265	90	16	0.55	0.10	0.30	0.032
WP2005DG101N	100.0		50	30	7	0.20	0.05	0.20	0.020
WP3005DH200N	20.0	50 (DH)	50	35	8	0.30	0.05	0.20	0.020
WP3006DH500N	50.0		50	35	8	0.30	0.06	0.25	0.020
WP2005DH101N	100.0		50	30	7	0.20	0.05	0.20	0.020

CONFIGURATIONS

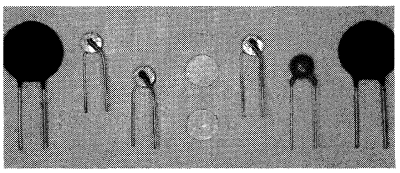


Options: If one of the modifications in Table 2 is required, add the dash number listed to the part number (see example). Other options are available including non-standard base resistance values and tolerances.

Modification	Dash No.
No Leads	-01
Inside Kink	-02
Outside Kink	-03
Epoxy Coating (150°C Max. Temp.)	-04
Silicone Coating (200°C Max. Temp.)	-05
Epoxy/Inside Kink	-06
Epoxy/Outside Kink	-07
Silicone/Inside Kink	-08
Silicone/Outside Kink	-09

Example: WP5004DB2R2N-06 (Standard part with epoxy coating and inside Kink leads)

Table 2



TYPICAL APPLICATIONS

- Self Regulating Heaters
- Single Phase Motor Starting
- Over Temperature Protection
- Air Flow/Liquid Level Sensing
- Time Delay
- Degaussing
- Arc Suppression
- Solid State Fusing

INTRODUCTION

Switching PTC (Positive Temperature Coefficient) Thermistors are thermally sensitive resistors. A PTC will exhibit an extremely rapid increase in resistance (several decades) when heated beyond its switching temperature (Tsw). Standard resistance Ratio-temperature curves are illustrated in Figure 1. Figure 2 illustrates a typical static voltage/current curve.

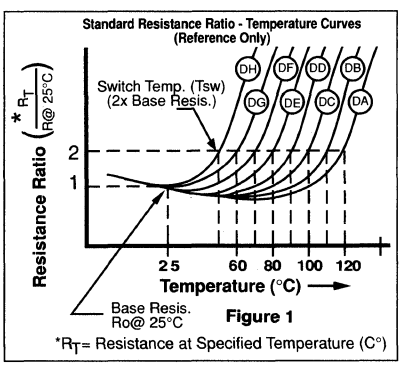


Figure 1

*R_T = Resistance at Specified Temperature (C°)

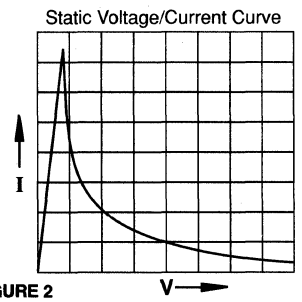


FIGURE 2

TERMINOLOGY

Base Resistance (Ro)
The resistance value of a thermistor at a specified temperature with negligible electrical power to avoid self heating. Usually base resistance will be defined at 25°C. See Fig. 1.

Switch Temperature (Tsw).
The temperature when the resistance of the PTC thermistor reached two (2) times the base resistance, sometimes referred to as curie point or transition temperature. See Fig. 1.

Maximum Operating Voltage (Vmax)
The maximum rated voltage the thermistor can continuously withstand 60 cycle AC or DC.

Dissipation Constant (Dc)
The amount of power through self-heating necessary to raise the thermistor body 1°C (units-Mw/°C)

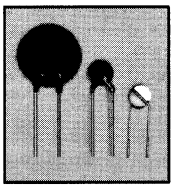
Time Constant
The time, in seconds, required for a thermistor dissipating negligible power to change 63% of the total difference between its initial and final body temperature when subjected to a change in temperature.

Western Electronic Components Corp. 1250-A Avenida Acaso, Camarillo, CA USA 93010-8729
(805) 482-8002•Fax (805) 482-8675•Telex-401076

Western Electronic Components Corp.

PTC OVER CURRENT PROTECTORS

Part Number	Ro@25°C (Ω) ±20%	Switch Temp. Tsw ±5°C	Maximum Continuous Current-Imcc (Amps.)		Minimum Switching Current-Imsc (Amps.)		Vmax	Max Current (Amps.)	D Max. Body Dia. (In.)	L Lead Dia. (In.)
			55°C	35°C	15°C	0°C				
WC8004DA0R8M	0.8		0.78	0.96	1.60	1.76	12	4	0.80	0.032
WC6004DA1R0M	1.0		0.60	0.75	1.30	1.43	15	3.5	0.60	0.032
WC8004DA0R3M	1.3		0.55	0.70	1.20	1.28	15	3.5	0.60	0.032
WC5504DA1R5M	1.5		0.50	0.60	1.05	1.12	20	3	0.55	0.032
WC4504DA3R3M	3.3	120	0.30	0.35	0.68	0.73	25	2	0.45	0.025
WC4004DA4R7M	4.7	(DA)	0.22	0.28	0.50	0.55	25	2	0.40	0.025
WC4004DA7R5M	7.5		0.17	0.22	0.42	0.48	50	1.5	0.40	0.020
WC4004DA100M	10.0		0.15	0.19	0.35	0.42	50	1.5	0.40	0.020
WC4004DA150M	15.0		0.12	0.15	0.30	0.35	50	1.5	0.40	0.020
WC3005DA200M	20.0		0.100	0.123	0.25	0.30	50	1.5	0.30	0.020
WC4006DA500M	50.0		0.065	0.080	0.15	0.18	50	0.8	0.40	0.025
WC3505DA101M	100.0		0.045	0.06	0.095	0.12	50	0.8	0.35	0.020
WC7510DB4R7M	4.7		0.28	0.35	0.65	0.70	132	2	0.75	0.032
WC6010DB6R8M	6.8		0.22	0.28	0.50	0.55	132	1	0.60	0.032
WC4505DB5R0M	5.0		0.20	0.25	0.47	0.52	25	2	0.45	0.025
WC6060DB100M	10.0		0.18	0.22	0.45	0.49	132	1	0.60	0.032
WC4004DB7R5M	7.5		0.15	0.20	0.40	0.45	50	1.5	0.40	0.020
WC6010DB150M	15.0		0.15	0.19	0.35	0.42	132	1	0.60	0.032
WC5510DB220M	22.0		0.110	0.15	0.30	0.35	132	0.8	0.55	0.032
WC3505DB250M	25.0	110	0.075	0.10	0.20	0.25	50	1.5	0.35	0.020
WC4008DB330M	33.0	(DB)	0.075	0.095	0.20	0.25	132	0.5	0.40	0.025
WC3507DB500M	50.0		0.055	0.070	0.14	0.17	132	0.5	0.35	0.020
WC3508DB750M	75.0		0.045	0.055	0.10	0.13	175	0.3	0.35	0.020
WC3507DB101M	100.0		0.035	0.050	0.090	0.110	132	0.3	0.35	0.020
WC3507DB151M	150.0		0.030	0.040	0.085	0.100	175	0.2	0.35	0.020
WC2508DB501M	500.0		0.015	0.020	0.040	0.050	250	0.3	0.25	0.020
WC2508DB102M	1000.0		0.010	0.015	0.030	0.035	300	0.2	0.25	0.020
WC6010DD100M	10.0	90	0.18	0.35	0.42	132	1	15	0.60	0.032
WC6010DD150M	15.0	(DD)	0.085	0.15	0.30	0.35	132	1	0.60	0.032



TYPICAL APPLICATIONS

- Transistor Protection
- Motor Protection
- Transformer Protection
- Telecommunication Line Protection

PTC Over Current Protectors are used in series to protect from over current conditions. The PTC will switch from its normal low resistance to a very high resistance state reducing the current flow to a safe level. Once this over current condition has been removed, the PTC will cool to its normal (low) resistance.

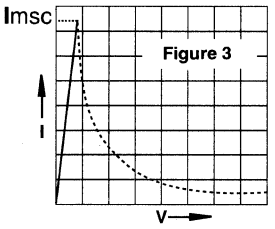
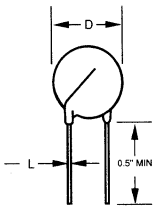


Figure 3 illustrates the Static Voltage/Current curve relationship



DEFINITIONS

Maximum Continuous Current (Imcc)
The maximum amount of current which a PTC Thermistor must be able to pass without switching into its ihgh resistance state. Expressed in Amps.

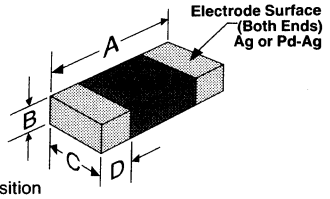
Minimum Switching Current (Imsc)
The minimum amuont of current necessary to switch the thermistor into its high resistance state. Expressed in Amps.

SURFACE MOUNT PTC CHIP THERMISTORS

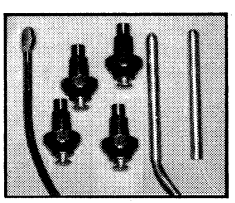
Applications
- Over Temp. Sensing.
- Self Regulating Heaters
- Temperature Compensation

Options
- Special dimensions
- Termination materials
- Special resistance values

Features
- Five sided terminations
- Solid State ceramic composition



Part Number	Ro@25°C (Ω) ±30%	Tsw ±5°C (Curve)	Reference Dimensions (Inches)			
			A	B	C	D
WS8055DA201N	200		0.100	0.055	0.080	0.02
WS8404DA301N	300		0.100	0.040	0.080	0.02
WS6540DA401N	400		0.100	0.040	0.065	0.02
WS6540DA501N	500		0.110	0.040	0.065	0.02
WS6535DA601N	600		0.110	0.035	0.065	0.02
WS6535DA801N	800	120	0.110	0.035	0.065	0.02
WS6035DA102N	1000	(DA)	0.110	0.035	0.060	0.02
WS6035DA202N	2000		0.110	0.035	0.060	0.02
WS6035DA302N	3000		0.110	0.035	0.060	0.02
WS6035DA502N	5000		0.110	0.035	0.060	0.02
WS6035DA103N	10000		0.110	0.035	0.060	0.02
WS6540DE501N	500		0.110	0.040	0.065	0.02
WS6535DE601N	600		0.110	0.035	0.065	0.02
WS6535DE801N	800		0.110	0.035	0.065	0.02
WS6035DE102N	1000	80	0.110	0.035	0.060	0.02
WS6035DE202N	2000	(DE)	0.110	0.035	0.060	0.02
WS6035DE302N	3000		0.110	0.035	0.060	0.02
WS6035DE502N	5000		0.110	0.035	0.060	0.02
WS6035DE103N	10000		0.110	0.035	0.060	0.02
	Ro@ – 40°C					
WS7540DJ102N	1000		0.100	0.040	0.75	0.02
WS7540DJ202N	2000	40	0.100	0.040	0.075	0.02
WS7540DJ302N	3000	(DJ)	0.100	0.040	0.075	0.02
WS6535DJ502N	5000		0.100	0.035	0.065	0.02
WS6535DJ103N	10000		0.100	0.035	0.065	0.02
WS7540DL102N	1000		0.100	0.040	0.075	0.02
WS7540DL202N	2000	20	0.100	0.040	0.075	0.02
WS6536DL502N	5000	(DL)	0.100	0.035	0.065	0.02
WS6535DL103N	10000		0.100	0.035	0.065	0.02
WS7540DN102N	1000		0.100	0.040	0.075	0.02
WS7540DN202N	2000	0	0.100	0.040	0.075	0.02
WS6535DN502N	5000	(DN)	0.100	0.035	0.065	0.02
WS6535DN103N	10000		0.100	0.035	0.065	0.02



PROBES/ASSEMBLIES

Many probes and assemblies are available for numerous applications.
Please contact **WECC** Applications Engineering with specific requirements.

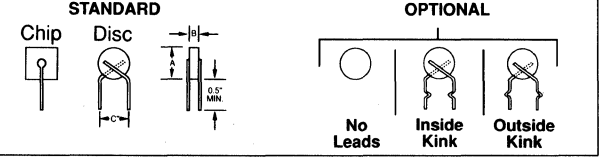
Western Electronic Components Corp. 1250-A Avenida Acaso, Camarillo, CA USA 93010-8729
(805) 482-8002•Fax (805) 482-8675•Telex-401076

NTC THERMISTORS

NTC (Negative Temperature Coefficient) Thermistors are thermally sensitive resistors which show a large (2 to 6%°C) decrease in resistance as temperature increases. Figure 1 illustrates the resistance ratio-temperature curves of four standard thermistor materials. These materials are manufactured using transition metal oxides that are formed into the desired shape and sintered at very high temperatures (≈ 1200°C).

Part Number	Base Resis. Ro@25°C (μ) ±10%	TCR@25°C (%/°C) (Curve)	Dissipation Constant Dc(mW/°C)	Time Constant Tc(Sec)	Body Type	Reference Dimensions (Inches) A	B	C	LEAD AWG#
WN5004D2R5K	2.50		14.00	60.00	DISC	0.500	0.040	0.30	22.00
WN3003D5R0K	5.00		8.00	35.00	DISC	0.300	0.030	0.20	24.00
WN3005D7R5K	7.50		8.00	42.00	DISC	0.300	0.045	0.20	24.00
WN2304D100K	10.00		7.00	22.00	DISC	0.225	0.035	0.20	24.00
WN2004D150K	15.00		7.00	20.00	DISC	0.200	0.040	0.2	24.00
WN2005D200K	20.00	3.3	7.00	25.00	DISC	0.200	0.050	0.20	24.00
WN2008D300K	30.00	(D)	7.00	25.00	DISC	0.200	0.080	0.20	24.00
WN1104D400K	40.00		2.50	4.00	CHIP	0.110	0.040	—	28.00
WN1004D500K	50.00		2.50	4.00	CHIP	1.100	0.040	—	28.00
WN0704D101K	100.00		2.00	4.00	CHIP	0.070	0.040	—	28.00
WN0504D201K	200.00		2.00	3.00	CHIP	0.50	0.030	—	28.00
WN0407D501K	500.00		2.00	2.00	CHIP	0.040	0.070	—	28.00
WN5004A250K	25.00		14.00	60.00	DISC	0.500	0.040	0.30	22.00
WN3003A500K	50.00		8.00	48.00	DISC	0.350	0.040	0.20	24.00
WN3005A750K	75.00		8.00	42.00	DISC	0.300	0.045	0.20	24.00
WN2304A101K	100.00		7.00	22.00	DISC	0.225	0.035	0.20	24.00
WN2005A201K	200.00	-3.9	7.00	25.00	DISC	0.200	0.055	0.20	24.00
WN2008A301K	300.00	(A)	7.00	25.00	DISC	0.200	0.080	0.20	24.00
WN1004A501K	500.00		2.50	4.00	CHIP	0.100	0.040	—	28.00
WN0804A801K	800.00		2.00	4.00	CHIP	0.080	0.045	—	28.00
WN0704A102K	1000.00		2.00	4.00	CHIP	0.070	0.040	—	28.00
WN0504A202K	2000.00		2.00	3.00	CHIP	0.050	0.040	—	28.00
WN0406A402K	4000.00		2.00	2.00	CHIP	0.040	0.055	—	28.00
WN0407A502K	5000.00		2.00	2.00	CHIP	0.040	0.070	—	28.00
WN5005B201K	200.00		14.00	60.00	DISC	0.500	0.050	0.30	22.00
WN3004B501K	500.00		8.00	35.00	DISC	0.300	0.040	0.20	24.00
WN2701B751K	750.00		8.00	33.00	DISC	0.270	0.050	0.20	24.00
WN2004B102K	1000.00	-4.4	7.00	22.00	DISC	0.200	0.040	0.20	24.00
WN1204B202K	2000.00	(B)	3.00	6.00	CHIP	0.120	0.035	—	28.00
WN0804B502K	5000.00		3.00	5.00	CHIP	0.080	0.040	—	28.00
WN0704B802K	8000.00		2.00	3.00	CHIP	0.065	0.040	—	30.00
WN0605B103K	10000.00		2.00	3.00	CHIP	0.060	0.045	—	30.00
WN0607B203K	20000.00		2.00	4.00	CHIP	0.055	0.070	—	30.00
WN5005C202K	2000.00		14.00	60.00	DISC	0.500	0.050	0.30	22.00
WN3004C502K	5000.00		8.00	35.00	DISC	0.300	0.040	0.20	24.00
WN2705C752K	7500.00		8.00	33.00	DISC	0.270	0.050	0.20	24.00
WN2004C103K	10000.00	-4.9	7.00	22.00	DISC	0.200	0.040	0.20	24.00
WN1204C203K	20000.00	(C)	3.00	6.00	CHIP	0.120	0.035	—	28.00
WN0804C503K	50000.00		3.00	5.00	CHIP	0.080	0.040	—	28.00
WN0605C104K	100000.00		2.00	3.00	CHIP	0.060	0.045	—	30.00
WN0607C204K	200000.00		2.00	4.00	CHIP	0.055	0.070	—	30.00
WN0408C404K	400000.00		2.00	4.00	CHIP	0.040	0.075	—	30.00
WN0410C504K	500000.00		2.00	5.00	CHIP	0.040	0.095	—	30.00

CONFIGURATIONS

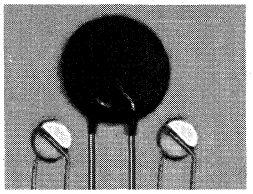


Modification	Dash No.	Body Type
No Leads	-01	Disc/Chip
Inside Kink	-02	Disc Only
Outside Kink	-03	Disc Only
Epoxy Coating (150°C Max. Temp.)	-04	Disc/Chip
Silicone Coating (200°C Max. Temp.)	-05	Disc/Chip
Epoxy/Inside Kink	-06	Disc Only
Epoxy/Outside Kink	-07	Disc Only
Silicone/Inside Kink	-08	Disc Only
Silicone/Outside Kink	-09	Disc Only

Example: WN2005D200K-06 (Standard part with epoxy coating and inside Kink leads)
Table 2

Options: If one of the modifications in Table 2 is required, add the dash number listed to the part number (see example). Other options are available including non-standard base resistance values and tolerances.

Please contact **WESTERN ELECTRONIC COMPONENTS CORP.** Applications Engineering with specific requirements.

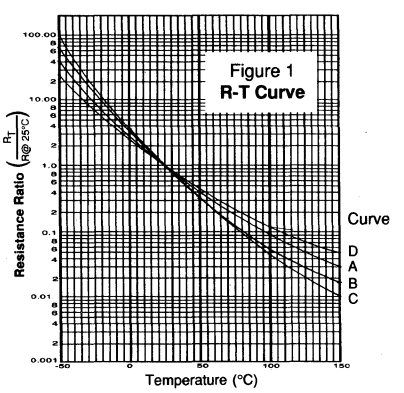


TYPICAL APPLICATIONS

- Temperature Measurement
- Temperature Control
- Inrush Current Limiting
- Temperature Compensation
- Sensing Liquid Level or Air Flow

STANDARD NTC CURVE CHARACTERISTICS

Curve		D		A		B		C	
Beta in °K		2925±225		3545±150		3965±125		4500±200	
Resis. Ratio 25/125°C		11.8±15%		19.80±10%		29.4±10%		48.7±10%	
TCR@25°C (%/°C)		-3.3		-3.9		-4.4		-4.9	
Temperature		R-T	TCR	R-T	TCR	R-T	TCR	R-T	TCR
°F	°C	Curve	(%/°C)	Curve	(%/°C)	Curve	(%/°C)	Curve	(%/°C)
-58.00	-50.00	23.62	5.400	40.06	6.100	67.06	7.20	98.20	7.40
-40.00	-40.00	14.05	5.050	22.06	5.900	34.01	6.70	47.34	7.00
-22.00	-30.00	8.623	4.700	12.51	5.500	17.84	6.20	23.76	6.60
-13.00	-25.00	6.849		9.633		13.12		17.08	
-4.00	-20.00	5.461	4.400	7.431	5.100	9.766	5.80	12.39	6.30
14.00	-10.00	3.588	4.10	4.534	4.80	5.552	5.50	6.700	5.90
32.00	0.00	2.417	3.80	2.848	4.50	3.269	5.10	3.746	5.60
41.00	5.00	2.002		2.281		2.539		2.835	
50.00	10.00	1.674	3.60	1.844	4.30	1.988	4.80	2.161	5.30
59.00	15.00	1.397		1.494		1.567		1.661	
68.00	20.00	1.194	3.40	1.216	4.00	1.245	4.50	1.284	5.10
77.00	25.00	1.000	3.30	1.000	3.90	1.000	4.40	1.000	4.90
86.00	30.00	0.8575	3.20	0.8260	3.80	0.9052	4.30	0.7844	4.80
95.00	35.00	0.7340		0.6858		0.6526		0.6190	
104.00	40.00	0.6311	3.00	0.5726	3.60	0.5320	4.00	0.4915	4.50
113.00	45.00	0.5419		0.4804		0.4361		0.3926	
122.00	50.00	0.4673	2.85	0.4051	3.40	0.3596	3.80	0.3174	4.30
131.00	55.00	0.4015		0.3425		0.2983		0.2547	
140.00	60.00	0.3512	2.65	0.2915	3.20	0.2485	3.60	0.2069	4.10
149.00	65.00	0.3066		0.2489		0.2076		0.1689	
158.00	70.00	0.2686	2.50	0.2137	3.00	0.1745	3.40	0.1385	3.90
167.00	75.00	0.2365		0.1837		0.1478		0.1142	
176.00	80.00	0.2090	2.35	0.1592	2.90	0.2157	3.30	0.09453	3.70
185.00	85.00	0.1860		0.1385		0.1070		0.07863	
194.00	90.00	0.1660	2.25	0.1206	2.70	0.09146	3.10	0.06568	3.50
203.00	95.00	0.1485		0.1055		0.07856		0.05509	
212.00	100.00	0.1335	2.10	0.09242	2.60	0.06778	2.90	0.04640	3.40
230.00	110.00	0.1100	2.00	0.07182	2.50	0.05094	2.80	0.03329	3.30
248.00	120.00	0.09211	1.95	0.05653	2.30	0.03884	2.70	0.02424	3.10
257.00	125.00	0.08472	1.90	0.05033	2.30	0.03407	2.60	0.02059	3.00
266.00	130.00	0.07830	1.90	0.04488	2.20	0.02998	2.50	0.01789	3.00
284.00	140.00	0.06767	1.80	0.03622	2.10	0.02340	2.40	0.01338	2.90
302.00	150.00	0.05912	1.75	0.02679	2.00	0.01847	2.30	0.010110	2.70



TERMINOLOGY

Base Resistance (Ro) – The resistance value of a thermistor at a specified temperature with negligible electrical power to avoid self heating. Usually base resistance will be defined at 25°C.

Dissipation Constant (Dc) – The amount of power through self-heating necessary to raise the thermistor body 1°C. (Units in Mw/°C).

Time Constant (Tc) – The time, in seconds, required for a thermistor dissipating negligible power to change 63% of the total difference between its initial and final body temperature when subjected to a change in temperature.

TCR (Temperature Coefficient of Resistance) – Defined by the following equation: and is expressed in %/°C.

$$TCR = \frac{1}{R_T}\frac{(dR_T)}{(dT)}$$

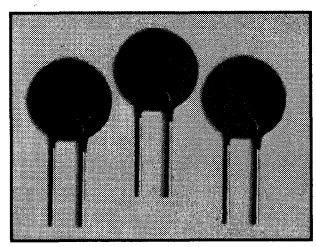
Western Electronic Components Corp. 1250-A Avenida Acaso, Camarillo, CA USA 93010-8729
(805) 482-8002•Fax (805) 482-8675•Telex-401076

Western Electronic Components Corp.

NTC THERMISTORS

Part Number	Resis. Ro@25°C (Ohms) ±20%	Imax Max. Steady State Current (amps)	R@Imax (OHMS)	Physical Dimensions (Inches) "D" (Max Dia. Over Coating)	"T" (Max. Thickness Over Coating)	"L" Lead Diameter
WS320	1.00	20.00	0.015	0.90	0.30	0.040
WS330	2.00	18.00	0.030	0.90	0.35	0.040
WS340	2.50	3.00	0.150	0.60	0.25	0.032
WS350	2.50	7.00	0.050	0.60	0.25	0.032
WS360	2.50	9.00	0.040	0.60	0.25	0.032
WS370	2.50	10.00	0.040	0.90	0.25	0.040
WS380	2.50	15.00	0.030	0.90	0.30	0.040
WS390	4.00	5.00	0.150	0.50	0.25	0.032
WS400	4.00	8.00	0.070	0.60	0.25	0.040
WS410	4.00	14.00	0.050	0.90	0.35	0.040
WS420	5.00	2.00	0.400	0.60	0.25	0.032
WS430	5.00	4.00	0.150	0.60	0.25	0.032
WS440	5.00	7.00	0.070	0.60	0.25	0.032
WS450	5.00	8.00	0.050	0.70	0.25	0.040
WS460	5.00	9.00	0.060	0.90	0.25	0.040
WS470	5.00	10.00	0.060	0.90	0.35	0.040
WS480	5.00	12.00	0.060	0.90	0.50	0.040
WS490	7.00	3.00	0.140	0.50	0.25	0.032
WS500	7.00	4.00	0.150	0.60	0.30	0.040
WS510	7.00	5.00	0.150	0.60	0.30	0.040
WS520	7.00	6.00	0.150	0.60	0.30	0.040
WS530	10.00	1.50	0.250	0.45	0.25	0.032
WS540	10.00	2.00	0.200	0.45	0.25	0.032
WS550	10.00	3.00	0.200	0.50	0.30	0.032
WS560	10.00	5.00	0.200	0.50	0.35	0.032
WS570	10.00	6.00	0.150	0.60	0.35	0.040
WS580	12.00	4.00	0.220	0.50	0.30	0.040
WS600	20.00	1.75	0.600	0.50	0.35	0.032
WS610	20.00	2.50	0.500	0.50	0.35	0.032
WS620	25.00	1.50	0.600	0.50	0.30	0.032
WS630	40.00	2.00	0.600	0.65	0.25	0.032
WS650	120.00	3.00	0.900	0.95	0.25	0.040

NTC INRUSH CURRENT LIMITERS



Inrush current limiters limit the large initial current present when a circuit is first energized. The relatively high initial resistance of the thermistor acts to limit the inrush current until the power it is dissipating heats it up to a high temperature where its resistance will be reduced to a negligible value.

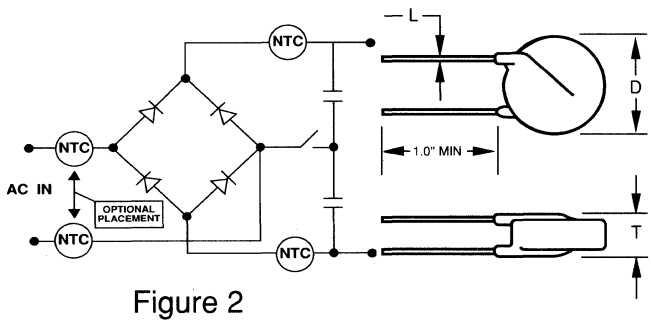


Figure 2

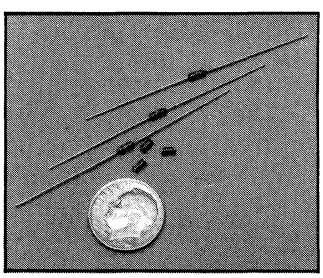
APPLICATIONS

Figure 2 illustrates a typical application in a power supply. The thermistors are placed in either the AC or DC locations of the circuit.

DEFINITIONS

R@Imax-Approximate resistance at maximum steady state current.

Imax-Maximum steady state current (DC or AC)



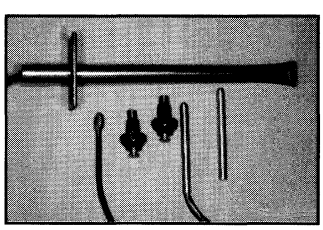
GLASS ENCAPSULATED THERMISTORS

WECC's glass encapsulated thermistors are hermetically sealed in a controlled atmosphere which results in an extremely stable part. This product is offered in both the surface mount and axial leaded configuration.

Applications
- Temperature Sensing
- Temperature Control
- Temperature Compensation

Options
- Tape & Reeling
- Special Resistance Values

Features
- Maximum operating temperature of 350°C
- Resistance values from 1k to 1Meg



PROBES/ASSEMBLIES

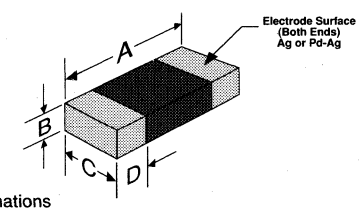
Many probes and assemblies are available for numerous applications. Please contact **WECC** Applications Engineering with specific requirements.

SURFACE MOUNT NTC CHIP THERMISTORS

Applications
- Temperature Sensing
- Temperature Control
- Temperature Compensation

Options
- Termination Materials
- Special resistance values
- Special dimensions

Features
- Five sided wrap-around terminations
- Allows design flexibility
- Solid state ceramic composition

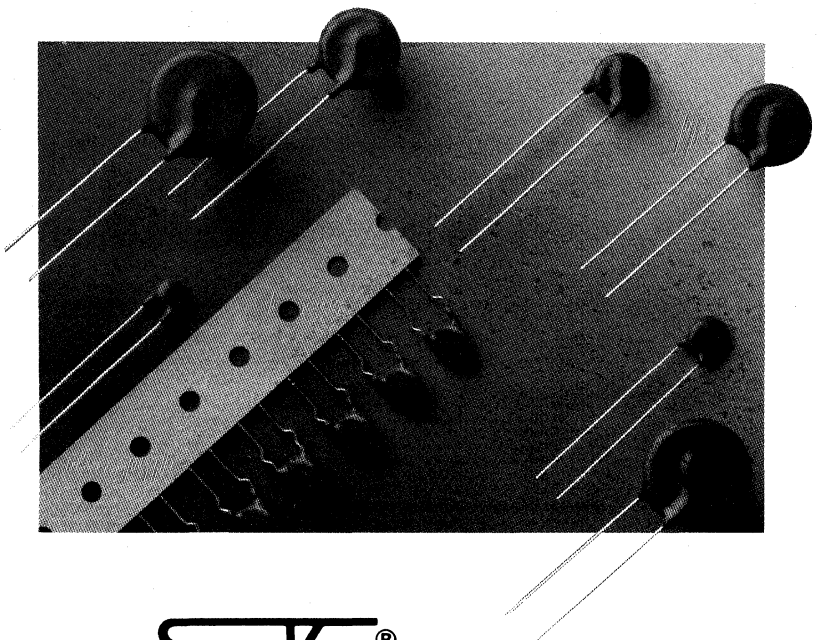


Part Number	Ro@25°C (Ω)±10%	Curve	TCR@25°C (%/°C)	Physical Dimensions (Inches) A	B	C	D
WM0952D201K	200.00	D	−3.30	0.100	0.052	0.090	0.020
WM0783D401K	400.00	D	−3.30	0.110	0.038	0.070	0.020
WM0635D501K	500.00	D	−3.30	0.110	0.035	0.060	0.020
WM0439D801K	800.00	D	−3.30	0.125	0.039	0.040	0.020
WM0431D102K	1000.00	D	−3.30	0.125	0.031	0.040	0.020
WM1083A102K	1000.00	A	−3.90	0.090	0.083	0.100	0.020
WM0859A202K	2000.00	A	−3.90	0.100	0.059	0.080	0.020
WM0751A302K	3000.00	A	−3.90	0.110	0.051	0.070	0.020
WM0634A502K	5000.00	A	−3.90	0.100	0.034	0.055	0.020
WM0634A602K	6000.00	A	−3.90	0.125	0.034	0.060	0.020
WM0632A702K	7000.00	A	−3.90	0.125	0.032	0.055	0.020
WM0531A802K	8000.00	A	−3.90	0.125	0.031	0.050	0.020
WM0431A103K	10000.00	A	−3.90	0.125	0.031	0.040	0.020
WM0973B103K	10000.00	B	−4.40	0.100	0.073	0.090	0.020
WM0951B203K	20000.00	B	−4.40	0.125	0.051	0.085	0.020
WM0637B303K	30000.00	B	−4.40	0.100	0.037	0.060	0.020
WM0533B403K	40000.00	B	−4.40	0.100	0.033	0.050	0.020
WM0632B503K	50000.00	B	−4.40	0.125	0.032	0.055	0.020
WM0524B603K	60000.00	B	−4.40	0.100	0.024	0.045	0.020
WM0524B803K	80000.00	B	−4.40	0.125	0.024	0.045	0.020
WM0422B104K	100000.00	B	−4.40	0.125	0.022	0.040	0.020
WM0973C104K	100000.00	C	−4.90	0.100	0.073	0.090	0.020
WM0850C204K	200000.00	C	−4.90	0.110	0.050	0.075	0.020
WM0529C504K	500000.00	C	−4.90	0.100	0.029	0.045	0.020
WM0523C754K	750000.00	C	−4.90	0.125	0.023	0.050	0.020
WM0422C105K	1000000.00	C	−4.90	0.125	0.022	0.040	0.020

Western Electronic Components Corp. 1250-A Avenida Acaso, Camarillo, CA USA 93010-8729
(805) 482-8002•Fax (805) 482-8675•Telex-401076

W O R L D P R O D U C T S

S A N K E N V A R I S T O R S S N R S E R I E S



SanKen® SNR Series

A full range of high quality metal oxide varistors at competitive prices make the SNR Series the ideal choice for protection in AC and DC circuits.

*SNR - Sanken nonlinear resistor

Refer to Sections 1500, 2450 and 4800 for additional product listings.

W O R L D P R O D U C T S

SANKEN NONLINEAR RESISTOR (SNR) SERIES

Part Numbering System	Available Disc Diameter	Rated AC Volts (RMS)	Rated DC (Volts)	Nominal Varistor Voltage @ 1mA DC (Volts)	Peak Current 8/20 µs (Amps)	Energy 8/20 µs (Joules)	Max Clamping Volts 8/20 µs (Volts)	Max Clamping Volts 8/20 µs (Amps)	Typical Capacitance @ 1KHz (Picofarads)
Asian Standard SNR - □□□ □ D □□ **Diameter** Number 05 07 10 14 20 Diameter 5ø 7ø 10ø 14ø 20ø **Series Designation** **Voltage Tolerance at 1mA DC** K=±10%, L=±15% **Varistor Voltage** - The first two digits identify the first two figures of Varistor Voltage and the last digit identifies the number of Zero to follow them. (Ex. 241 indicates 240V).	5ø, 7ø, 10ø, 14ø, 20ø	11 - 680	14 - 895	18 - 1100	100 - 6500	.15 - 405	38 - 1815	1 - 100	40 - 10000
North American Standard (SNR-A Series) SNR-A □□□ □ □□ **No Significance To Varistor Characteristics** **Varistor Voltage Tolerance at 1mA DC** K=±10%, J=±5% **Max. RMS Continuous Voltage** **Series Designation**	7ø, 14ø, 20ø	95 - 1000	127 -1200	150 - 1584	1200 - 6500	15 - 360	250 - 2610	10 - 100	80 - 1500
North American Standard (SNR-D Series) SNR- D □□□ □ □□ **No Significance To Varistor Characteristics** **Voltage Tolerance at 1mA DC** L=±15%, K=±10%, M=±20% **Nominal Varistor Voltage at 1mA DC** **Series Designation**	7ø, 14ø, 20ø	11 - 115	14 - 153	18 - 180	250 - 4500	.4 - 160 Test waveform may vary	39 - 300	5 - 50	190 - 22000
Asian Standard (Low Voltage Series) SNR - □□□ □ D □□ **Diameter** Number 05 07 10 Diameter 5ø 7ø 10ø **Series Designation** **Varistor Tolerance** M=±20% **Varistor Voltage** - The first two digits identify the first two figures of Varistor Voltage and the last digit identifies the number of Zero to follow them. (Ex. 120 indicates 12V).	5ø, 7ø, 10ø	4 - 6	5.5 - 8	8 - 12	50 - 250	.05 - .25	20 - 32	1 - 5	1700 - 10000

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Protection Products Group
19654 8th St. East/P.O. Box 517
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Our Family of Protection Products

- Metal Oxide and Silicon Varistors
- Gas Tube Arrestors
- RFI, X and Y Capacitors
- Transient Voltage Suppressor Diodes

Refer to Sections 1500, 2450 and 4800 for additional product listings.

TRANSDUCERS

Manufacturer	Starting EEM Page No.	Audio	Force/ Weight	Mag-netic Field	Pres-sure	Temp.	Position		Position Velocity	Velocity	Other
							ABS	Displace-ment			
Airpax Corp.	B•1931					√				√	
American Aerospace Controls	B•1932									√	
BEI Motion Systems Co.	B•1934							√	√	√	
Blatek Inc.	B•1936	√									Ultrasonic test, Air coupling, Transducers
Computer Optical Products	B•1942								√		
Data Instruments	B•1943				√						Depth sensors
Enprotech Corp.	B•1953						√				
Entran Devices Inc.	B•1954				√						
HBM	B•1958				√						Load cells
Micro Mo Electronics Inc.	B•1966							√	√	√	
Murata Erie North American Inc.	B•1967	√									Piezoelectric ceramics
Ohio Semitronics	B•1968			√							
Omega Engineering	B•1988		√		√	√		√	√	√	Strain
Setra Systems Inc.	B•1990		√		√						
Transducers & Systems	B•1996		√								
Vernitech Div./Vernitron Corp.	B•1998				√		√	√	√	√	
Vibra-Metrics Inc.	B•1999									√	Vibration

ACCELEROMETERS

Manufacturer	Starting EEM Page No.	Accel-eration	Vibration	Shock
Entran Devices Inc.	B•1954	√	√	√
HBM	B•1958		√	
Setra Systems Inc.	B•1990	√		
Wilcoxon Research	B•2000	√	√	√

SENSORS/TRANSDUCERS

Manufacturer	Starting EEM Page No.	Current, DC			Current, AC		Power		Power Factor	Phase Angle	Frequency	Voltage		Other
		Magnitude	Level Sensing	Bidirectional	Ampl./RMS	Level Sensing	True (W)	Apparent (VAR)				DC	AC	
Airpax Corp.	B•1931										√			MIL
American Aerospace Controls	B•1932	√	√	√	√	√	√	√			√	√	√	MIL
F.W. Bell Inc.	B•1935													Hall effect
Blatek Inc.	B•1936		√											
ETA Circuit Breakers	B•1956					√								Flow monitors
Hamlin Inc.	B•1957	√	√			√	√					√	√	Proximity transducers
HBM	B•1958				√									Strain gauges
Itek Encoder	B•1960	√												
IVO Industries	B•1962			√								√	√	Proximity sensors
Ohio Semitronics	B•1968	√		√	√		√	√	√		√	√	√	Watt transducers, Hall effect sensors
Omega Engineering	B•1988		√			√								
Transducers & Systems	B•1996													Inclinometer

ENCODERS, SHAFT ANGLE

Manufacturer	Starting EEM Page No.	Optical		Contact		Other
		Abs.	Diff.	Abs.	Diff.	
BEI Motion Systems Co.	B•1934	√	√			Incremental
Canon USA Inc.	B•1937		√			Laser linear encoders
Clarostat Mfg. Co.	B•1940		√		√	Incremental
Computer Optical Products	B•1942	√	√			
Data Technology Inc.	B•1945	√	√			
Disc Instruments/Honeywell	B•1949		√			Digital potentiometers
Enprotech Corp.	B•1953	√				
Itek Encoder	B•1960	√				MIL
IVO Industries	B•1962	√	√		√	
Litton Encoder	B•1963	√		√		Trackball systems
Lucas Ledex Inc.	B•1964					Incremental
Micro Mo Electronics Inc.	B•1966		√			Magnetic
Sharp Electronics/ Opto Electronics	B•1995	√				
US Digital Corp.	B•1997		√			
Vernitech Div./Vernitron Corp.	B•1998	√	√	√	√	Modular

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

TACHOMETERS AND MAGNETIC SPEED SENSORS

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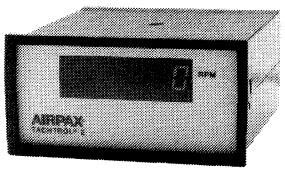
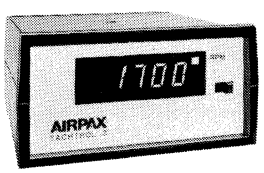


Tachtrol® 2 – Speed/Rate Monitor

A single input digital instrument, this speed/rate monitor offers fast-response, high-precision monitoring. Measured values are displayed in engineering/units: RPM, FPM, frequency or other values. Rugged, easy to set up, yet costs less than competitive models.

Features:

- Single-channel precision speed or rate monitoring.
- Period mode measuring system.
- Five-digit auto-ranging .56″ LED display; full or partial auto-ranging with leading zero suppression. Updates twice per second.
- Active or passive sensor input; accepts any pulse output device, magnetic digital speed sensor.
- Meets MIL-810C shock and vibration.

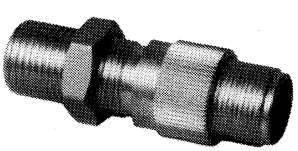


Tachtrol® 3 – Dual Input Digital Tachometer

Single or dual channel instrument, this computing tachometer measures input frequencies and displays the resulting quantities in RPM, FPM, % Draw and other rates. A unique method of setting conversion factors and instrument functions allows easy configuring or altering at any time.

Features:

- Measures speed or frequency (2 Hz to 30,000 Hz).
- Active or passive speed sensor inputs.
- Auto ranging LED display.
- Meets MIL-810C shock and vibration.



1-3111 – Low-Cost Molded Magnetic Speed Sensor

Stainless steel housing and one-piece construction, this speed sensor has interior section coated with epoxy resin to resist both oil and moisture.

Features:

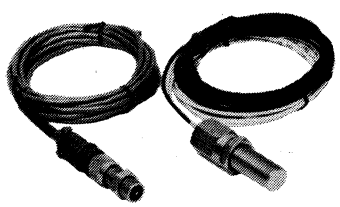
- Wide operating and storage temperature range: −40°F to +300°F.
- 190-volt minimum output (P-P).
- Mates with MS3106A-10SL-4S.

Tach-Pac® 3

The single channel, microcomputer-based Tach-Pak® 3 uses adaptive period averaging which permits a combination of fast response and high accuracy. It measures input frequency and converts the resulting quantities to a meter output, an analog output, and four relays. A unique method of setting instrument functions permits them to be easily configured or altered in the field at any time.

Features:

- Measures frequency from .0625 to 30,000 Hz.
- Active or passive sensor inputs: accepts input from any frequency source.
- Response time – 50 millisecond updates above 100 Hz.
- Field programmable.

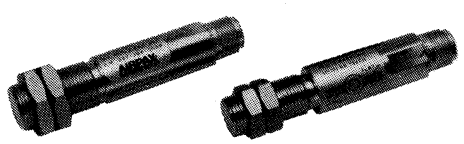


1-0001 and 1-0005 – Passive Magnetic Speed Sensors

Convert mechanical motion to AC voltage. The frequency of the AC signal is exactly proportional to the speed or RPM.

Features:

- No moving parts.
- Wide temperature range.
- Stainless steel housing.
- UL/CSA and FM listed sensors available. Intrinsically safe.

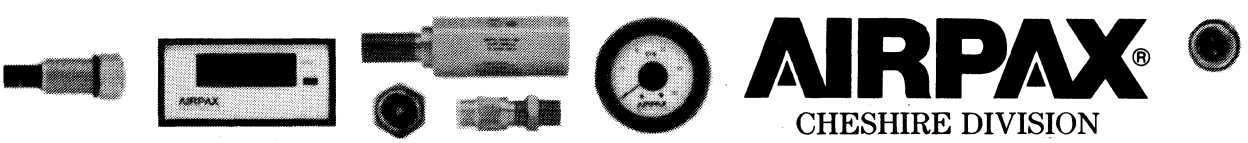


4-0070 and 4-0036 – Active Magnetic Speed Sensors/Zero Velocity

Either speed sensor can be used to sense the speed of any rotating machinery, including motors, generators, turbines, compressors, conveyors – wherever speed or RPMs need to be monitored.

Features:

- Low cost.
- 12V ± 2 VDC power supply.
- −25°C to +70°C operating temperature range.
- 4-0036 is UL listed.
- DC to 10K Hz frequency.
- UL/CSA listed sensors available.



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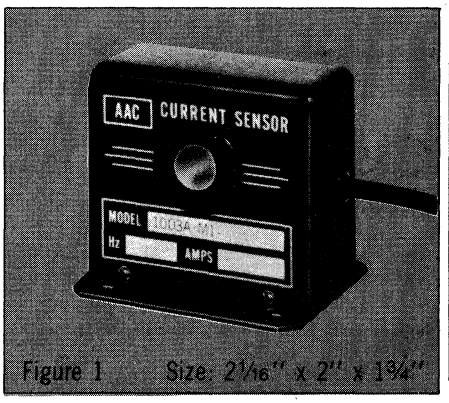

Figure 1 Size: 2 1/16" x 2" x 1 3/4"

AC CURRENT SENSORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
1002M1	0.25, 0.5, 1, 5, 10, 20, 25, 50, 100, 150, 200, 250Aac	+5Vdc	0.5%FS	10ms	5
C	1, 2, 5, 10, 20Aac	+1mAdc	0.25%FS	400ms	6
C-X	1, 2, 5, 10, 20Aac	4-20mAdc	0.5%FS	400ms	6
S383	2, 5, 10, 15, 20, 30, 40, 50, 75, 100, 150, 200, 250Aac	4-20mAdc	0.5%FS	200ms	–
1004	2, 5, 10, 20, 50, 100, 150, 200, 250, 300Aac	+5Vdc	1%FS	150ms	5
1003AM1	2, 5, 10, 15, 20, 25, 30, 50, 100Aac	+5Vdc	1%FS	150ms	1
1003AM2	30, 50, 75, 100, 150, 200, 250Aac	+5Vdc	1%FS	150ms	–
1003AM3	150, 250, 350, 500, 600, 800, 1000, 1200, 1500Aac	+5Vdc	1%FS	150ms	–
1001	100, 250, 500, 750, 1000, 1500, 2000, 2500, 3000Aac	+5Vdc	1%FS	100ms	4

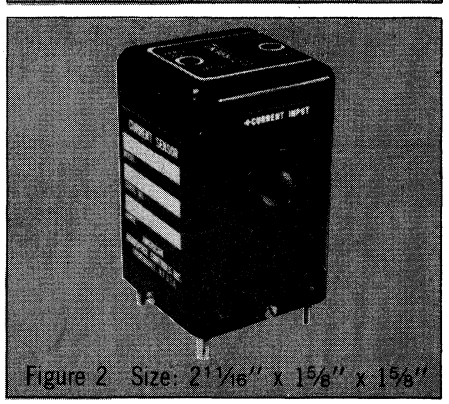

Figure 2 Size: 2 1/16" x 1 5/8" x 1 5/8"

DC CURRENT SENSORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
904B	0.1, 0.2, 0.5, 1, 2, 5mAdc	+5Vdc	1%FS	50ms	–
903B	5, 10, 20, 50, 100, 200, 500mAdc & 1, 2, 5Adc	+5Vdc	1%FS	50ms	5
S209-903B	5, 10, 20, 50, 100, 200, 500mAdc & 1, 2, 5Adc	+1mAdc	1%FS	50ms	5
936	20, 50, 100, 200, 250, 500mAdc & 1, 2, 5Adc	+5Vdc	1%FS	50ms	3
S218-903	100, 200, 500mAdc & 1, 2, 5Adc	+5Vdc	1%FS	50ms	–
937	10, 20, 30, 50, 100Adc	+5Vdc	2%FS	200µs	–
913A	10, 20, 50, 100Adc	+5Vdc	1%FS	1ms	2
913B	10, 20, 50, 100Adc	+5Vdc	1%FS	1ms	5
S155-913B	10, 20, 35, 50, 75, 100Adc	+5Vdc	1%FS	1ms	5
950	10, 20, 30, 40, 50Adc	+5Vdc	0.5%FS	10ms	5
951	10, 20, 30, 40, 50Adc	+5Vdc	0.5%FS	30ms	–
952	100, 200, 300, 400, 500, 750, 1000, 1500, 2000Adc	+5Vdc	0.5%FS	50µs	5
934	100, 200, 250, 300, 500, 750, 1000Adc	+5Vdc	2%FS	200µs	5
S338-909	150, 250, 500, 750, 1000, 1500, 2000, 2500Adc	4-20mAdc	1%FS	200µs	4
S347-909	200, 250, 300, 500, 750, 1000, 1500, 2000, 2500Adc	+5Vdc	1%FS	200µs	4

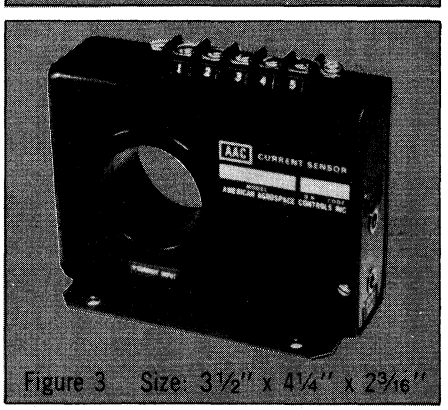

Figure 3 Size: 3 1/2" x 4 1/4" x 2 3/16"

BIDIRECTIONAL CURRENT SENSORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
S263	±5, 10, 20, 50, 100, 200, 500mA & ±1, 2, 5A	±5V	2%FS	40µs	–
905B	±50, 100, 200, 500mA & ±1, 2, 5A	±5V	1%FS	50ms	5
925B	±10, 20, 50, 100A	±5V	1%FS	1ms	5
S273-925	±10, 20, 50, 100A	±5V	1%FS	1ms	5
910	±25, 50, 100, 150, 200, 250A	±250mV	2%FS	5µs	–
907	±25, 50, 100, 150, 200, 250, 300A	±5V	2%FS	100µs	–
907A	±25, 50, 100, 150, 200, 250, 300A	±5V	2%FS	40µs	–
908	±25, 50, 100, 150, 200A	±250mV	2%FS	5µs	–
S164-908	±50, 100, 150, 200, 300A	±250mV	1%FS	20µs	–
927B	±150, 200, 250, 300, 500, 750, 1000A	±5V	1%FS	100µs	5
942A	±100, 200, 300, 400, 500, 600, 800, 1000, 1500, 2000A	±5V	1%FS	100µs	3
909	±100, 150, 250, 500, 750, 1000, 1500, 2500, 5000A	±250mV	1%FS	200µs	4
909M4	±150, 250, 500, 750, 1000, 1500, 2000, 2500A	±5V	1%FS	200µs	4
921	±250, 500, 750, 1000, 2000A	±250mV	2%FS	20µs	5

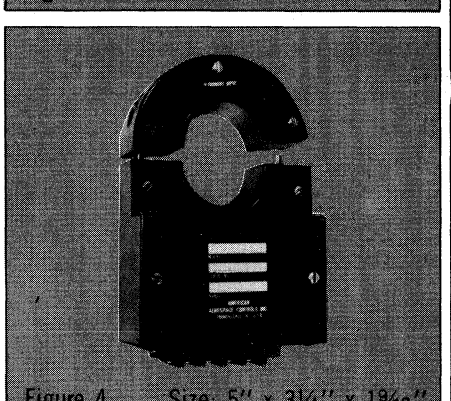

Figure 4 Size: 5" x 3 1/4" x 1 9/16"

CURRENT, VOLTAGE AND POWER INSTRUMENTATION

CALL 516-694-5100

AC & DC CURRENT LEVEL DETECTORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
870	1, 2, 5, 10, 15, 20, 50, 100, 150, 200, 250, 300Aac	RELAY	0.5%FS	500ms	8
S212-850	500mAac (75Aac Overload)	RELAY	±75mAac	200ms	5
901B	20, 50, 100, 200, 250, 500mAdc & 1, 2, 5Adc	+5V & SW	1%FS	50ms	–
S204-800	100, 150mAdc & 2Adc (10Adc Overload)	RELAY	10%FS	3ms	5
S58-800	200mAdc (10Adc Overload)	SWITCH	N/A	1ms	–
S201-800	1Adc (100Adc Overload)	RELAY	±150mAdc	200ms	5

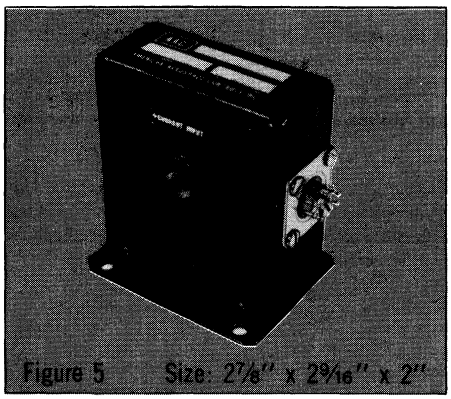

Figure 5 Size: 2⅞" x 2⁹⁄₁₆" x 2"

AC VOLTAGE SENSORS

SERIES	FULL SCALE (FS) INPUT VOLTAGE RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
108	130, 150, 270, 500, 600Vac @ 47-420Hz (0 to FS)	+5Vdc	2%FS	200ms	–
S190-108	130, 150, 270, 300, 600Vac @ 47-63Hz (0 to FS)	+10Vdc	2%FS	200ms	–
V	150, 300, 500Vac @ 47-1000Hz (0 to FS)	+1mAdc	0.25%FS	400ms	6
V-X	150, 300, 500Vac @ 47-1000Hz (0 to FS)	4-20mAdc	0.5%FS	400ms	6
101M3	90-150 Vac @ 60Hz (Suppressed Zero)	+5Vdc	0.5%FS	17ms	–
102M3	90-175 Vac @ 400Hz (Suppressed Zero)	+5Vdc	0.5%FS	3ms	–
105	390-490Vac or 430-530Vac @ 60Hz*	+5Vdc	0.5%FS	17ms	–
109	120, 125, 135, 240, 250, 270Vac @ 60Hz*	+1mAdc	0.5%Vmax	300ms	–
110	120, 125, 135, 240, 250, 270Vac @ 400Hz*	+1mAdc	0.5%Vmax	300ms	–

*Suppressed Zero

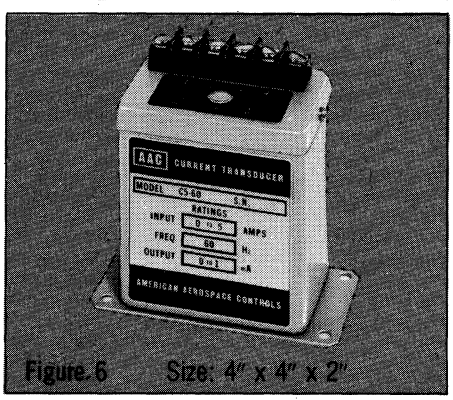

Figure 6 Size: 4" x 4" x 2"

WATT & VAR TRANSDUCERS

SERIES	FULL SCALE (FS) INPUT POWER RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
415A/416A	1-200KW 120, 220 or 440Vac	+5Vdc	2%FS	400ms	8
S217	2-80KW 220 & 440Vac	+5Vdc	2%FS	400ms	8
S73-413	0-100KW (0 to 150Vac or 0 to 300Vac)	+5Vdc	2%FS	400ms	8
W106	0.5-2KW (1 ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
W206	1-4KW (2 ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
W256	1-4KW (2½ ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
W306	1-4KW (3 ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
Q106	0.5-2K VAR (1 ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
407	0.3-60KW dc 12-240Vdc & 25-250Adc	250mV	2%FS	5μs	–
401	2.7-150KW dc 18-150Vdc & 150-1000Adc	250mV	2.5%FS	200μs	4

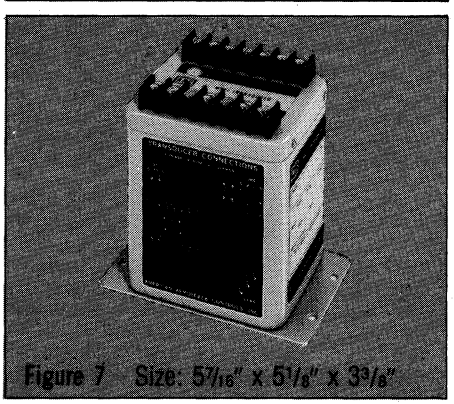

Figure 7 Size: 5⁷⁄₁₆" x 5⅛" x 3⅜"

FREQUENCY TRANSDUCERS

SERIES	FULL SCALE (FS) INPUT FREQUENCY RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
S343	360 to 440Hz (102-127Vac or 200-250Vac)	+5Vdc	±0.8Hz	250ms	–
S350L	100, 200, 300, 500, 1K, 2K, 3K, 5K, 10K & 20K Hz	+5Vdc	0.25%FS	3-300ms	–

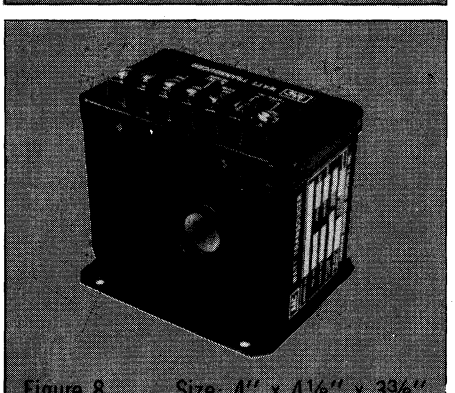

Figure 8 Size: 4" x 4⅛" x 3⅜"

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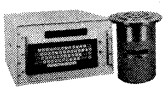

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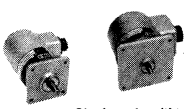

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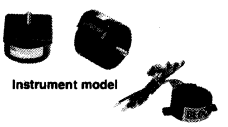

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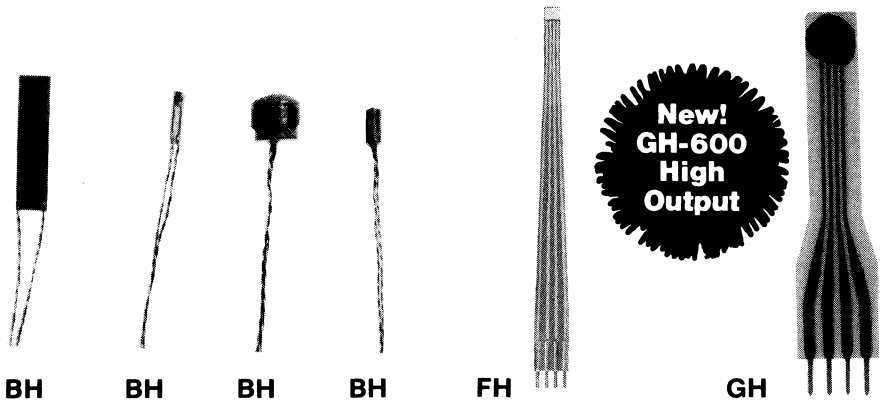
Hall Generators



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- **Magnetic Field Measurements**
- **Electrical Power Measurements**
- **Guidance Systems**
- **Brushless dc Motors**
- **Proximity Sensors**
- **Watt-hour Meters**

DESCRIPTION

The F.W. Bell series of Hall effect magnetic field sensors consists of 29 standard models designed to meet the requirements of most magnetic field measurement applications. The sensors are small, solid-state devices. They produce a voltage which is proportional to the product of the control current and the magnetic field component normal to the Hall active area. Each unit has four electrical connections. Two carry the control current (I_C) and the other two supply the Hall voltage.

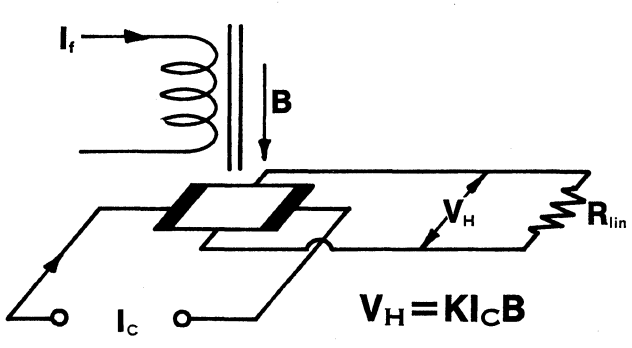
These models are built in various configurations to measure axial, transverse, and tangential magnetic field components. Their operating characteristics permit virtually any application: frequency, dc to MHz; magnetic flux density, milligauss to kilogauss; linearity to 0.1%; temperature, -269°C to +100°C.

MODELS

BH-200
General Purpose Transverse
BH-201
Ultra-Thin Transverse
BH-202
Small Axial
BH-203
General Purpose Axial
BH-204
Midget Axial
BH-205
Midget Transverse
BH-206
High Sensitivity Transverse
BH-207
High Resolution Tangential
BH-208
Ultra-Midget Axial
BH-700
Low Cost Transverse
BH-701
High Linearity Transverse
BH-702
Ferrite Imbedded
BH-703
3-Axis
FH-301, -302, -500
Thin Film
GH-600
High Output
BHT/BHA-900
High Field
BHT/BHA-910
High Linearity
BHT/BHA-921
High Field/ Cryogenic

SPECIFICATIONS

	BH	FH	GH
Control Current I_C	100-200 mA	15-30 mA	10 mA dc
Input Resistance, R_{in}	1-6 ohms	20-80 ohms	450-900 ohms
Output Resistance, R_{out}	1-6 ohms	50-200 ohms	1000 ohms
Magnetic Sensitivity, λB	6-16 mV/kG, standard 5 mV/kG, high sensitivity		50-120 mV



This schematic representation illustrates both the measuring and multiplying capabilities of a Hall generator. By holding I_C constant, V_H becomes a direct function of B, the magnetic flux density. If both, I_C and B are variable, V_H is proportional to the product of the two functions. Holding B and I_C constant, V_H becomes a function of the angle between B and the plane of the Hall-generator active area.

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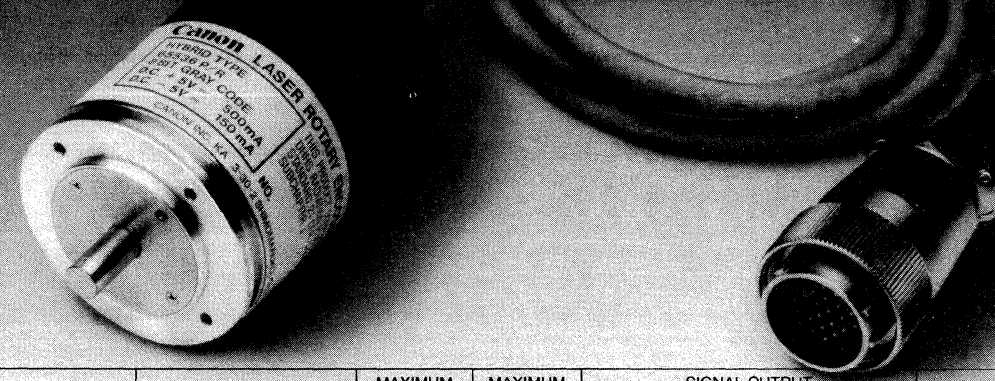

MODEL	RESOLUTION (ppr)	MAXIMUM FREQUENCY RESPONSE (KHz)	MAXIMUM ANGULAR VELOCITY (rps)	SIGNAL OUTPUT			SIZE (mm x mm)
				Analog or Digital	Output Circuit	Absolute or Incremental	
K-1*	81,000	500	6.2 (372 rpm)	Analog	Op Amp + Serial Resistor (1 Vp-p)	Incremental	36 x 48
R-10	81,000	500	6.2 (372 rpm)	Digital	Open Collector	Incremental	36 x 48
R-1L	81,000	500	6.2 (372 rpm)	Digital	Line Driver (Balanced)	Incremental	36 x 58
R-2A*	Incremental 65,536 (2^{16})	500	7.6 (456 rpm)	Analog	Op Amp + Serial Resistor (1 Vp-p)	Incremental & Absolute	56 x 80
	Absolute 256 (2^8)						
R-2L	Incremental 65,536 (2^{16})	500	7.6 (456 rpm)	Digital	Line Driver (Balanced)	Incremental & Absolute	56 x 80
	Absolute 256 (2^8)						
M-1	50,000	2,000	40 (2400 rpm)	Digital	Line Driver (Balanced)	Incremental	56 x 70

*CI 16-1 (16x output pulse) Interpolator available with Analog Output units.

FEATURES: • COMPACT SIZE • LOW INERTIA • HIGH RESOLUTION
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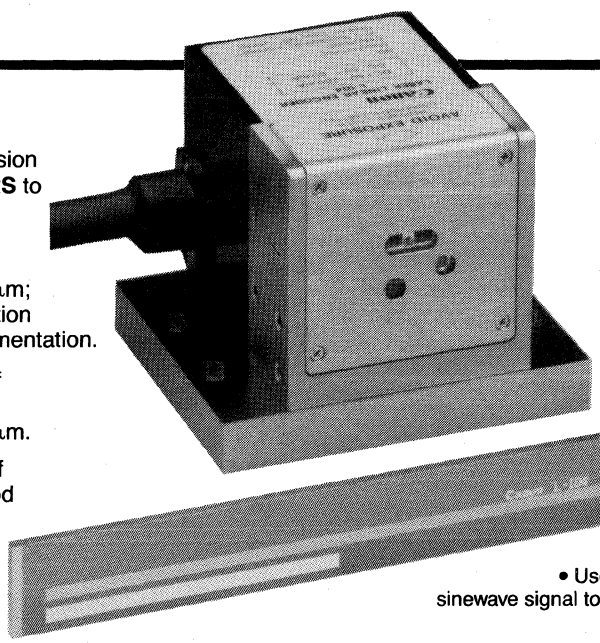

Canon has added high-precision **LASER LINEAR ENCODERS** to its full line of laser rotary encoders. The Canon laser linear encoder provides for maximum resolution of 0.01μm; thereby allowing high resolution closed loop control of instrumentation.

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L-108 has a scale slit pitch of 3.2μm and a sinewave period output from main unit of 0.8μm.

A 16 signal interpolator CI16-2 and 40 signal interpolator, CI40-2 are available, enabling optimum combinations to achieve various resolution and responsiveness.

FEATURES:

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- More stable under variable ambient conditions compared to conventional laser interferometers due to the use of a scale method instead of the laser wavelength standard method.
- Zero-phase index signals are output, allowing simple control of positioning.
- Uses interference, thus providing a full sinewave signal to be obtained from the photodetector.

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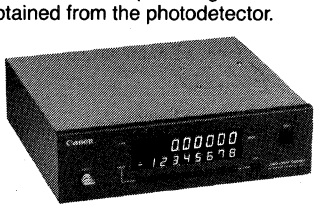

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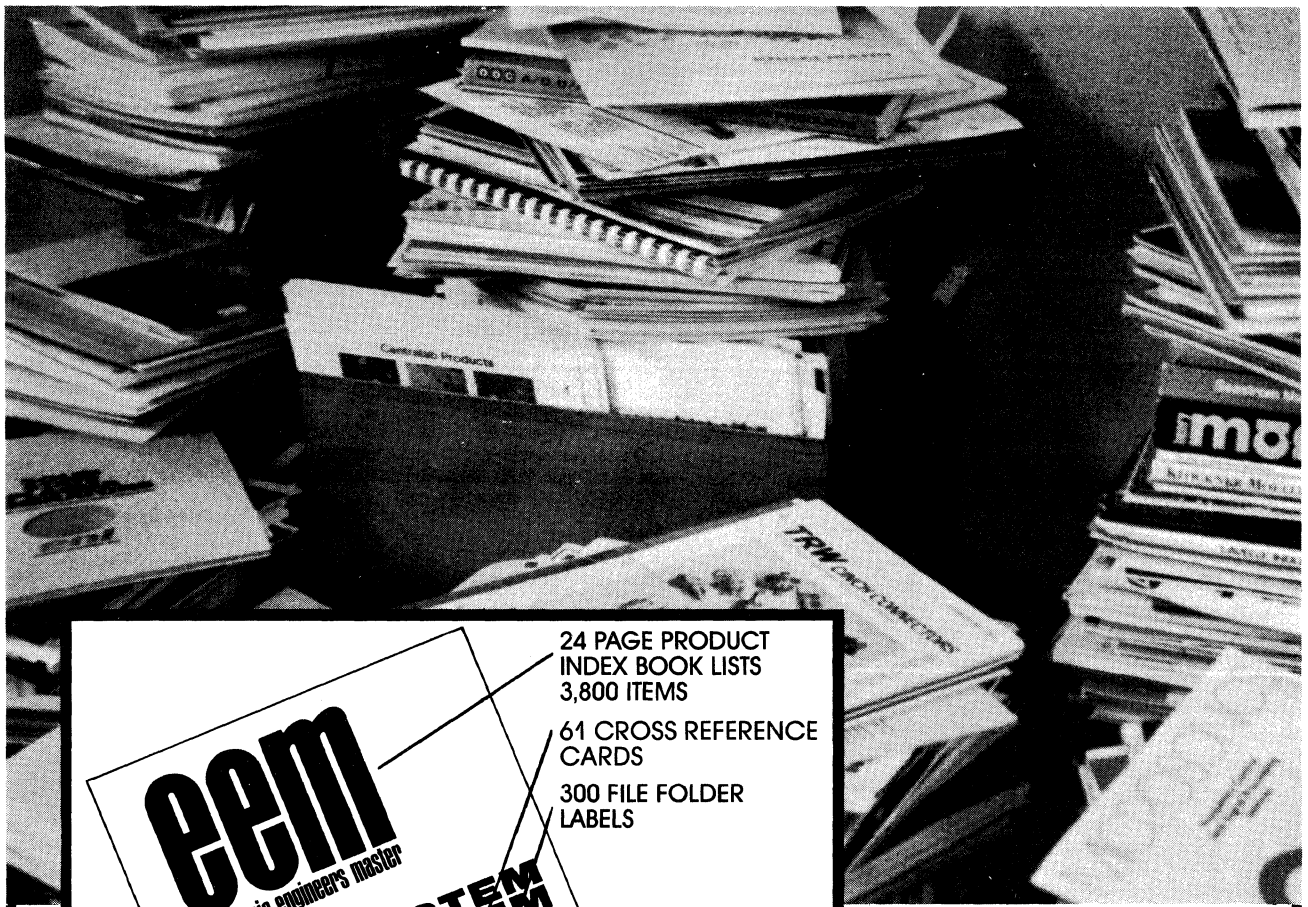

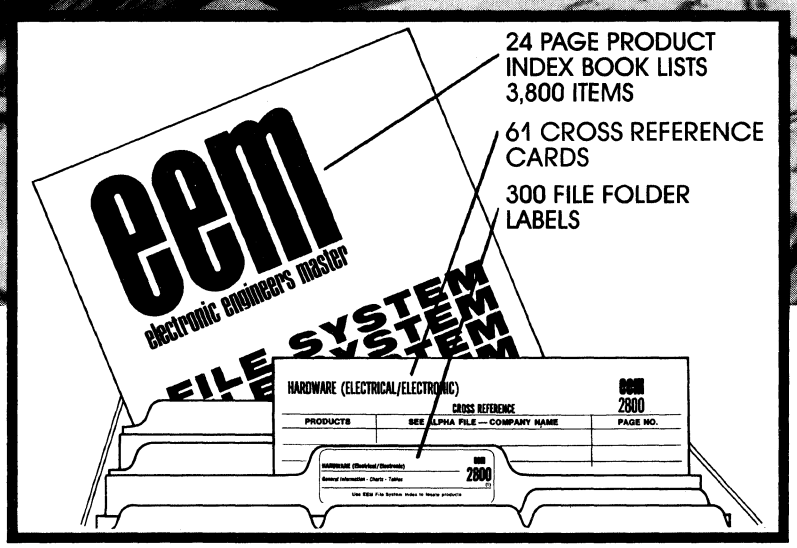

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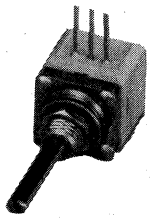
CLAROSTAT

ENCODERS

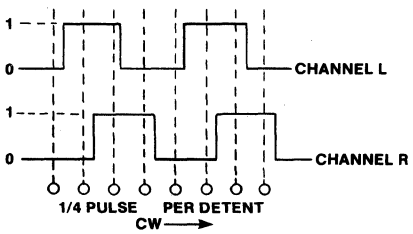
SERIES 388E
TWO BIT GRAY CODE MECHANICAL ENCODER



DESCRIPTION:
Only one half inch square, the Series 388E is a direct digital, contacting, mechanical encoder for low resolution limits in such applications as sensing, cursing, scanning or robotics. Meets those requirements for a digital output component for limited space applications.

Electrical Specifications
OUTPUT: 2 Bit gray code, channel L leads channel R by 90° electrically in CW direction.
CONTACT RESISTANCE: 2.5K Max.
OPERATIONAL RESISTANCE: 10 Megohm Min.
CONTACT RATING: 5 VDC at 5 ma
INSULATION RESISTANCE: 100 Megohm at 50 VDC
JITTER: 5 Milliseconds/cycle at 15 RPM

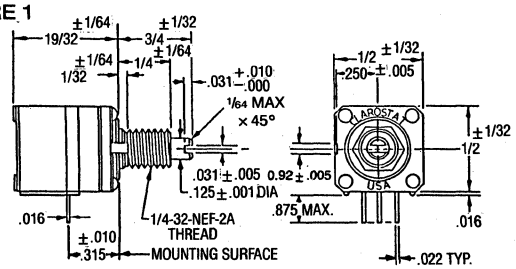
OUTPUT TABLE



Environmental Specifications
TEMPERATURE RANGE: Operating temp. is −40°C to +100°C. Storage temp. is −55°C to +120°C.
HIGH TEMP. EXPOSURE: 100°C@250 hrs. Contact resistance 2.5KΩ max.
HUMIDITY: 95% RH@40°C for 10 days. Contact R 7.5KΩ max. Open R 1 MegΩ min.
SHOCK: 100 G@6 Milisec. per MIL Std. 202, Method 213, Condition 1
VIBRATION: MIL Std. 202, Method 204, Condition C, Part 2
ROTATIONAL LIFE: 100,000 Shaft Revolutions

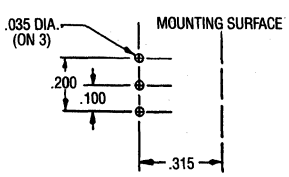
Mechanical Specifications
TORQUE: 1-5.5 oz. in. with detents
TERMINALS: PC type with gold plate to facilitate soldering.
DIMENSIONS: See Fig. 1
ROTATION: Continuous

FIGURE 1



MOUNTING DIMENSIONS:

MOUNTING INFORMATION
BUSHING: 1/4 x 1/4 inches.
SHAFT: 1/8 dia. x 3/4 in. FMS lg., screw driver slotted.
TERMINALS: .875 in. lg., P.C. Pins
LOCATING PIN: 9 o'clock

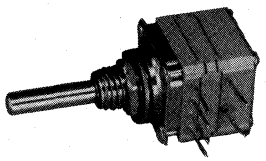


HOW TO ORDER

P.C. BOARD LAYOUT

Cat. No.	Description	Detents	Pulse
388EN-4	4 Pulse/Rev/Chan.	16	1/4/Det.
388EN-6	6 Pulse/Rev/Chan.	24	1/4/Det.
688EN-64	64 Pulse/Rev/Channel	N/A	N/A

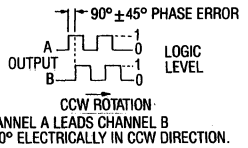
SERIES 688
1/2 INCH SQUARE OPTICAL ENCODER



DESCRIPTION:
The Series 688 controls are manually operated, rotary, optical encoders that output two squre waves in quadrature at a rate of 64 pulses per channel per revolution as a standard with other resolutions down to 20 pulses available. The outputs are TTL compatible.

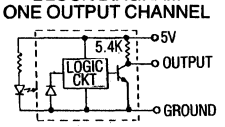
Electrical Specifications
INPUT POWER: 5 volts DC ±5%@30 MA max. plus external requirements.
OUTPUT RATE: 64 pulses/revolution per channel-standard. Other pulses/revolution between 20 and 64 are available.
CHANNELS: Two separate output channels in quadrature, 90° ±45°.
OUTPUT VOLTAGE: High level voltage–2.4 volts min. with 10KΩ load to ground. Low level voltage–.4 volt max.

OUTPUT WAVEFORM



*CHANNEL A LEADS CHANNEL B BY 90° ELECTRICALLY IN CCW DIRECTION.

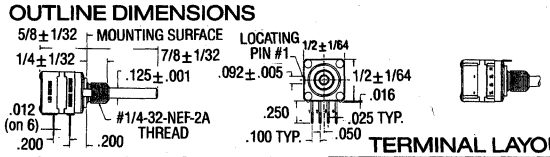
BLOCK DIAGRAM ONE OUTPUT CHANNEL



Environmental Specifications
STORAGE TEMP: −55°C to +10°C
OPERATING TEMP: −20°C to +65°C
HUMIDITY: 85% R.H.@40°C, 240 hours
VIBRATION: 10 to 2000 Hz, 15 G peak MIL-STD-202 method 204 test C
SHOCK: 100 G @6 MS MIL-STD-202 method 213 condition 1
PHYSICAL SIZE: Housing–1/2 inch square
Depth–5/8 inch from mtg. surface to rear

Mechanical Specifications
SHAFT ROTATION: Continuous in either direction
OPERATING SPEED: 300 rpm max.
ROTATIONAL LIFE: 1 million revolutions min.
ROTATIONAL TORQUE: 1.0 oz. in. max. Other torque ranges available
SHAFT: 1/8 dia. standard. Brass nickel-plated
BUSHING: 1/4 dia. standard. Brass, nickel-plated
SHAFT END PLAY: .005 in. max.
SHAFT RADIAL PLAY: .010 in. max. @1 in. FMS with 1/4 long bushing
AXIAL FORCE: 8 lb. min. push & pull force applied to shaft end
TERMINALS:
P/C TYPE .025 by .012 thick brass, Gold plated to facilitate soldering.
STRENGTH Terminals withstand 2 lb. push and pull and a 90° bend.
MOUNTING HARDWARE: For 1/4 bushing, hex mounting nut 1/4 x 32 thread, 5/16 across flats, 1/16 thick; internal tooth lockwsher 13/32 O.D. by .025 thick.
SEALS: Mounting seal and shaft seal available. Controls are not sealed for board washing. Consult factory for specifications.
MARKING: Consists of customer or Clarostat part number and EIA source and date code. Ink stamped on periphery of the control meets EIA RS230 & RS327 specifications.
LOC. PIN: Single pin located 1/4 from center can be supplied.

OUTLINE DIMENSIONS



MOUNTING INFORMATION
BUSHING: 1/4 x 1/4 inches.
SHAFT: 1/8 dia. x 7/8 in. FMS lg., plain round.
TERMINALS: .250 in. lg., Std. P.C. Pins
LOCATING PIN: 9 o'clock

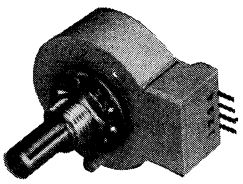
TERMINAL LAYOUT

DESCRIPTION	SECTION	
	SENSOR	LED
"B" OUT	1	—
±5 VOLTS	2	2
"A" OUT	3	—
GROUND	4	4

CLAROSTAT

ENCODERS

SERIES 600
OPTICAL ROTARY ENCODER

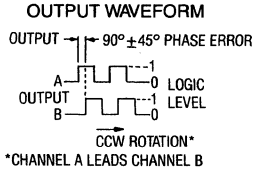


DESCRIPTION:
The series 600 controls are manually operated, rotary, optical encoders that output two square waves in quadrature at a rate of 128 pulses per channel per revolution as a standard with other resolutions down to 24 pulses available. The outputs are TTL compatible. The variation by construction is the terminal configuration, with the one model having (4) cable leads, and the other model having (4) pin leads and internal resistors.

Electrical Specifications

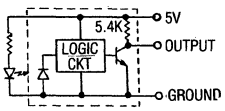
INPUT POWER: 5 volts DC ± 5% @ 30 MA max. plus external requirements.
OUTPUT RATE: 128 pulses/revolution per channel–standard
Other pulses/revolution between 24 and 128 are available.
CHANNELS: Two separate output channels in quadrature, 90° ± 45°
OUTPUT VOLTAGE: High level voltage–2.4 volts min. with 10K load to ground. Low level voltage–.4 volt max.

OUTPUT WAVEFORM



*CHANNEL A LEADS CHANNEL B BY 90° ELECTRICALLY IN CCW DIRECTION.

BLOCK DIAGRAM
ONE OUTPUT CHANNEL



Environmental Charateristics

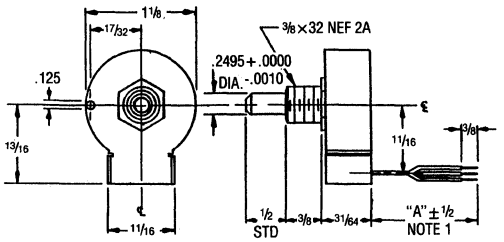
STORAGE TEMP: – 55°C to + 110°C
OPERATING TEMP: – 20°C to + 65°C
HUMIDITY: 85% R.H. @ 40°C, 240 hours
VIBRATION: 10 to 2000 Hz, 15 G peak MIL-STD-202 method 204 test C.
SHOCK: 100 G @ 6 MS MIL-STD-202 method 213 condition 1

Mechanical Characteristics

SHAFT ROTATION: Continuous in either direction
OPERATING SPEED: 300 rpm max.
ROTATIONAL LIFE: 10 million revolutions min.
ROTATIONAL TORQUE: 1.5 oz. in. max. Other torque ranges available.
SHAFT: 1/4 dia. standard, stainless steel
BUSHING: 3/8 dia. standard. Brass, nickel-plated.
SHAFT END PLAY: .005 in. max.
SHAFT RADIAL PLAY: .010 in. max. @ 1 in. FMS with 3/8 long bushing
AXIAL FORCE: 15 lb. min. push & pull force applied to shaft end
TERMINALS:
P/C TYPE .025 by .0.12 thick brass, gold-plated to facilitate soldering
CABLE TYPE Four lead ribbon cable, color-coded, with .050 spacing, 28 AWG stranded copper wire, .039 diameter
STRENGTH Terminals withstand 2 lb. push and pull and a 90° bend.
MOUNTING HARDWARE: For 3/8 bushing, hex mounting nut 3/8 x 32 thread, 1/2 across flats, 3/32 thick; internal tooth lockwasher 11/16 O.D. by .022 thick.
SEALS: Mounting seal and shaft seal available. Controls are not sealed for board washing. Consult factory for specifications.
MARKING: Consists of customer or Clarostat part number and EIA source and date code. Ink stamped on periphery of the control meets EIA RS230 & RS327 specifications.
WEIGHT: P/C type or cable type. 1 in. FMS shaft and 3/8 bushing–.046 lb. (21 G)
LOC. PIN: Single pin located 17/32 from center can be supplied. Pin withstands 5 in. lb. torque.

STOCK VALUES
600—128—B66 PC Terminals Type B-66
600—128—C24 PC Terminals Type C-24
600—128—CBL 7″ Long Cable Lead

MODEL 600—Cable Style

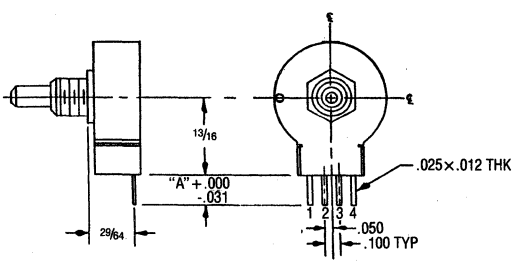


NOTE:
1. "A" cable length standard 7 1/2 ± 1/2 in.
Other lengths available, specified by customer.
2. A and B outputs are TTL compatible on all models.

CABLE CODE

Color	Function
Red	5VDC ± 5% @ 30 MA max.
Green	Ground
Yellow	A Out
Orange	B Out

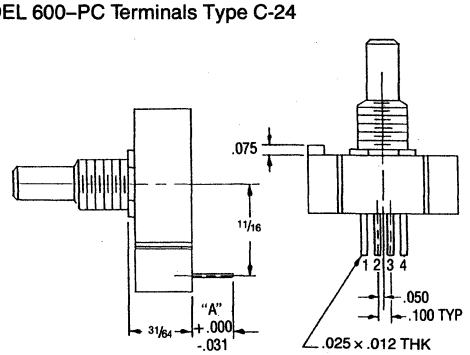
MODEL 600–PC Terminals Type B-66



DIMENSION TOLERANCES UNLESS OTHERWISE SPECIFIED
Fractions = ± 1/64; Decimals = ± .005; Grids = ± .010

TERM #	FUNCTION	"A" DIMENSIONS	
1	5VDC ± 5% @ 30 MA max.	Standard	.160
2	A Out	Special	.400 max.
3	Ground		
4	B Out		

MODEL 600–PC Terminals Type C-24



HOW TO ORDER–Example:

600EN — 128 — B66

Number of Pulses/Revolution

Terminal Configuration

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COMPUTER OPTICAL PRODUCTS, INC.

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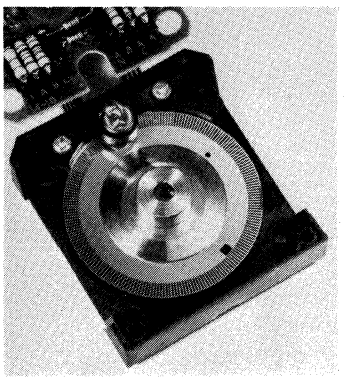
CP-200/250 Series

Incremental Integrated Encoder/Tachometer



FEATURES:

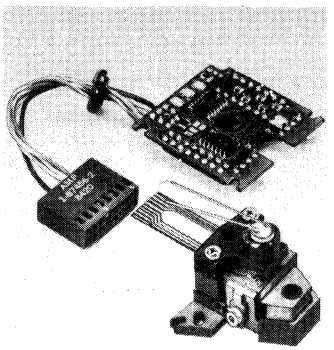
- Low cost/High performance
- Self-contained gap setting mechanism
- Self-contained centering mechanism
- Monolithic multi-output sensor
- Single, controlled output GaAlAs light source
- Collimated optics
- Push-pull readout system
- Low offset
- Extremely easy to install
- Up to 500 counts for metal disks, up to 1000 counts for glass disks.

APPLICATIONS:

- Incremental Motion Systems
- Daisy Wheel Printers
- Inkjet Printers
- Matrix Printers
- Winchester Disk Drives

CP 40/45 Series

Optical Linear or Semi-Linear Transducer



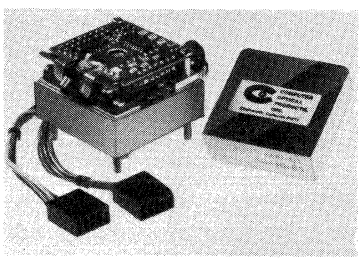
FEATURES:

- Full differential readout
- Monolithic multi-element sensor
- Single, controlled output GaAlAs light source
- Up to 1,000 lines/inch (Analog)
  Digital output CP-045-XXXX up to 1400 lines/inch
- Temperature compensation circuit
- Simple installation with one-screw gap adjustment
- Optional complementary outputs
- Single polarity power supply
- TTL index (second index optional)

- Copying Machines
- Medical Equipment
- Factory Automation Systems
- Robotics
- XY Plotters

CM300/350 Series

Brushless DC Motor or Torquer/Optical Encoder



FEATURES:

ENCODER:

- Full differential readout
- Monolithic Multi-Element Sensor
- Single, controlled output GaAlAs Light Source
- Up to 1,000 lines/turn (Analog)
- Digital output up to1500 counts/turn
- Single Polarity Power Supply
- Replaces 39mm square stepper motors

APPLICATIONS:

- Disk Memory Systems (magnetic, 5.25″ half-high & 3.5″ formats)
- Optical Disk systems
- Incremental Motion systems

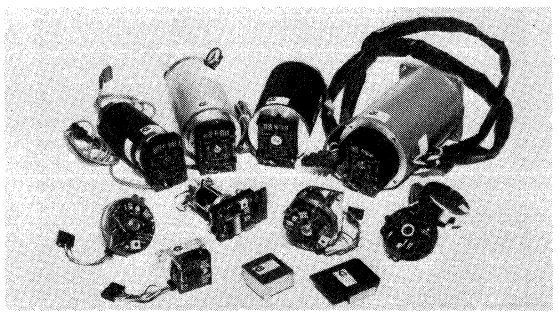
MOTOR:

- Rare-earth Magnets
- Excellent torque linearity
- Compact design
- Easy to use

OPTIONS

MOTOR
—Two, three or four phase windings for full rotation
—Wide choice of coil resistances
—Different mounting configurations

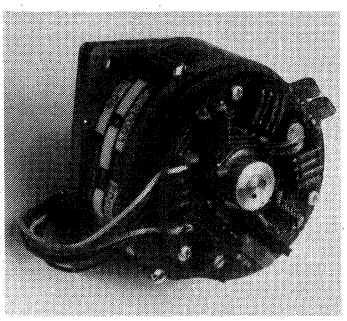
ENCODER
—Index (TTL compatible)
—Different connectors
—Wide range of output voltages
—Output waveform around zero volt



PROVEN PERFORMANCE IN HUNDREDS OF THOUSANDS OF WINCHESTER DISK DRIVES, PRINTERS, PLOTTERS, MEDICAL AND OTHER EQUIPMENT AND APPLIANCES

CM 400/450 Series

Encoder/Torquer



FEATURES:

ENCODER:

- Push-Pull Readout system
- Monolithic multi-element sensor
- Single, controlled output GaAlAs LED light source
- Outstanding repeatability
- Up to 2500 counts/turn, infinite resolution.

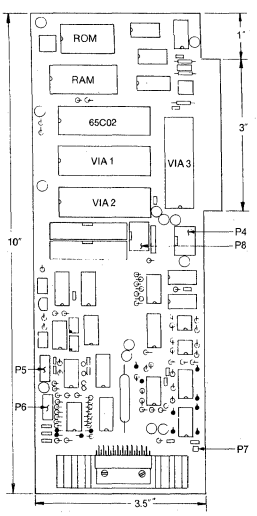
APPLICATIONS:

- Disk memory systems
- Robotics

MOTOR:

- Rare-earth Magnets (neodymium or samarium-cobalt)
- Excellent torque linearity
- Compact design
- Easy to use
- High torque/inertia ratio

CP 530 Motor Controller



FEATURES:

- Complete positioning system with constant velocity, deceleration ramp and analog position locking (detenting) and all necessary schematics and firmware listings
- 1200 baud RS 232 interface
- ROM based monitor and command interpreter
- 32 Kbytes RAM available to download positioning and test routines
- ±15 V, +5V power supplies, motor runs off +15 V only
- Smooth 128:1 speed range
- Simple, quadrature incremental optical encoder for full control
- Continuous velocity information (unavailable with strictly digital systems)
- True detenting (no "one bit jitter")
- No Hall switches needed for commutation of BDC motors
- Detent discrete position resolution is 512 times encoder resolution
- Current capacity: max 2 amps, short circuit protected

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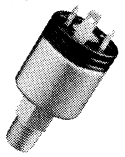
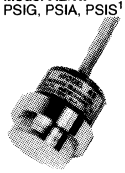
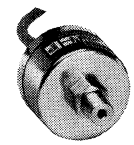
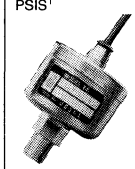
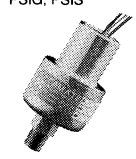
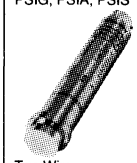
Features

- Pressure ranges: 0–5 to 20,000 PSI
- Output: voltage, frequency, or current
- A unique design that puts stainless steel in contact with your pressure media
- Up to 2× rated pressure without damage; up to 10× rated pressure without bursting
- Full calibration and temperature compensation
- Unit-to-unit interchangeability: ± 1%
- Some models rated intrinsically safe

	MEDIAMATE PSIG	**Model AB/HP** PSIG, PSIA, PSIS[1]	**Model AB** PSIG, PSIA, PSIS[1]	**Models EA & EAF** PSIG	**Model SA** PSIA, PSIS[1]	**Model ES** PSIS[1]	**DATAMATE** PSIG, PSIS[1]	**Model BL** PSIG, PSIA, PSIS[1]
	 Compact Size	 High Performance[2]	General Purpose[2]	Rugged OEM Style	 Sealed Absolute	 Sealed	 Two-Wire Transmitter	 Two-Wire Transmitter[2]
Pressure Range	0–15, 25, 50, 100, 200, 500, 1000, 5000	0–6, 15, 25, 50, 100, 200, 500, 1000, 2000, 3000, 5000, 10,000, 15,000, 20,000	0–6, 15, 25, 50, 100, 200, 500, 1000, 2000, 3000, 5000, 10,000, 15,000, 20,000	0–6, 15, 25, 50, 100, 200, 300, 500, 1000, 2000, 5000	0–15, 25, 50, 100, 200, 500, 1000, 3000, 5000	0–100, 200, 300, 500	0–15, 25, 50, 100, 200, 500 1000, 3000, 5000	0–5, 15, 25, 50, 100, 200, 500, 1000, 2000, 3000, 5000, 10,000, 20,000
Accuracy[3]	± 1% span	To ± 0.25% span	± 1% span	± 1% span	± 1% span	± 1% span	± 1% span	± 1% span
Signal Output	0 to 50 mV	0 to 100 mV	0 to 100 mV	1 to 6 Vdc 1 to 6 kHz	1 to 6 Vdc	1 to 6 Vdc	4 to 20 mA	4 to 20 mA
Excitation Voltage	5 Vdc rec	5 Vdc rec 6 Vdc max	5 Vdc rec 6 Vdc max	8 to 20 Vdc 10 to 20 Vdc	9 to 20 Vdc	9 to 20 Vdc	12 to 45 Vdc	14 to 50 Vdc
Operating Temperature Range	−40°F to 257°F	−65°F to 200°F	−65°F to 200°F	−67°F to 257°F −40°F to 185°F	−67°F to 257°F	−67°F to 221°F	0°F to 212°F	0°F to 200°F
Compensated Temperature Range	30°F to 180°F	30°F to 160°F	30°F to 130°F	30°F to 185°F	30°F to 185°F	30°F to 185°F	30°F to 130°F	30°F to 130°F
Thermal Effect on Zero[4]	Less than ± 1% span	Less than ± 1% span	Less than ± 5% span	Less than ± 1% span	Less than ± 1% span	Less than ± 1% span	Less than ± 1% span	Less than ± 2% span
Thermal Effect on Span[4]	Less than ± 1%	Less than ± 1%	Less than ± 2%	Less than ± 1%	Less than ± 1%	Less than ± 1%	Less than ± 1%	Less than ± 1%

Transducer Instrumentation

Two meters are available: the versatile Intelligent Monitor/Control (IMC) and the low-cost PL-1.

IMC

Internal power supply ▪ Models available to match all transducers ▪ Two independent alarm circuits ▪ 4-digit/ self-calibration ▪ zero and span adjustments ▪ memory ▪ user access code ▪ voltage, current, or serial output

PL-1

Used with EA, ES, SA ▪ low cost ▪ zero and span adjustments

Talk to us about your special needs in the areas of:
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We'll help you solve your pressure measurement problems.

[1] PSIS-pressure measured with reference to an internal chamber sealed at normal atmospheric pressure.

[2] Various adapters with threaded ports available for ease of installation.

[3] Includes effects of non-linearity, hysteresis, and repeatability.

[4] Specification applies to any 100°F range within the compensated temperature range.

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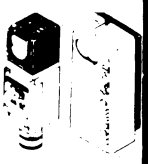
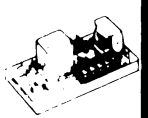
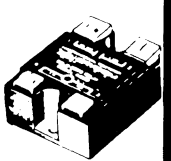
TOGGLE SWITCHES

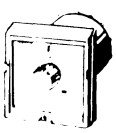

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS


TEMPERATURE CONTROLS

TIMERS

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IVO
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Omron
Redington
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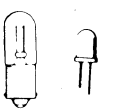
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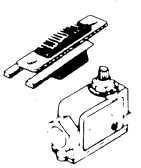
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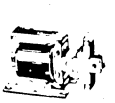
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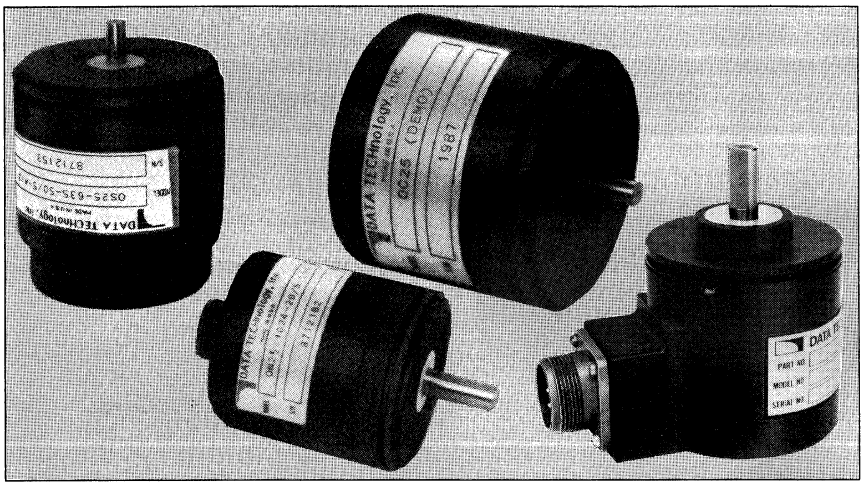
Data Technology... *a leader in the encoder field, offers a wide range of encoder products that are ideally suited for today's demanding applications.*



Industrial

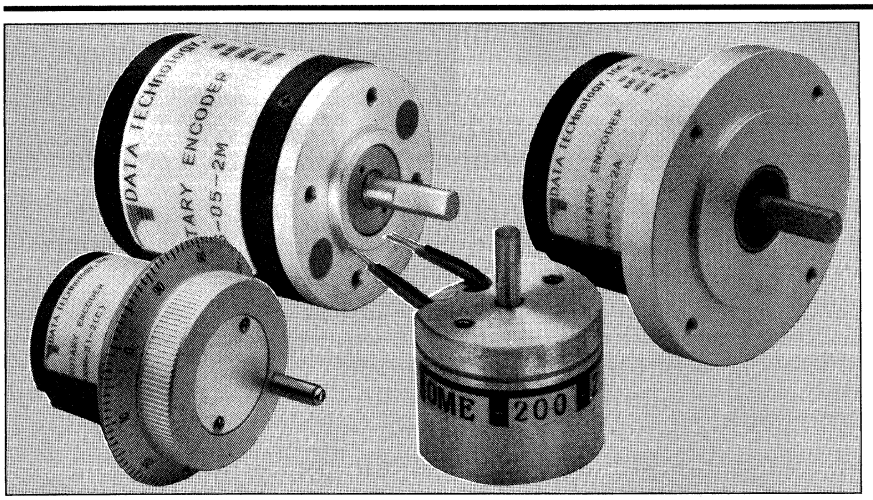
Benefits and Features

Superior operating speed–100 kHz standard frequency inclusive of A, B and Z outputs. High accuracy with tight phase relationship–90 degrees ± 22.5 degrees quadrature output and 180 degrees ± 9 degrees symmetry. High resolution–line counts up to 5400 CPR (actual lines on disc), 86,400 PPR with internal multiplication.

Instrument Grade/ Modular

Benefits and Features

Precision surface mount technology. Single LED and monolithic array of differentially connected photo sensors. Up to 100 kHz standard frequency inclusive of A, B and Z outputs. Resolution up to 2000 pulses per revolution.



SEC Series

Benefits and Features

Wide variety of models available within this series providing countless solutions to your application requirements. Countless size configurations, line counts and options to choose from. The OSS, OES and FES encoders, for example, range from 1.18″ to 1.654″ are built with performance and price in mind.

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Industrial

The Optecon Series has four configurations from light to heavy duty application requirements. The Optecon offers a wide variety of standard and special options and delivers 5400 CPR (up to 86,400 PPR with internal multiplication) with 100 kHz frequency response. The DT25 Heavy Duty Industrial Encoder offers complete protection against contamination. It is constructed to withstand heavy shock and vibration and to reliably operate over a wide temperature range. The MS58 Metric Encoder has been designed for industrial automation applications in which a metric size encoder is necessary.

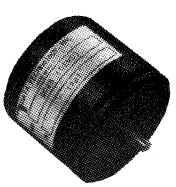
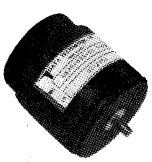
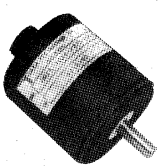
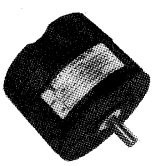
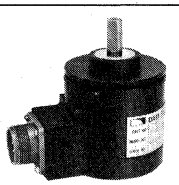
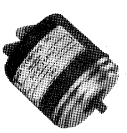
Instrument Grade/Modular

The RS23L Instrument Quality Encoder is specified where high volume and price is a concern. The RS23L is available with options normally found in higher priced encoders. The M20 Modular Encoder is designed for applications in which it is desired to mount the encoder directly on an existing shaft. The M20 offers a unique design with its wide air gap of .010". The SM23 Low Cost Multipurpose Encoder was designed for high volume low cost O.E.M. application requirements.

The Sec Series

The SEC Series, the latest addition to our encoder line, consists of a wide variety of models from very small micro encoders to large industrial encoders. 3 models are 1.654" in diameter and less, manual pulse generators, hollow shaft encoders, absolute encoders, etc. are all standard within this series. The SEC Series provides countless solutions to your application requirements.

Industrial Series Specifications

		 OC25	 OS25	 ON25	 ON35	 DT25	 MS58
Resolution		1-5400 cpr	1-5400cpr	1-5400cpr	1-5400cpr	1-5400cpr	1-5000cpr
		*86,400 pulses per revolution with internal multiplier					
Shaft Load:	**Radial**	12 lbs	12 lbs	35 lbs	35 lbs	35 lbs	53 N
	Axial	12 lbs	12 lbs	35 lbs	35 lbs	35 lbs	53 N
Shaft Diameter		0.250"	0.250"	0.375"	0.375"	0.375"	6mm
Operating Temperature		−18−+71°C	−18−+71°C	−18−+71°C	−18−+71°C	−18−+71°C	−18−+71°C
Frequency Response		100 kHz	100 kHz	100 kHz	100 kHz	100 kHz	100 kHz
Illumination Source		**Single GaAlAs LED to be stated for all					

* This statement applies to all units in the industrial series except the MS58
** This statement applies to all units in the industrial series

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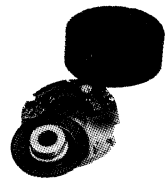
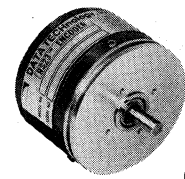
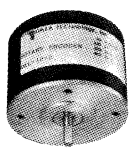
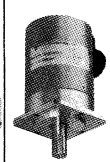
Instrument Grade/Modular Series Specifications

		SM23	 M20	 RS23L
Resolution		1-2000 ppr	1-1270 ppr	1-2000 ppr
Shaft Load:	**Radial**	5 lbs	n/a	5 lbs
	Axial	5 lbs	n/a	5 lbs
Shaft Diameter		0.250"	n/a	0.250"
Starting Torque		0.05 oz-in	n/a	0.05 oz-in
Operating Temperature		– 10 to + 65°C	0 to + 70°C	– 10 to + 65°C
Frequency Response		100 kHz	50 kHz	100 kHz
Illumination Source		Single Infrared Emitting Diode (IRLED)		

SEC Series Specifications

	OSS	OES	FES	 OEL	OEN	OPN	OEK	 NE	OGM/OSM	SBR	AES	OME/OMS
Resolution	60-500 CPR	100-1024 CPR	100-1024 CPR	100-1200 CPR	100-2500 CPR	100-2500 CPR	5-360 CPR	1000-2500 CPR	25 or 100	100-2500 CPR	360 CPR	50-360 CPR
Output Signals	A quad B	A quad B and Z	A quad B and Z	A quad B and Z	A quad B and Z	A quad B and Z	A quad B	A quad B and Z with Driver and compliments	A quad B	A quad B and Z	NPN transistor	A-B 90° ±45°
Output Circuit	Pull up resistor or open collector	Pull up resistor or open collector	Pull up resistor or open collector	Pull up resistor, open collector or line driver	Pull up resistor or open collector	Open collector	Pull up resistor	SN75113	Pull up resistor	Open collector	BCD parallel	Near Sine
Input Voltage	+4.5 VDC to +26.4 VDC	+4.5 VDC to +26.4 VDC	+4.5 VDC to +26.4 VDC	+4.5 to +13.2 VDC or 5 VDC	+4.5 VDC to +26.4 VDC	+10.8 to +26.4 VDC	+4.5 to +13.2 VDC	+5 VDC	+4.5 to +13.2 VDC	+5 VDC	+12 VDC	60ma
Frequency Response	30 KHz	Up to 60 KHz	Up to 60 KHz	60 KHz	100 KHz	100 KHz	10 KHz	150 KHz	10 KHz	100 KHz	—	10 KHz

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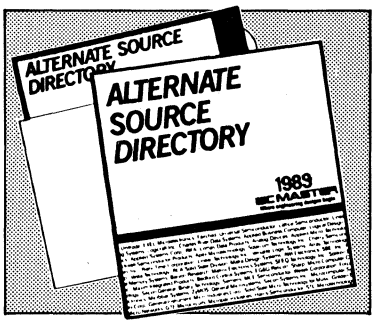

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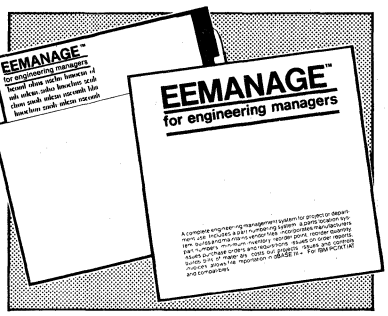

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Optical Incremental Encoders

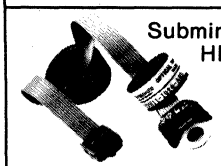
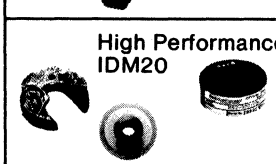
DISC INSTRUMENTS specializes in providing modular, enclosed, and panel mounted optical incremental encoders for position and velocity sensing applications. These encoders feature an exceptionally accurate quadrature output, minimal PM error, high frequency response, minimal edge jitter and low power consumption. These characteristics, combined with long term stability, makes these encoders ideal for a wide variety of motion control loop applications.

Keyed to the high performance and low cost features of these encoders is the incorporation of DISC's integrated optoelectronic technology. The sensor array and the optoelectronic signal processing integrated circuits are mounted on a .40" square hybrid circuit. All passive components are surface mounted on a printed wiring board.

High reliability and accuracy are assured by the use of state of the art robotic equipment to perform most of the encoder assembly and the use of resistor laser trimming for its calibration. Reduced component count due to the integrated optoelectronic circuitry also greatly enhances reliability.

Standard encoders do not always meet specific design requirements. For this reason, DISC INSTRUMENTS has developed an in-house optics shop, machine shop, prototype shop, and life testing lab in order to develop encoders to meet unique applications requirements.

Modular Encoders

	OUTPUT FORMATS	PULSES PER REVOLUTION	FREQ RANGE (kHz)	INPUT VOLTAGE (VDC)	INDEX OPTION	HUB SIZE	OUTLINE DIMENSIONS INCHES
 Subminiature HDM-11	Squarewave Quadrature TTL/CMOS compatible	Up to 500	w/o index DC to 100 w/index DC to 50	5	Yes	.1247 in., .1562 in. 2mm, 3mm	1.10D x .60L
Miniature HDM-15	Squarewave Quadrature TTL/CMOS compatible	Up to 1024	w/o index DC to 100 w/index DC to 50	5 12	Yes	.1247 in., .1562 in. .1872 in., .2497 in. .3122 in., .3747 in. 4mm, 6mm 8mm	1.50D x .60L
General Purpose HDM-20	Squarewave Quadrature TTL/CMOS compatible	Up to 2500	w/o index DC to 100 w/index DC to 50	5 12	Yes	.1562 in., .1872 in. .2497 in., .3122 in. .3747 in., .4372 in. .4997 in. 4mm, 6mm 8mm, 10mm	2.20D x .65L
Low Cost LDM20	Squarewave Quadrature TTL/CMOS compatible	Up to 250	DC to 100	5	No	.2497 in., .3747 in. .4372 in., .4997 in. 4mm, 8mm	2.20D x .65L
 High Performance IDM20	Squarewave Quadrature TTL/CMOS Line Driver Option	Up to 2500	w/o index DC to 100 w/index DC to 50	5 12 15	Yes	.2497 in., .3747 in. .4372 in., .4997 in. 6mm, 8mm 10mm, 12mm	2.23D x .79L

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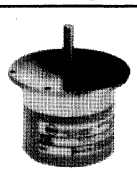
Panelcoder Series

	OUPUT FORMATS	PULSES PER REVOLUTION	INPUT VOLTAGE (VDC)	OUTER DIAM. (IN.)	DEPTH BEHIND PANEL (IN.)	SHAFT DIAM. (IN.)	SHAFT LENGTH (IN.)
PC10C	Squarewave Quadrature TTL/CMOS compatible	5, 24, 64, 100, 120	5	1.0	.68	.2497	.25
PC10N	Squarewave Quadrature TTL/CMOS compatible	5, 24, 64, 100, 120	4.5 to 16	1.0	.50	.2497	.25
PC62	Squarewave Quadrature TTL/CMOS compatible	10, 40, 60, 100, 120, 127, 180, 200, 250, 256	5	1.5	1.08	.2497	.48

Enclosed Encoders

	OUTPUT FORMATS	PULSES PER REVOLUTION	FREQ RANGE (kHz)	INPUT VOLTAGE (VDC)	INDEX OPTION	SHAFT DIAM. (IN.)	OUTLINE DIMENSIONS INCHES
Subminiature Series E11	Squarewave Quadrature TTL/CMOS	100 to 1200	Data DC to 100 Index DC to 50	5, 12 or 15	Yes	.1247	1.062D x 1.10L
Miniature Series E15	Squarewave Quadrature TTL/CMOS Line Driver Option	100 to 1200	Data DC to 100 Index DC to 50	5, 12 or 15	Yes	.1247 or .2497	1.50D x 1.50L
General Purpose Series HDE23	Squarewave Quadrature TTL/CMOS compatible Line Driver Option Open Collector Option	80 to 3710	Data DC to 100 Index DC to 50	5, 12 or 15	Yes	.2497	2.25D x 1.56
Heavy Duty Series HDE25	Squarewave Quadrature TTL/CMOS compatible Line Driver Option Open Collector Option	5 to 5000	Data DC to 100 Index DC to 50	5, 12 or 15	Yes	.2498 or .3748	2.50D x 2.5L
Low Cost EC82 	Squarewave Quadrature TTL/CMOS compatible	20 to 1024	DC to 50	5, 12 or 15	No	.2497	2.75D x 1.88L

SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States (ANSI) American National Standards Institute

United States (NEMA) National Electrical Manufacturers Association

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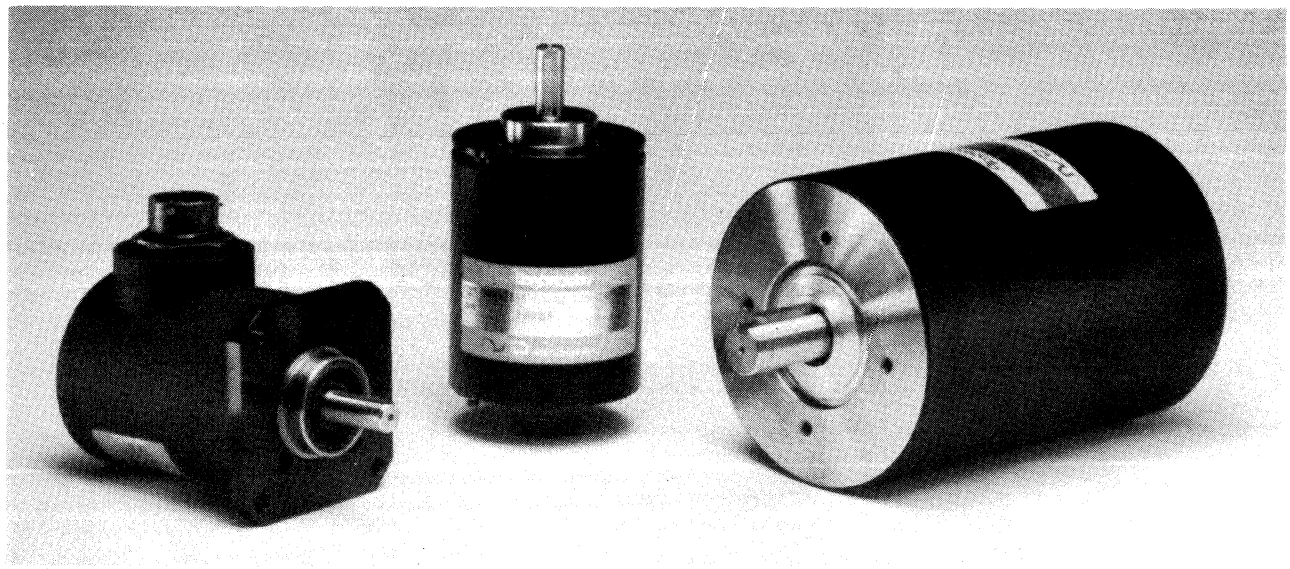
ABSOCODER®... a new leader in absolute position sensors.

VRB Series and MRB Series



Designed to replace absolute encoders, the Built-In Converter (BIC)-type Absocoder® is a variable-reluctance sensor based on measuring changes in magnetic resistance. This rugged absolute-position sensor contains no optical discs, LED's or brushes; it provides reliability and long service life in the harshest of environments.

The VRB series offers two models; 2.5 inch and 4 inch diameter. The 4 inch unit can be geared up to 100:1.

The MRB series is a multiple sensor unit. It offers up to 4096 bits/rev. over 32, 64, or 128 total revolutions.

KEY FEATURES

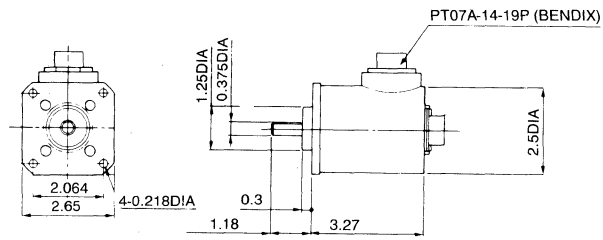
- Popular output codes: Binary 4096, Gray binary 4096, BCD 1000 (VRB and MRB models); Gray-binary 360, BCD 3600 (VRB model)
- Source or sink output transistors, positive or negative logic
- Short circuit and reverse voltage protection safeguard electronics
- Unique circuit board enables shock resistance over 300 G's

SPECIFICATIONS:

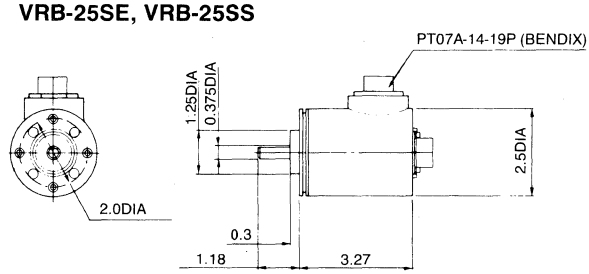
Input Power	24VDC ± 10%; 80mA max.
Output Ratings	7 - 50VDC max.; 50mA max. (continuous)
Output Logic	Source type transistor (standard); Sink type open-collector transistor available
Output Data	Updated every 100usec.; data frozen 15usec. after DTC signal is applied
Number of Revolutions	1 (VRB-25) 1, 2, 3, 4, 8, 12, 16, 24, 32, 48, 64, 100:1 (VRB-40) 32, 64, 128, (MRB-40)
Operating Speed	5,000 rpm max.
Vibration Resistance	20 G's to 2,000 Hz.
Shock Resistance	300 G's for 2.5 msec.
Enclosure	NEMA 13
Operating Temperature	32 to 131° F.
Mounting Style	Flange or servo mount (VRB-25) Face mount (VRB-40 and MRB-40)
Connector Position	Side or end mount (VRB-25) End or conduit mount (VRB-40 and MRB-40)
Rotation Direction	CW or CCW selectable

DIMENSIONS:

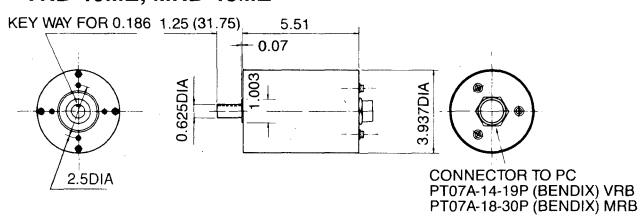
VRB-25FE, VRB-25FS



VRB-25SE, VRB-25SS



VRB-40ME, MRB-40ME



For further information on ordering and pricing of the BIC, and our entire product line contact:

ENPROTECH CORP.
445 W. Michigan Ave., Kalamazoo, Michigan 49007
616-381-0665 FAX: 616-381-9810

Absocoder is a registered trademark of the manufacturer, NSD Corporation

The advantages of being tiny.

At Entran, we've solved most of the problems you might encounter with pressure transducers by making them tiny. And nowadays, tiny is the state-of-the-art.

Being tiny means you don't interfere with the integrity of the system being measured.

Being tiny means less measuring surface to bear loads, and a more compact solid state density with no moving parts.

Being tiny means being insensitive to acceleration, vibration and shock, so you get flat pressure readings, both static and dynamic.

And, being tiny means greater handling ease in hard-to-get-at places. Which adds up to more applications flexibility.

Entran pressure tranducers can usually be interfaced directly with scopes, recorders and milliammeters.

Our transducers come complete and ready to use. All you need supply is the excitation voltage on two leads and read output on the other two leads.

All units give you direct linear output in millivolts/psi and read both static and dynamic pressures. There's no need for charge or voltage amplifiers. Calibrations are traceable to The National Bureau of Standards.

Write Entran Devices, Inc., 10 Washington Ave., Fairfield, N.J. 07006 (201) 227-1002, Telex 130-361.

$360.00

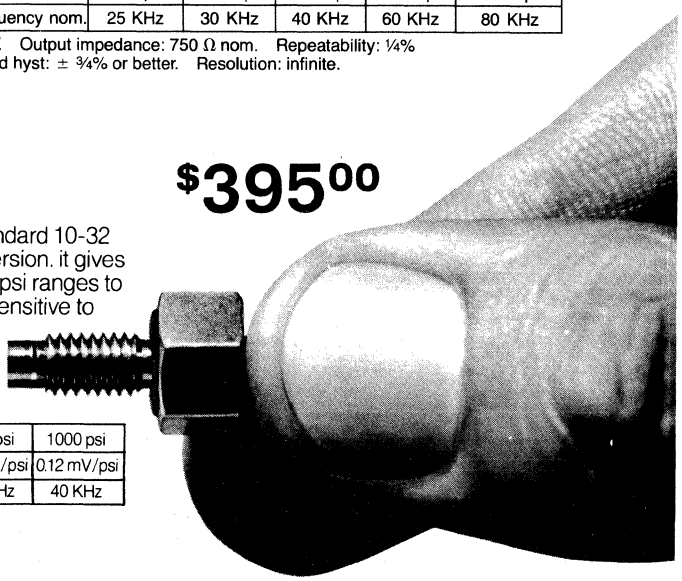
Must not be used in water or corrosive medium.

Only 0.080 in diameter (that's tiny), EPI-080.

This solid-state pressure transducer is 0.080" in diameter, 0.25" in length and occupies a volume of only 0.0013 cubic inches. Yet it gives accurate static and dynamic pressure readings like the big ones do. Its atomically bonded, diffused diaphragm with leads attached to the non-active area make this device virtually insensitive to acceleration, vibration and shock.

Typical ranges	25 psi	50 psi	100 psi	250 psi	500 psi
Sensitivity nom.	3mV/psi	1.8mV/psi	1.0mV/psi	0.4mV/psi	0.2mV/psi
Useful frequency nom.	25 KHz	30 KHz	40 KHz	60 KHz	80 KHz

Excitation: 5V. Output impedance: 750 Ω nom. Repeatability: ¼%
Non linear and hyst: ± ¾% or better. Resolution: infinite.



$395.00

Tiny but easy to handle, EPX-10

This easy to install pressure transducer is built with standard 10-32 UNF thread and is available in an optional M5 metric version. it gives flat pressure readings static and dynamic, in 5 to 5,000 psi ranges to as high as 90KHz. Has infinite resolution and is also insensitive to acceleration, vibration and shock. Made of stainless steel, and with its built-in "O" ring seal can be screwed in just about anywhere. However, for corrosive or water usage, order our "welded" version.

Typical ranges	5 psi	50 psi	100 psi	250 psi	1000 psi
Sensitivity nom.	3 mV/psi	1.5mV/psi	1.2 mV/psi	0.5 mV/psi	0.12 mV/psi
Useful frequency nom.	9 KHz	15 KHz	15 KHz	20 KHz	40 KHz

Combined non-linear and hyst: ± 1% below 100psi, ½% above 100 psi.
Excitation: 10V. Output impedance: 350 Ω nom.
Repeatability: 0.25%. Thread length: 7/16".

Entran® Pressure Transducers.

(Today, miniature makes sense.)

FAX (201) 227-2865
For Technical Assistance & Customer Service Call 1-800-635-0650
Fast Delivery? Request Our New Off The Shelf Catalog

The advantages of being tiny.

At Entran we build a line of accelerometers that can best be described as tiny.

Being tiny means you don't interfere with the integrity of the system being measured.

Being tiny gives you greater handling ease in hard-to-get-at places, which adds up to more applications flexibility. And, being tiny means less mass to distort your test scale, more room for other instruments. All at no sacrifice in test data.

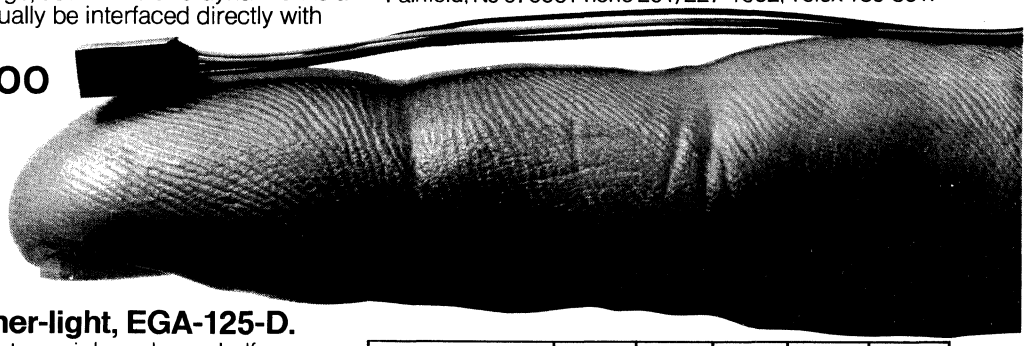
Entran accelerometers give you high output, low impedance readings, both static and dynamic. As a result they can usually be interfaced directly with scopes, recorders and milliammeters.

Entran accelerometers come complete and ready to use. All you supply is the excitation voltage on two leads and read output in millivolts on the other two leads.

All units give you direct linear output in millivolts/g and read both static and dynamic acceleration. There's no need for charge or voltage amplifiers. Calibrations are traceable to The National Bureau of Standards.

Write Entran Devices, Inc., 10 Washington Ave., Fairfield, NJ 07006 Phone 201/227-1002, Telex 130-361.

$379.00



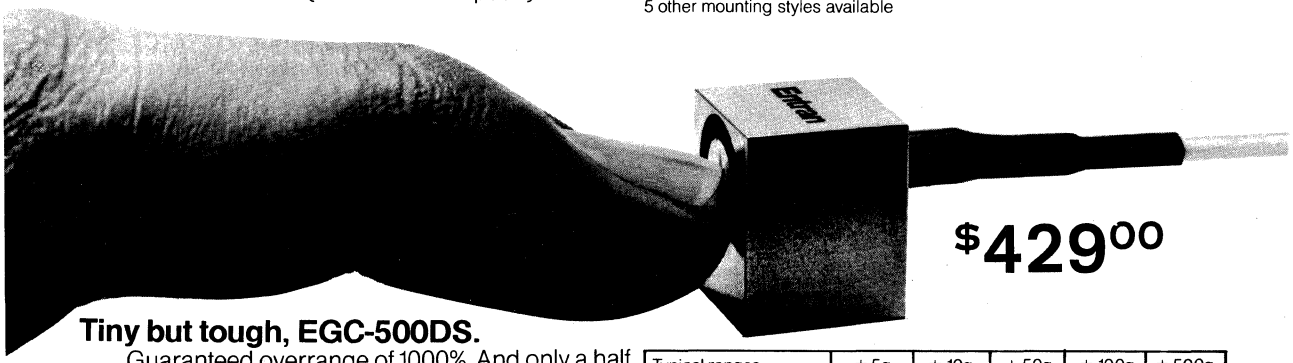
Tiny and feather-light, EGA-125-D.

This accelerometer weighs only one half a gram. Is less than 0.006 cu. inches in volume. Yet gives you static & dynamic readings of acceleration, vibration and shock. And comes with .7 critical damping to eliminate resonance. ("D" is for "damped.")

Typical ranges	± 5g	± 10g	± 50g	± 100g	± 500g
Sensitivity nom.	15 mV/g	12 mV/g	4 mV/g	2.5 mV/g	0.5 mV/g
Useful frequency nom.	150 Hz	200 Hz	500 Hz	600 Hz	1200 Hz

Excitation: 15V, Weight: ½ gram without leads, Non-linearity: ± 1%

5 other mounting styles available



$429.00

Tiny but tough, EGC-500DS.

Guaranteed overrange of 1000%. And only a half inch cube to boot.

Static & dynamic measurements of acceleration, vibration and shock in ranges from 5 to 1,000 g. Fully damped to eliminate resonance and fitted with mechanical stops to impede overload response.

Typical ranges	± 5g	± 10g	± 50g	± 100g	± 500g
Sensitivity nom.	25 mV/g	20 mV/g	4 mV/g	2 mV/g	0.4mV/g
Useful frequency	150 Hz	200 Hz	600 Hz	1000 Hz	1500 Hz

Excitation: 15V, Weight: ½ gram without leads, Non-linearity: ± 1%

Output impedance: 450 Ω nom., Input impedance: 1000 nom.

Size: 0.5" × 0.5" 0.6" width, 10-32UNF tapped hole

Entran Accelerometers.

(Today, miniature makes sense.)

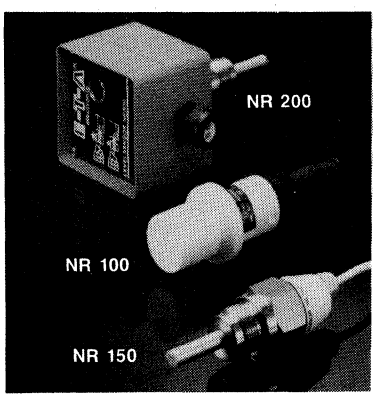
FAX (201) 227-2865

For Technical Assistance & Customer Service Call 1-800-635-0650

Fast Delivery? Request Our New Off The Shelf Catalog

E-T-A® electronic

LEVEL SENSORS



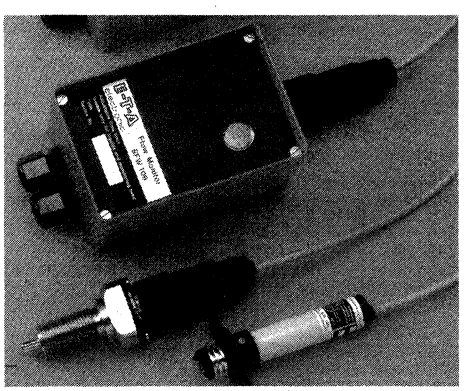
Level Sensors NR 150 and NR 200 are fully electronic and have no moving parts (except the output relay in model NR 200). Model NR 100, with Teflon® sensor head is also offered for food industry applications. The devices operate on the capacitance principle. A tunable oscillator circuit is ON when the probe is immersed, keeping the output conductive (relay output NR 200, transistor output NR 150). The indicator LED is now lit. When the level drops below the sensor position, the LED will extinguish and the output relay will drop out. Transistor output of model NR 150 is now non-conductive.

Technical Data

	NR 150	NR 200
Supply Voltage	DC 24V ± 15% reverse polarity protected	AC 115V + 10 − 15%

	NR 150	NR 200
Power Consumption	1 Watt max	4 VA max
Output	PNP transistor, DC 24V/0.3A Cont. load max., 1.5V drop approx. Integral suppression diode for short circuit protection.	Relay, SPDT contacts max 5A at AC240V or DC24V. Higher DC contact voltages up to DC100V are permissible but load must not exceed 120W
Ambient Temperature	−20°C to +85°C (−4°F to +185°F	−20°C to +85°C (−4°F to +185°C)
Medium Temperature	−20°C to +85°C (−4°F to +185°F) up to +100°C (+212°F) intermittent	−20°C to +85°C (−4°F to +185°F) up to 100°C (+212°F) intermittent
Environmental Protection	Electronic portion splash water/dust proof	Electronic portion splash water/dust proof
Probe Pressure Resistance	10 bar (147 PSI)	10 bar (147 PSI)
Terminations	Cable, 2m (6ft.)	Terminal block
Materials: probe fitting cover housing	Tefzel V2A Delrin –	Tefzel V2A Alu, black anodized ABS
Switch Point Hysteresis (probe mounted horizontally)	9mm (0.35in) max, equivalent to probe diameter	9mm (0.35in) max, equivalent to probe diameter
Fittings	Stainless Steel ¾" NPT	Stainless Steel ¾" NPT
Probe Diameter	9mm (0.35")	9mm (0.35")
Dimensions Overall length (incl. sensor) Housing	133mm (5.24") –	154.5mm (6.10") 82.5mm (3.25") x 80.5mm (3.17")

FLOW MONITORS



The E-T-A range of Electronic Flow Monitoring Systems has been designed to supervise the flow rate of gases and liquids in pipelines. There are no moving parts in the flow stream, thus these systems are particularly suitable for liquids of high viscosity or containing particles in suspension. Corrosion resistant monitoring heads are also available for aggressive liquids/gases.

Typical applications for E-T-A Flow Monitors include the control of lubricating, hydraulic and cooling systems and the requirements of the petrochemical, food processing and brewing industries when flow control is often associated with the correct dosage of ingredients.

The systems operate on the calorimetric principle i.e. heat transfer between two probes is detected as a function of flow rate.

	SFW 109	SLW 107	SFW 108	SLW 112
For liquids	●		●	
For air/gas	●	●		
For air only				●
Separate control unit and monitoring head	●			
Integral unit combining control unit and monitoring head		●	●	●
Miniaturized designed for mounting directly in flow stream				●
220/240 V.A.C. input	●	●	●	
115 V.A.C. input	●	●	●	
24 V.A.C. or D.C. input	●	●	●	●

E-T-A®
ELECTRONIC
PRODUCTS GROUP

7400 N. CRONAME RD.
CHICAGO, ILLINOIS 60648
TEL: (312) 647-8303
FAX: (312) 647-7494

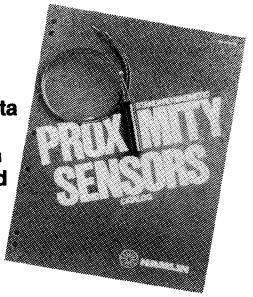
PROXIMITY SENSORS

HAMLIN

HAMLIN INC.
612 East Lake Street
Lake Mills, WI 53551
Phone 414/648-2361 • FAX 414/648-5244

The heart of all Hamlin magnetic proximity sensors is a precious metal contact reed switch, sealed in a glass envelope for environmental integrity and dependability. When a magnetic actuator is placed within a prescribed proximity of the sensor, the switch contact changes state. Their cost is far below inductive or capacitive proximity sensors and they require no power to operate and provide a switch closure output.

For detailed product information request the Hamlin Magnetic Proximity Sensor Catalog. The 16 page brochure provides complete data about Hamlin's broad family of standard Magnetic Proximity Sensors plus application and design recommendations. Also included are dimensions, electrical specifications and operation characteristics.



SPECIFICATIONS

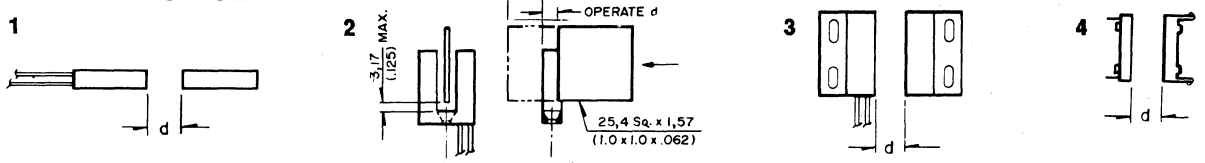
Initial Contact Resistance (Max.)... 0.200 Ohms (except 59045-010-0.250 Ohms)
Typical Operate Time.....1.000ms
Shock W/O False Operation.....100 G's, 11ms, 1/2 sine wave
Operate & Storage Temp..... -40°C to +105°C
Operation Life (Typical) ..... 50,000,000 @ 5Vdc, 10ma.
5,000,000 @ 120Vdc, 75ma.

ORDERING INFORMATION

SENSOR NUMBER	OPERATE POSITION	CONTACT RATING	SWITCHING VOLTAGE	MUST OPERATE DISTANCE	MUST RELEASE DISTANCE	TERMINATION OR WIRING	SENSOR LIST PRICE	MATCHING ACTUATOR	ACTUATOR LIST PRICE
59025-010	1	10W	200Vdc	.200	.550	12" PVC Leads	$3.50	57025-000	$2.80
59045-010	4	3W	150Vdc	.110	.275	PCB Pins	3.25	57045-000	2.60
59050-010	4	10W	200Vdc	.200	.450	PCB Pins	3.00	57050-000	2.40
59065-010	1	10W	200Vdc	.200	.550	12" PVC Leads	4.50	57065-000	3.60
59070-010	1	10W	200Vdc	.200	.550	12" PVC Leads	4.50	57070-000	3.60
59085-010	2	10W	200Vdc	.060	1.100	12" PVC Leads	8.75	Vane	
59105-010	3	10W	200Vdc	.225	.500	Connector	4.15	57105-000	3.35
59125-010	3	10W	200Vdc	.225	.500	Pins	4.15	57125-000	3.35
59135-010	3	10W	200Vdc	.400	1.000	12" Teflon Leads	7.35	57135-000	5.80
59140-010	3	10W	200Vdc	.225	.500	12" PVC Leads	5.10	57140-000	4.85
59145-010	3	10W	200Vdc	.275	.600	12" PVC Leads	4.15	57145-000	3.35

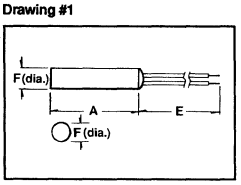
NOTE: All sensors listed are Contact Form A except for Model 59085-010 Vane Sensor.

OPERATE POSITION



DIMENSIONS

Drawing #1



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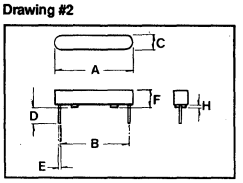

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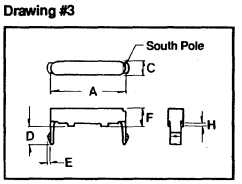

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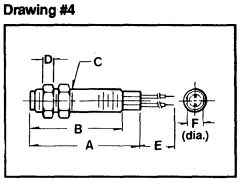

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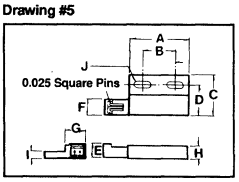

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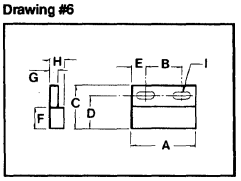

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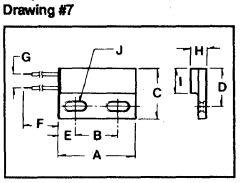

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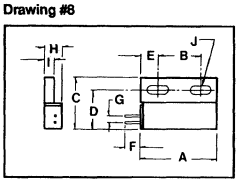
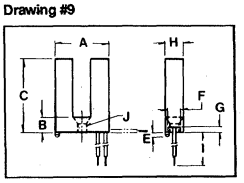


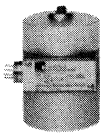
Drawing #9



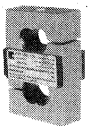
MODEL NUMBER	DESCRIPTION	DWG. NO.	A	B	C	D	E	F	G	H	I	J
59025-010	Sensor	1	1.000	—	—	—	12.0	0.245	—	—	—	—
57025-000	Actuator	1	1.000	—	—	—	—	0.245	—	—	—	—
59045-010	Sensor	2	0.700	0.600	0.130	0.115	0.017	0.170	—	0.025	—	—
57045-000	Actuator	3	0.700	—	0.130	0.160	0.250	0.170	—	0.025	—	—
59050-010	Sensor	2	0.900	0.800	0.180	0.115	0.020	0.200	—	0.025	—	—
57050-000	Actuator	3	0.900	—	0.180	0.160	—	0.200	—	0.025	—	—
59065-010	Sensor	4	1.500	1.250	5/16-24	0.187	12.0	7/32	—	—	—	—
57065-000	Actuator	4	1.500	1.250	5/16-24	0.187	—	7/32	—	—	—	—
59070-010	Sensor	4	1.500	1.250	M8x1,25	0.250	12.0	5,56mm	—	—	—	—
57070-000	Actuator	4	1.500	1.250	M8x1,25	0.250	—	5,56mm	—	—	—	—
59105-010	Sensor	5	1.125	0.625	0.750	0.562	0.260	0.288	0.375	0.250	0.135	0.125x0.308
57105-000	Actuator	6	1.125	0.625	0.750	0.562	0.250	0.375	0.135	0.250	0.125x0.308	—
59125-010	Sensor	8	1.125	0.625	0.750	0.562	0.250	0.236	0.100	0.250	0.135	0.125x0.308
57125-000	Actuator	6	1.125	0.625	0.750	0.562	0.250	0.375	0.135	0.250	0.125x0.308	—
59135-010	Sensor	7	1.125	0.625	0.750	0.562	0.250	12.0	0.200	0.250	0.375	0.125x0.312
57135-000	Actuator	6	1.125	0.625	0.750	0.500	0.250	0.375	0.135	0.250	—	0.312x0.125
59140-010	Sensor	7	0.906	0.551	0.551	0.430	0.177	12.0	—	0.236	0.296	0.126x0.150
57140-000	Actuator	6	0.906	0.551	0.551	0.430	0.177	0.296	0.118	0.236	0.126x.150	—
59145-010	Sensor	7	1.125	0.625	0.750	0.562	0.250	12.0	—	0.385	12.0	0.125x0.308
57145-000	Actuator	6	1.125	0.625	0.750	0.562	0.250	0.375	0.135	0.250	—	0.125x0.308
59085-010	Sensor	9	0.750	0.150	1.000	—	0.062	0.165	0.075	0.250	12.0	4-40 & C' Sink

HBM TRANSDUCERS

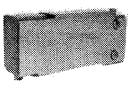
LOAD CELLS for reliable, accurate WEIGHT and FORCE measurement



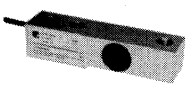
Q11 Load Cell
0-5 gm to 0-20 kg



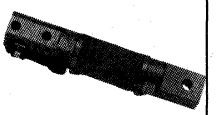
U1T Universal
Load Cell
0-50 to 0-3000 lbs



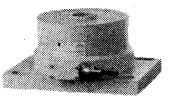
PLC Platform
Load Cell
0-2 to 0-200 lbs



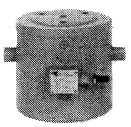
BLC Load Cell
Stainless Steel
0-1,000 to 0-10,000 lbs



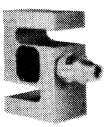
BBS Bending Beam
Load Cell
0-50 to 0-7,500 lbs.



TRT Torsion Ring
Low profile
High capacity —
to 150,000

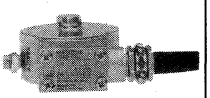


C6 Load Cells
20 to 1,000 tons



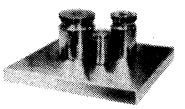
USB Universal
Shear Beam
0-200 to 0-10,000 lbs

SB3
Shear Beam
0-1,000 to
0-200,000 lbs



U2A Load Cell
Stainless - Low profile
50 kg to 50 tons

Z6 Load Cells
0-5 to 0-1,000 kg

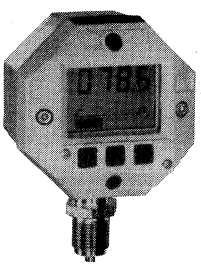


PST Platform Scale
Transducer

PRESSURE TRANSDUCERS

DIGIBAR™

PE100/200 DIGITAL PRESSURE GAUGE



Programmable gauge head can directly replace existing gauges — provides high-visibility digital pressure indication. Stores peak values-has two settable limit switches. Model PE200 provides both indication and control functions.

P3M Absolute Pressure Transducer

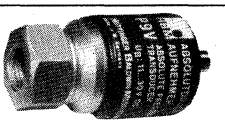
- Sensing of static and dynamic pressures
- Nine ranges from 0-10 bar through 0-3,000 bar
- Extremely compact

P42K and P42P Absolute Pressure Transducers

- Flush diaphragm—no dead volume
- Measure static and dynamic pressures
- Pressure ranges from 0-0.2 bar to 0-500 bar
- High overload capability (up to 1000%)

P8A Absolute Pressure Transducer

- Measures static & dynamic pressures
- Pressure ranges from 0-20 bar to 0-500 bar
- Extremely compact—easy to install with readily available tube fittings
- Excellent price/performance ratio

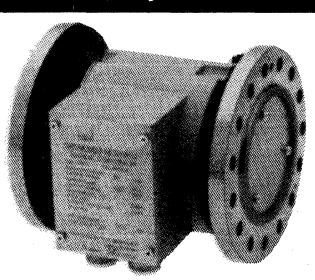


P9K Absolute Pressure Transducer

Available output of:

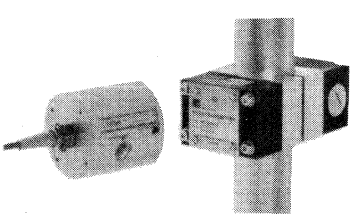
- 0-5 V and 4-20 ma.
- Pressures form 0-20 bar to 0-1,000 bar
- For measurement of static and dynamic liquid or gas pressures

TORQUE, TELEMETRY, TORSIONAL VIBRATION TRANSDUCERS



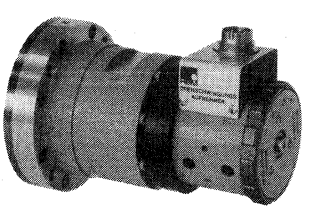
T30/T32 Torque Transducers

- No bearing between rotor and housing (Model T32 only)
- Brushless transfer of measured signals
- 9 models for nominal torques from 50 Nm to 25kNm
- Nominal speeds up to 15,000 RPM



Telemetry System for Electrical Measurements

- No wear—low maintenance
- Frequency modulation for accuracy
- Useful in aggressive environments
- Simple installation on moving equipment



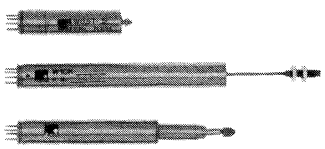
Torsional Vibration Transducer

- Measures vibration angles and rotary acceleration
- Connects to free shaft ends of machines, gear boxes, etc.
- Built in calibration feature

HOTTINGER BALDWIN MEASUREMENTS, INC., 19 Bartlett Street, Marlboro, MA 01752 • Phone (508) 624-4500 • FAX: (508) 485-7480

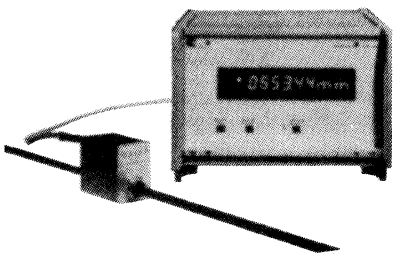
TRANSDUCERS
& Instrumentation

DISPLACEMENT TRANSDUCERS & SYSTEMS



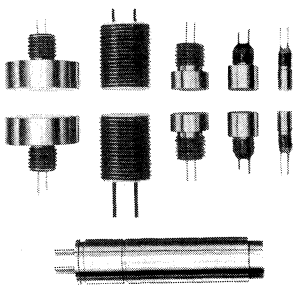
Inductive Displacment Transducers

- **Measure fast and slow movements of machine parts**
- **Detect shifts in structure and foundations**
- **Measure changes in thickness, length and other material deformations**



WMG Digital Displacement Measuring System

- **Traversing speed—15 m/s**
- **Displacement measurement up to 2 meters**
- **Resolution—10 micrometers**
- **Reference zero provides absolute repeatability**
- **Optional printer output, analog output, input for external control**



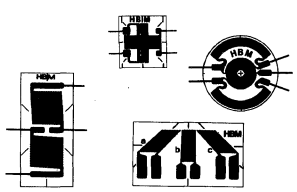
TR Contactless Displacement Transducers

- **Require little space**
- **Extremely versatile**
- **Rugged construction, protected against moisture**
- **Small mass permits measurement of vibrations, rapid accelerations and other dynamic effects**

STRAIN GAGES & ACCESSORIES

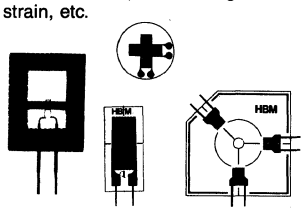
Standard Gages

Hundreds of standard foil gage types, available for immediate shipment



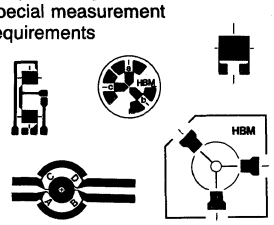
Special Gages

A broad line of special-application types including high-temperature weldable, encapsulated, high-strain, etc.



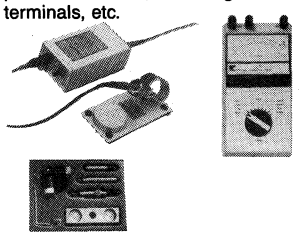
Custom Gages

HBM designes and fabricates unique configurations to meet special measurement requirements

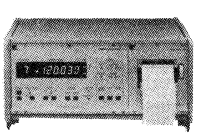


Accessories

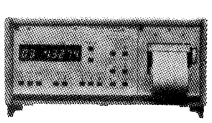
A complete range of adhesives, protective covers, soldering terminals, etc.



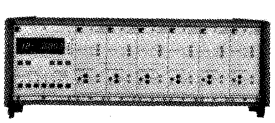
TYPICAL HBM MEASUREMENT INSTRUMENTATION



DK38 Transducer Indicator
Monitors up to 18 strain gage transducers, each with individual measuring programs



UPM40/UPM60 Scanning & Data Acquisition Systems
Manual or automatic selection of up to 40 (or 60) mixed transducers



MGT Transducer Amplifiers
Designed for continuous industrial use in harsh environments

MVD Amplifiers with Digital Indication
Low cost, digitally-indicating conditioner-amplifiers

HBM MEASUREMENT SOLUTIONS
Send Us Your Measurement Problems

HBM specializes in handling difficult and unusual measurement problems. More than two decades of experience with special measurement jobs around the world, a large staff of technical specialists and an extensive inventory of advanced sensors and instrumentation enable us to develop elegant, economical electrical/electronic solutions for monitoring and gauging real-world mechanical phenomena.

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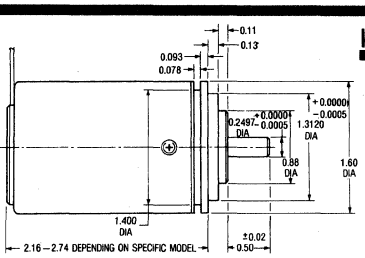
ITEK LSI MICROSERIES® ENCODERS:

USED IN MORE AND MORE TACTICAL WEAPONS SYSTEMS.

FEATURES: Large Scale Integrated Circuits • Small Size • Absolute Whole Word Output • LED Illuminators • MIL Environment: Vibration 20g, Shock 1000g – 0.8ms • High Reliability.

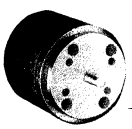
SMALL SIZE

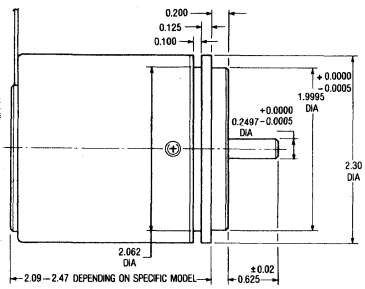


µS/16 FAMILY

HIGH ACCURACY

L, LS, LC Models	Quanta/ Revolution	Accuracy[1] (Arc Minutes)
µS13/16	8192	2.0
µS14/16	16384	1.4
µS15/16	32768	1.0





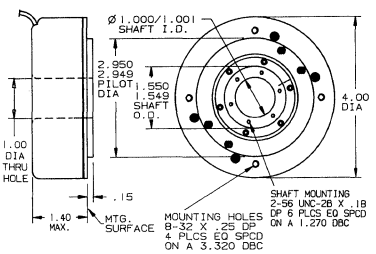
µS/23 FAMILY

L, LS, LC Models	Quanta/ Revolution	Accuracy[1] (Arc Minutes)
µS14/23	16384	1.0
µS15/23	32768	0.7
µS16/23	65536	0.5 or 0.2
µS17/23	131072	0.2
K Model		
µS12/23	4096	2.6
µS13/23	8192	1.3

PANCAKE µS/40 FAMILY

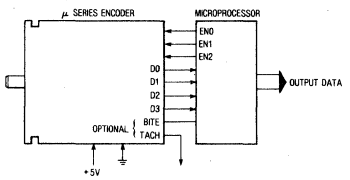
(Please consult Factory for other Pancake sizes)

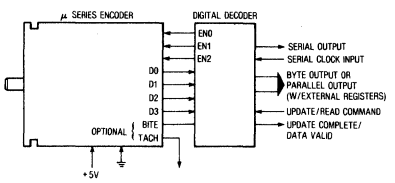
L, LS, LC Models	Quanta/ Revolution	Accuracy[1] (Arc Minutes)
µS14/40	16384	1.0
µS15/40	32768	0.7
µS16/40	65536	0.25
µS17/40	131072	0.2

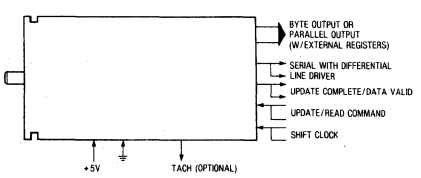


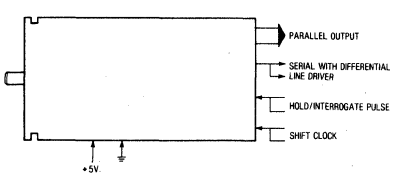
[1] Peak Transition Error of Transducer and Electronics, Excludes Quantizing Error of ½ LSB.

VERSATILE INTERFACE









L MODEL

The L model is the basic encoder configuration which outputs a 4 wire multiplexed, 3-State Logic Level MicroSeries Code Word. the encoder is addressed by 3 Enable Lines activated in a controlled sequence. This model is intended for direct interface with a user (or Itek) furnished microprocessor where the microprocessor can be programmed to perform the encoder's digital logic functions.

LS MODEL

The LS model consists of the basic L encoder (described above) and a separate Digital Decoder. The use of the external Digital Decoder is suggested when the user does not have a microprocessor available to perform the digital processing of the outputs of the L Model encoder or when the length of the LC encoder exceeds available space in the intended application. The external digital decoder also affords the user the flexibility to access the various input/output programming modes available with MicroSeries encoders. The Digital Decoder can be user programmed for three output modes: serial, 8 bit bytes, or parallel with strobe signals to latch user supplied external registers. Additionally, two data acquisition modes are possible: Update and Read.

LC MODEL

The LC Model contains an Integral MicroSeries Digital Decoder Chip. This model, essentially similar to the LS, is appropriate when an encoder without external processing circuits is desired. The same output and data acquisition modes as the LS Model are available but are built in at the factory for the LC Model.

K MODEL

The µS/23K Model encoders are *low cost* absolute encoders which provide 12 or 13 bits resolution with either parallel or serial output. In the parallel output mode all bits are continuously available. The HOLD pulse prevents any bit from changing state while the encoder is being read. In the serial output mode the user provides an interrogate pulse which provides the hold function and loads the shift register. Shift (clock) pulses provided by the user serially shift out the stored information.

Litton

Itek Encoder

27 Christina Street
Newton, Massachusetts 02164-1515

Telephone: 617-969-7300
TWX: 710-335-6783
FAX: 617-964-3705

ITEK PRECISION ENCODERS ON TARGET:

HIGH PERFORMANCE IN A SMALL PACKAGE.

Itek's precision encoders have substantially better accuracy than other shaft angle digitalizers of similar size and are designed for military or other demanding applications where high reliability is desired.

All Itek precision encoders are specifically designed for rugged military environments – tracked vehicles, shipboard, and airborne – and have been tested to corresponding vibration, shock, and temperature levels for these applications.

Digisec® Encoders–RA series

Rotary Absolute Encoders

	SIZE (Inches) Model	O.D.	Shaft Diam.	Resolution (Quanta/Rev.) Binary (2^{xx})	BCD
SOLID SHAFT	15	1.5	.187	C 8 · C 9 · C 10 · C 11 · C 12 · C 13	
	23	2.3	.25	C 11 · C 12 · C 13 · T 16 · T 17 · T 18 · T 19 · T 20	
	35	3.5	.375	C 12 · C 13 · C,S 14 · C,S 15 · C,S 16 · C,S 17 · S 18	S 3.6K · S 36K
THRU-HOLE	55	5.5	.75	S 16 · S 17 · S 18 · S 19 · S 20	
	60	6.0	2.25	S 16 · S 17 · S 18 · S 19 · S 20	
	100	10.0	2.75	S 16 · S 17 · S 18 · S 19 · S 20 · S 21	S 36K · S 360K
	106	10.0	6.0	S 16 · S 17 · S 18 · S 19 · S 20 · S 21	S 36K · S 360K
	117	11.0	7.0	S 19 · S 20 · S 21	
	158	15.0	8.0	S 20 · S 21 · S 22	

RI series

Rotary Incremental Encoders

	SIZE (Inches) Model	O.D.	Shaft Diam.	Resolution (Quanta/Rev.) Binary (2^{xx})	Decimal
SOLID SHAFT	15	1.5	.187	C 8 · C 9 · C 10 · C 11 · C 12 · C 13	C 0.5K · C 1.0K · C 1.8K · C 2.0K · C 3.6K · C 4.0K · C 5.0K · C 6.4K · C 8.0K
	23	2.3	.25	C 11 · C 12 · C 13 · T 16 · T 17 · T 18 · T 19 · T 20	
	35	3.5	.375	C 13 · C 14 · C 15 · C 16 · C 17 · C 18 · C 19	C 20K · C 32K · C 36K · C 40K · C 50K · C 64K · C 72K · C 100K · C 128K · C 180K · C 200K · C 320K · C 360K · C 640K
THRU-HOLE	55	5.5	.75	C 16 · C 17 · C 18 · C 19 · S 20	
	60	6.0	2.25		
	100	10.0	2.75	C 17 · C 18 · C 19 · C 20 · S 21	C 360K
	106	10.0	6.0	C 17 · C 18 · C 19 · C 20 · S 21	C 360K
	117	11.0	7.0		
	158	15.0	8.0	C 20 · C 21 · S 22	

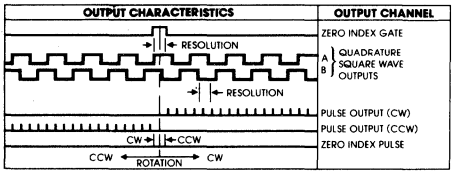
OD—Outside Diameter ID—Inside Diameter C—Self-contained Electronics S—Separate electronic enclosure T—2 speed geared paired configurations

Features: • Parallel whole word unambiguous output • T TL/DTL compatible • Resolution to 0.31 arc-seconds (22 bits) • Highest accuracies available anywhere • Operating temperature –40° to +71°C • Military Specification rated • Instant on-the-fly readout • LED light sources • Separate Electronics—no electronics in optical unit (thru-hole systems)

Available Options: • Serial readout • Line driver output • Redundancy • Chrome slit and disc (standard on size 23 and size 158) • Binary lamp display • Subtractor card for electronic zeroing

Features: • Quadrature square wave or pulse output, zero index • T TL/DTL compatible • Resolution to 0.31 arc-seconds (22 bits) • Self-contained electronics • Operating temperature –40° to +71°C • Military Specification rated • LED light sources

Available Options: • Line driver output • Pigtail cable • Square wave or pulse output



Environmental Ratings. All DIGISEC® encoders are designed to meet rigid military specifications. The following environmental specifications are typical: Temperature: –40° to +71°C Vibration: 10-20g Humidity: 0 to 98% Shock: 50g, 11 milliseconds (higher on solid shaft models)

Spacecraft Encoders: Absolute & Incremental

Model	Type	Diam. (Inches)	Resolution (Quanta/Rev.)	Accuracy	Weight (lbs.)	Power (watts)	Features
RA21/1510	Absolute	15.0	2^{21}	2.6 sec	20.0	3.0	10 inch Thru-hole Electrical Redundancy.
RA18/60	Absolute	6.0	2^{18}	10.0 sec	8.5	3.0	Elect. & Mech. Redundancy.
RI13/35	Incremental	3.5	2^{13}	2.6 min	3.0	2.0	Commutator Outputs.
RI20/63	Incremental	6.3	2^{20}	1.5 sec	1.7	0.5	Unhoused. Commutator Outputs.
RI36K/40	Incremental	4.0	36,000	2.5 sec	3.0	0.3	Electrical Redundancy.
RI14.4K/23	Incremental	2.3	14,000	1.5 min	.75	0.4	Commutator Outputs.

Features: LED Illuminators • Resolution to 0.31 Arc Seconds (22 Bits) • Highest Accuracy Available Anywhere. Available with bearings (housed) or without (unhoused).

Litton

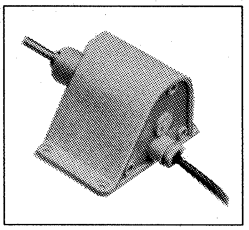
Itek Encoder

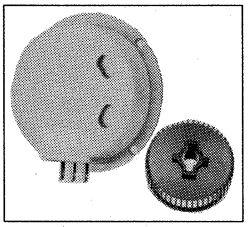
27 Christina Street
Newton, Massachusetts 02164-1515

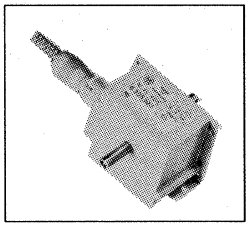
Telephone: 617-969-7300
TWX: 710-335-6783
FAX: 617-964-3705

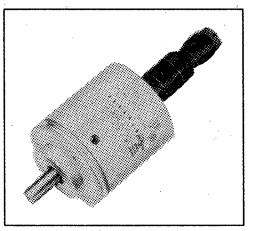
IVO Encoders & Proximity Sensors

Applications: *length and speed measurement, positioning, machine control, etc.*

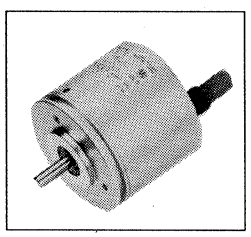


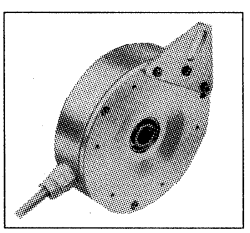


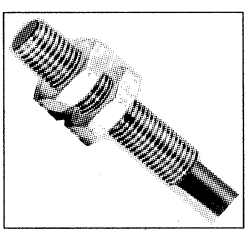


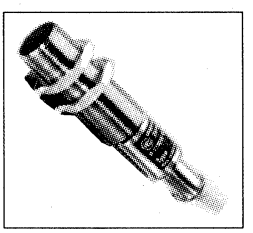


Model	G 080	G 313	G 305	G 317/327
Supply voltage	n/a	5VDC TTL	10-30 VDC, 5V TTL	10-30 VDC, 5V TTL
Output current	2A	-	40 mA	40 mA
Output signals	SPST contact	NPN open collector	Push-pull or TTL	Push pull or TTL
Output frequency	25 imp/s	10 kHz	10 kHz	50 kHz
Resolution - max.	20 imp/rev	90 imp/rev	120 imp/rev	2000 imp/rev
Speed max.	1500 rev/min	10000 rpm	6000 rpm	6000 rpm
Shaft diameter	7 mm	6 mm	7 mm	7/10 mm
Housing- dia/lgth	72/92 mm	48/18 mm	70 x 62.5 x 36 mm	60/65 mm
Price (average)	$55.00	$22.00	$75.00	$250.00
Comments	Mechanical rotary pulser, Ratios: 1 rev=1/2/3/4/5/6/7/10/20 pulses, or 1 pulse=2/3/4/5/6/10/20 revolutions.	Low-cost, optical kit encoder, drum design, self aligning, quick installation.	General purpose , low cost encoder. Plastic housing with mounting flanges, single pulse or quad output.	Medium resolution, environmentally stable, rugged, optical encoder. Options: quad output, zero pulse, inverted outputs.









Model	G 316	G 321	G 101	G 107
Supply voltage	10-30 VDC, 5V TTL	10-30 VDC, 5V TTL	10-30 VDC	90-250 VDC
Output current	40 mA	40 mA	200 mA	20 - 250 mA
Output signals	push-pull or TTL	push-pull or TTL	open collector	triac
Resolution - max.	5000 imp/rev	5000 imp/rev	n/a	n/a
Speed - max.	6000 rpm/80kHz	3000 rpm/50kHz	1000 Hz	15 Hz
Shaft diameter	10 mm	max. 22mm	n/a	n/a
Housing- dia/lgth	100/85 mm	105/55 mm	8/30 mm	18/100 mm
Switching dist.	n/a	n/a	0 - 1.2 mm	0 - 4 mm
Price (average)	$400.00	Call	$33.00	$45.00
Comments	High resolution, environmentally stable, rugged, optical encoder. Options: quad output, zero pulse, inverted outputs.	High resolution, hollow shaft, incremental. Options: quad output, zero pulse.	Inductive, high speed proximity switch.	Inductive proximity switch with LED switching indicator.

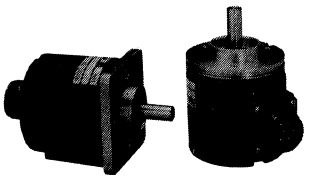
IVO Industries Inc.201 Industrial Way West, Eatontown, NJ 07724 **Tel.1-800-932-0489** Fax(201)542-2938

Call for immediate engineering assistance, exact price, delivery. Many other models available.

From robotics, computers, and machine tools to aerospace . . .

Use the Litton Encoder lineup to build a better product.

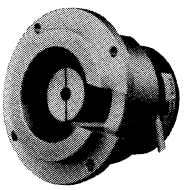
INCREMENTAL



MODEL 80
Optical
Industrial
2.5″ dia.

HYBRID TECHNOLOGY

NEW!



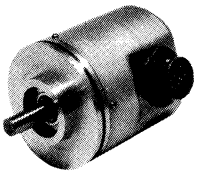
MODEL EHC25
Housed Unit with Integral Coupling
2.5″ dia.

NEW!

MODEL 83
Optical
1.5″ dia.

MODEL 84A
Optical
2.2″ dia.
HYBRID TECHNOLOGY

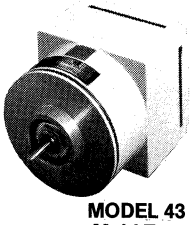
ABSOLUTE



MODEL 76
Low Cost Optical
2.65″ dia.

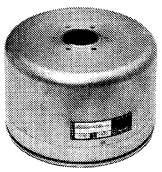
MODEL 22
Commercial & Industrial
2.187″ dia.

MODEL 23/35
Optical
Commercial & Military



MODEL 43
Multi-Turn
4.3″ dia.

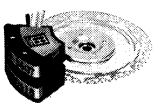
ABSOLUTE / INCREMENTAL



MODEL 60
Optical
6″ dia.

MODEL 11
Pin Contact/Optical

MODULAR



MODEL MGC
Absolute
Optical
2″ dia.

NEW!

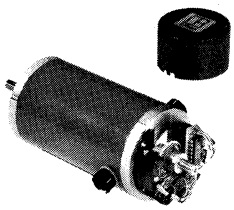
MODEL 815
Incremental
Optical
1.5″ dia.

MODEL 721
Incremental
Optical
2.2″ dia.

MODEL 820A
Incremental
Digital
2.1″ dia.

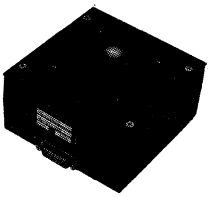
HYBRID TECHNOLOGY

MOTOR/ ENCODER PACKAGE



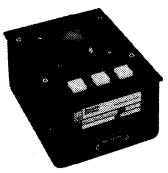
TRACKBALL SYSTEMS

NEW!



Commercial & Military
4″ sq.

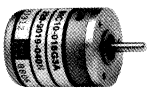
Commercial
3″ sq.
RS232 Interface Option



Special Push Button Model

SPECIALS/CUSTOM DESIGN

Incremental
Military



Optical Detented Switch

The Litton Encoder team leads the way with encoders and special products that help you build more reliable, higher quality, cost-effective products with the precision you need.

Our product lineup is the broadest in the industry and meets a wide range of requirements in applications from robotics, computer peripherals, medical equipment, and industrial controls to specialized, high-reliability designs for aerospace and defense.

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Litton
Encoder

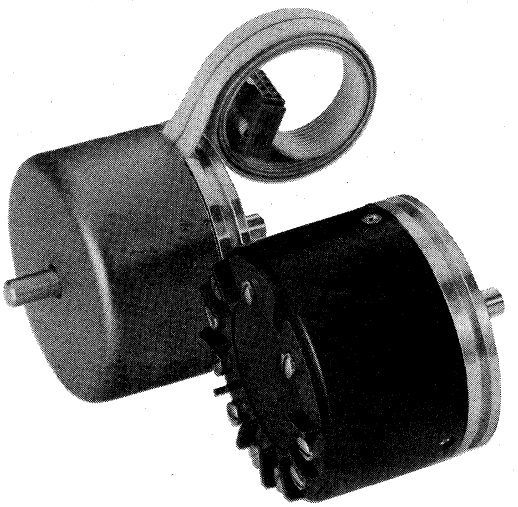
The Marketing Department
Litton Encoder Division
20745 Nordhoff Street
Chatsworth, California 91311-5979

Telephone (818) 341-6161 FAX 818-882-4553 TWX 910-494-1229

Optical Shaft Encoders

Incremental Encoders manufactured by Lucas Ledex Inc.

LC-23 Instrument Encoder

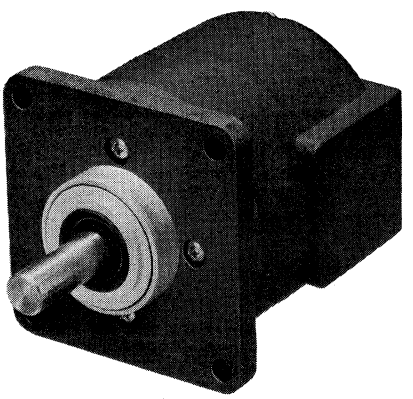


Low cost, high performance self-contained encoder which meets OEM requirements for high quality and offers features of more expensive units. LED light source, single or dual channel complementary outputs and optional marker pulse.

Pulses Per Rev.	Input Voltage (VDC)	Output Formats	Frequency Range (KHZ)	Shaft Dia. (Inches)	Outline Dimensions (Inches)
50 to 2500	5 to 15	TTL, CMOS, sine wave, line driver	0 to 50	1/4	2.3 DIA x 1.87 L

Stock models available. Request Bulletins 842 and 855.

Tru-Mite® Industrial Encoder

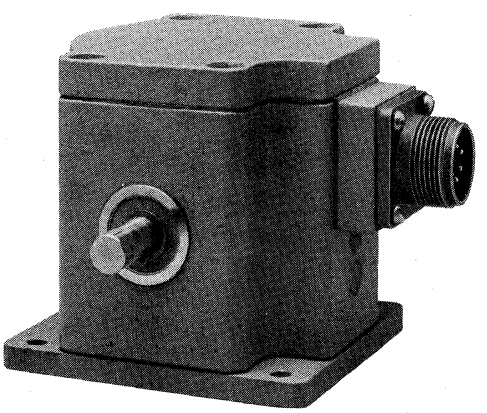


High performance, industrial duty, incremental encoder with 3/8" diameter shaft and sealed bearings. Cast aluminum housing with flange or servo mount. Side or end-mounted MS connector. LED light source. English/ Metric combinations available.

Pulses Per Rev.	Input Voltage (VDC)	Output Formats	Frequency Range (KHZ)	Shaft Dia. (Inches)	Outline Dimensions (Inches)
140 to 5000	5 to 15	TTL, HTL, CMOS, sine wave, line driver	0 to 100	3/8	2½ DIA x 2½ L

Stock models available. Request Bulletin 836.
Tru-Mite is a registered trademark of Lucas Ledex Inc.

Tru-Tac Industrial Encoder



Economical, industrial duty, incremental encoder with double-ended, 3/8" diameter shaft and sealed bearings. Foot or face mounting and MS connector. LED light source.

Pulses Per Rev.	Input Voltage (VDC)	Output Formats	Frequency Range (KHZ)	Shaft Dia. (Inches)	Outline Dimensions (Inches)
10 to 600	5 to 24	TTL, HTL CMOS, line driver	0 to 30	3/8	.3L x 3¼W x 3⅛H

Stock models available. Request Bulletin 835.

Lucas Ledex

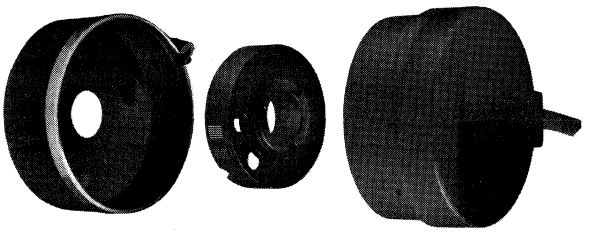
Lucas Ledex Inc.
P.O. Box 427
Vandalia, Ohio 45377-0427 U.S.A.

Phone: 513-898-3621
TWX/Telex: 6874241, 6874243
FAX: 513-898-8624

Optical Shaft Encoders

Incremental Encoders manufactured by Lucas Ledex Inc.

Trim-Step® Modular Encoder

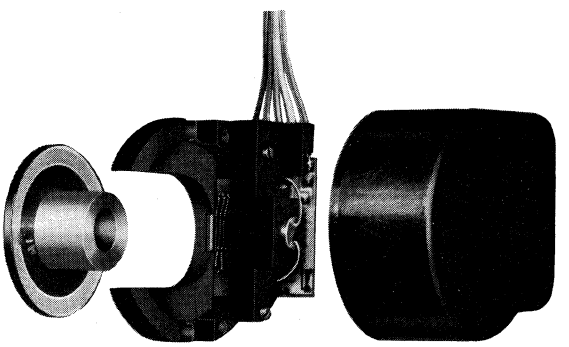


Rugged, modular, incremental encoder designed to be integrally mounted on a stepper motor. Consists of a cylindrical slotted rotor and concentric stator. High shaft end play tolerance (.020"). Easy to install.

Pulses Per Rev.	Input Voltage (VDC)	Output Formats	Frequency Range (KHZ)	Shaft Dia. (Inches)	Outline Dimensions (Inches)
50 to 250	5	TTL, HTL, CMOS, sine wave	0 to 25	N/A	2¼ DIA x 1⅜ L

Stock models available. Request Bulletin 820.
Trim-Step is a registered trademark of Lucas Ledex Inc.

K Series Modular Encoders

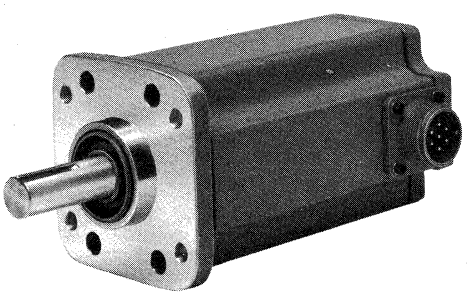


Two sizes of low cost, modular encoders designed for integral mounting on servo or stepper motors. Consists of a low inertia disc, photohead, and dust cover. Units are prealigned to minimize user installation time.

	Pulses Per Rev.	Input Voltage (VDC)	Output Formats	Frequency Range (KHZ)	Shaft Dia. (Inches)	Outline Dimensions (Inches)
K3	50 to 2500	5 to 12	TTL, CMOS, sine wave	0 to 50	N/A	2.1 DIA x .8 L
K15	50 to 1000	5 to 12	TTL	0 to 50	N/A	1.5 DIA x .75 L

Stock models available. Request Bulletins 843 (K3) and 846 (K15).

L Series and Explosion Proof (EX) Series



Designed for use in very severe environments. Large sealed bearings handle radial shift loads up to 100 lbs. Shaft seal and gasketed housing provide NEMA 4 integrity. For L Series information, request Bulletin No. 844.

EX Series is Factory Mutual approved for use in a range of hazardous environments, indoor and outdoor. For EX Series information, request Bulletin No. 848.

L Series

Pules per Rev.	Input Voltage (VDC)	Output Formats	Frequency Range (KHz)	Shaft Dia. (Inches)	Outline Dimensions (Inches)
100 to 5000	5 12 15	square wave, line driver, ampl. sine wave	0 to 100	5/8	5.7 L x 3.2 W x 3.2 H

Explosion Proof (EX) Series

Pules per Rev.	Input Voltage (VDC)	Output Formats	Frequency Range (KHz)	Shaft Dia. (Inches)	Outline Dimensions (Inches)
100 to 5000	5 12 15	square wave, line driver, ampl. sine wave	0 to 100	5/8	3.5 DIA x 6.2 L

Lucas Ledex

Lucas Ledex Inc.
P.O. Box 427
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- Special resolutions & integrated motor-encoder packages available.
- Built-in circuitry available on most models.

INCREMENTAL ENCODER STYLE SELECTOR

SERIES	CASE (mm)	DIAMETER (in.)	OPERATION	STD. RESOLUTION (PPR)	OUTPUT
02A	22	.866	OPTICAL	15	2 CHANNEL QUASISINUSOIDAL
09A	22	.866	OPTICAL	180	2 CHANNEL QUASISINUSOIDAL
10A	22	.866	OPTICAL	100	2 CHANNEL QUASISINUSOIDAL
10B	22	.866	OPTICAL	100	2 CHANNEL; SQUARE
HE	15 OR 16	.591/.630	MAGNETIC	15, 16	2 CHANNEL; SINE OR SQUARE
PREX	40	1.575	OPTICAL	100,200,250,300 360,400,500,600	2 CHANNEL + INDEX; SQUARE
HEDS-5000	28	1.102	OPTICAL	100,192,200,256, 360,400,500,512	2 CHANNEL + INDEX; SQUARE
HEDS-5500	30 × 41.1	1.18 × 1.62	OPTICAL	96,100,192 400,500,512	2 CHANNEL + INDEX; SQUARE
HEDS-6000	56	2.205	OPTICAL	192,200,400,500, 512,1000,1024	2 CHANNEL + INDEX; SQUARE

MCX-02 MOTOR CONTROL SERIES

SERIES	PRODUCT	FEATURES	OPTIONS
MCX-02X	MAIN CONTROLLER BOARD	AXES	SERVO; SELECT BLDC & STEP
MCX-02D	DAUGHTER BOARD	2 AXES/BOARD	MAX = 8 AXES/SET
MCX-02M	CONTROLLER MANUAL		
MCX-02J	JOYSTICK		
MCX-02A	AMPLIFIER	5,10,30 AMP	PWM
MCX-02P	EPROM PROGRAMMER BOARD		
MCX-02S	CUSTOM SOFTWARE		
MCX100	SPECIAL DESIGN CONTROL BOARD		

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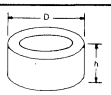
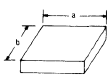
Piezoelectric Ceramics and Transducers

MURATA ERIE NORTH AMERICA

External Appearance		Description	How to Denote Type Number
Disk		Electrodes are provided at the both sides of the disk to generate radial mode and thickness mode (also with column type).	(Example) 3 ① D ② – 100 ③ – 200 ④ ①Signifies material, P-3 (expressed as 5 if P-5). ②Disk shape ③Diameter, D (mm) ④Resonant frequency (KHz)
Cylinder		Electrodes are provided on the interior and exterior surfaces of the cylinder to generate hoop mode, thickness mode and length mode.	(Example) 5 ① T ② – 38 ③ – 30 ④ – 400 ⑤ ①Signifies material, P-5. ②Cylindrical shape. ③Diameter, D (mm). ④Height, h (mm). ⑤Resonant frequency or desired mode (KHz).
Square plate		Electrodes are opposingly provided on the both sides of the plate to generate thickness mode and length mode (also with square pillar type).	(Example) 7 ① R ② – 12 ③ – 6 ④ – 3000 ⑤ ①Signifies material, P-7. ②Square plate shape. ③Lengthwise size, a (mm). ④Widthwise size, b (mm). ⑤Resonant frequency or desired mode (KHz).
Annular shape		Electrodes are provided on the both ends of the ring to mainly generate thickness mode.	(Example) 3 ① C ② – 50 ③ – 6 ④ – 200 ⑤ ①Signifies material, P-3. ②Annular shape. ③Outer diameter, D (mm). ④Inner diameter, d (mm). ⑤Resonant frequency (KHz).

1. Bimorph Type Actuator

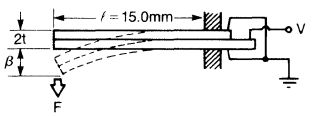


Fig. 1
Width: a = 10.0 mm
Thickness: 2t = 0.6 mm
Material: P-5D

2. Multilayer Type Actuator

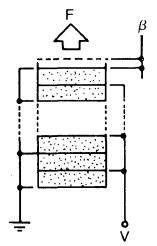
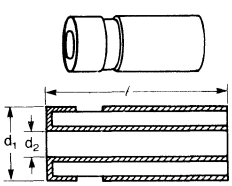


Fig. 2
Area: S = 25 mm
Thickness: t = 0.5 mm
No. of layers: a = 20
Material: P-7

3. Ink-Jet Actuator



(Sectional View)

Fig. 3
Shaded Section: Electrode
$d_1 > 1.5$ mm
$d_2 > 1.0$ mm
ℓ: 10~20 mm

PHYSICAL CONSTANTS OF PIEZOTITE®

Constant		Symbol	Unit	P-3	P-5	P-6E	P-7
Frequency Constant	Thickness mode	f·t	Hz·m	2560	1960	2000	1800
	Length mode	f·l		2280	1680	1700	1450
	Radial mode	f·D		3100	2220	2320	2000
Electro-mechanical Coupling Coefficient	Thickness mode	k_{33}	—	0.49	0.68	0.59	0.70
	Length mode	k_{31}		0.19	0.30	0.26	0.30
	Radial mode	k_p		0.32	0.52	0.45	0.60
Piezoelectric Strain Coefficient	Thickness mode	d_{33}	10^{-12} m/V	172	317	234	412
	Length mode	d_{31}		58	105	100	194
Voltage Output Coefficient	Thickness mode	g_{33}	10^{-3} V·m/N	15.2	28.9	19.0	24.0
	Length mode	g_{31}		5.3	10.2	8.3	11.0
Dielectric Constant		ε	—	1150	1300	1350	1900
Young's Modulus		E	10^{10} N/m^2	11.4	8.2	8.5	6.2
Density		ρ	10^3 kg/m^3	5.3	7.2	7.4	7.4
Mechanical Q		Qm	—	400	230	420	80
Curie Point		Tc	°C	110	260	275	320
Poisson's Ratio		σ	—	0.31	0.32	0.31	0.37
Thermal Expansion		α	10^{-6}/°C	15.0 (20~90°C)	2.0 (0~300°C)	1.5 (0~300°C)	5.0 (0~300°C)

CLASSIFICATION AND MAIN APPLICATIONS OF PIEZOTITE®

Material	Outstanding Feature	Main Application
P–3	A most broadly used material having barium titanate as a main constituent mixing other components to improve temperature characteristics around normal temperature.	For powerful ultrasonic oscillation such as cleaner, processing equipment, etc., fish finder, underwater sounding equipment, etc.
P–5	Titanate-zirconate is used as main constituent. Electromechanical transformation efficiency is great. This material resists against a high temperature of 200°C and has an excellent aging resistivity.	Powerful ultrasonic oscillation and high pressure generation such as for high-performance and high temperature cleaner or processing equipment, etc.
P–7	Like P–5, titanate-zirconate is used as a main constituent. P–7 has a greater electromechanical transformation efficiency than P–5. Especially, this material is suitable for application into nonoscillating system for its low mechanical Q.	Record player pickup, microphone, aerial ultrasonic equipment, high band resonator, etc.

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 54-2329 TWX: 810-766-1531

WATT TRANSDUCERS

AC WATT TRANSDUCER — MODEL PC5

SINGLE PHASE 50/60 HERTZ

FEATURES

- Accurate regardless of phase, voltage unbalance, current unbalance, or power factor.
- Output is proportional to true power delivered to a load; P=EI(COS θ). Provides bi-directional operation.
- **Factory calibration of all units traceable to NBS.**

APPLICATIONS

- Equipment power consumption
- For use with SCR controls, chopped waveforms, or where harmonic components exist.
- Standard outputs provide signal for interface with meters, recorders, or data acquisition equipment.

MODELS WITH INTEGRAL CURRENT SENSOR (SINGLE ELEMENT)

INPUTS		F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER PC5- STANDARD OUTPUTS							
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 1.0	100	N	103A	103B	103C	103D	103E	103E2	103CX5	103DX5
	0 to 2.5	250	O	106A	106B	106C	106D	106E	106E2	106CX5	106DX5
	0 to 5.0	500	T	001A	001B	001C	001D	001E	001E2	001CX5	001DX5
	0 to 10.0	1000		010A	010B	010C	010D	010E	010E2	010CX5	010DX5
	0 to 15.0	1500		019A	019B	019C	019D	019E	019E2	019CX5	019DX5
	0 to 20.0	2000	A	117A	117B	117C	117D	117E	117E2	117CX5	117DX5
0 to 300	0 to 1.0	200	P	104A	104B	104C	104D	104E	104E2	104CX5	104DX5
	0 to 2.5	500	P	107A	107B	107C	107D	107E	107E2	107CX5	107DX5
	0 to 5.0	1000	L	002A	002B	002C	002D	002E	002E2	002CX5	002DX5
	0 to 10.0	2000	I	011A	011B	011C	011D	011E	011E2	011CX5	011DX5
	0 to 15.0	3000	C	020A	020B	020C	020D	020E	020E2	020CX5	020DX5
	0 to 20.0	4000	A	110A	110B	110C	110D	110E	110E2	110CX5	110DX5
0 to 600	0 to 1.0	500	B	105A	105B	105C	105D	105E	105E2	105CX5	105DX5
	0 to 2.5	1000	L	108A	108B	108C	108D	108E	108E2	108CX5	108DX5
	0 to 5.0	2000	E	003A	003B	003C	003D	003E	003E2	003CX5	003DX5
	0 to 10.0	4000		012A	012B	012C	012D	012E	012E2	012CX5	012DX5
	0 to 15.0	6000		021A	021B	021C	021D	021E	021E2	021CX5	021DX5
	0 to 20.0	8000		111A	111B	111C	111D	111E	111E2	111CX5	111DX5

Highlighted models, (5A), can be used with customer's existing current transformers.

*Denotes self-powered unit, limiting input voltage ranges to:
85-135 for 150V models
200-280 for 300V models
380-550 for 600V models

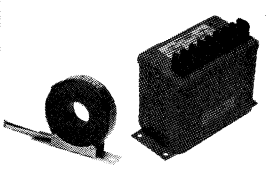
**4-20mA loop-powered unit, (15-40Vdc).

All others require 115VAC (+/-10%) instrument power (50/60Hz.).

MILLIVOLT OUTPUTS AVAILABLE- CONSULT FACTORY

ORDERING INFORMATION

Example: Self-powered, single-phase, 120V, 5A input with 0-5Vdc output.
PC5-001CX5



MODELS SUPPLIED WITH EXTERNAL SENSOR (SINGLE ELEMENT)

INPUTS		F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER PC5- STANDARD OUTPUTS							
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 50	5K	W	049A	049B	049C	049D	049E	049E2	049CX5	049DX5
	0 to 100	10K	W	058A	058B	058C	058D	058E	058E2	058CX5	058DX5
	0 to 200	20K	W	067A	067B	067C	067D	067E	067E2	067CX5	067DX5
	0 to 400	40K	X	076A	076B	076C	076D	076E	076E2	076CX5	076DX5
	0 to 600	60K	X	085A	085B	085C	085D	085E	085E2	085CX5	085DX5
	0 to 1000	100K	Y	094A	094B	094C	094D	094E	094E2	094CX5	094DX5
0 to 300	0 to 50	10K	W	050A	050B	050C	050D	050E	050E2	050CX5	050DX5
	0 to 100	20K	W	059A	059B	059C	059D	059E	059E2	059CX5	059DX5
	0 to 200	40K	W	068A	068B	068C	068D	068E	068E2	068CX5	068DX5
	0 to 400	80K	X	077A	077B	077C	077D	077E	077E2	077CX5	077DX5
	0 to 600	120K	X	086A	086B	086C	086D	086E	086E2	086CX5	086DX5
	0 to 1000	200K	Y	095A	095B	095C	095D	095E	095E2	095CX5	095DX5
0 to 600	0 to 50	20K	W	051A	051B	051C	051D	051E	051E2	051CX5	051DX5
	0 to 100	40K	W	060A	060B	060C	060D	060E	060E2	060CX5	060DX5
	0 to 200	80K	W	069A	069B	069C	069D	069E	069E2	069CX5	069DX5
	0 to 400	160K	X	078A	078B	078C	078D	078E	078E2	078CX5	078DX5
	0 to 600	240K	X	087A	087B	087C	087D	087E	087E2	087CX5	087DX5
	0 to 1000	400K	Y	096A	096B	096C	096D	096E	096E2	096CX5	096DX5

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WATT TRANSDUCERS

AC WATT TRANSDUCER — MODEL PC5

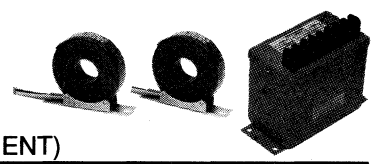
THREE PHASE-THREE WIRE 50/60 HERTZ

MODELS WITH INTEGRAL CURRENT SENSOR (DOUBLE ELEMENT)

INPUTS		F.S. IN	SENSOR	MODEL NUMBER PC5- STANDARD OUTPUTS							
VOLTAGE	CURRENT	(WATTS)	SIZE	0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150		1K	NOT	004A	004B	004C	004D	004E	004E2	004CX5	004DX5
	0 to 10	2K		013A	013B	013C	013D	013E	013E2	013CX5	013DX5
	0 to 15	3K		022A	022B	022C	022D	022E	022E2	022CX5	022DX5
	0 to 20	4K		112A	112B	112C	112D	112E	112E2	112CX5	112DX5
0 to 300		2K	APPLI	005A	005B	005C	005D	005E	005E2	005CX5	005DX5
	0 to 10	4K		014A	014B	014C	014D	014E	014E2	014CX5	014DX5
	0 to 15	6K		023A	023B	023C	023D	023E	023E2	023CX5	023DX5
	0 to 20	8K		113A	113B	113C	113D	113E	113E2	113CX5	113DX5
0 to 600		4K	CABLE	006A	006B	006C	006D	006E	006E2	006CX5	006DX5
	0 to 10	8K		015A	015B	015C	015D	015E	015E2	015CX5	015DX5
	0 to 15	12K		024A	024B	024C	024D	024E	024E2	024CX5	024DX5
	0 to 20	16K		114A	114B	114C	114D	114E	114E2	114CX5	114DX5

Highlighted models, (5A), can be used with customer's existing current transformers.
150V models may be used with single-phase, three wire, 120V Edison systems.
**4-20mA loop-powered unit (15-40Vdc).

* Denotes self-powered unit, limiting input voltage ranges to:
85-135 for 150V models
200-280 for 300V models
380-550 for 600V models



MODELS SUPPLIED WITH EXTERNAL SENSORS (DOUBLE ELEMENT)

INPUTS		F.S. IN	SENSOR	MODEL NUMBER PC5- STANDARD OUTPUTS							
VOLTAGE	CURRENT	(WATTS)	SIZE	0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 50	10K	W	052A	052B	052C	052D	052E	052E2	052CX5	052DX5
	0 to 100	20K	W	061A	061B	061C	061D	061E	061E2	061CX5	061DX5
	0 to 200	40K	W	070A	070B	070C	070D	070E	070E2	070CX5	070DX5
	0 to 400	80K	X	079A	079B	079C	079D	079E	079E2	079CX5	079DX5
	0 to 600	120K	X	088A	088B	088C	088D	088E	088E2	088CX5	088DX5
	0 to 1000	200K	Y	097A	097B	097C	097D	097E	097E2	097CX5	097DX5
0 to 300	0 to 50	20K	W	053A	053B	053C	053D	053E	053E2	053CX5	053DX5
	0 to 100	40K	W	062A	062B	062C	062D	062E	062E2	062CX5	062DX5
	0 to 200	80K	W	071A	071B	071C	071D	071E	071E2	071CX5	071DX5
	0 to 400	160K	X	080A	080B	080C	080D	080E	080E2	080CX5	080DX5
	0 to 600	240K	X	089A	089B	089C	089D	089E	089E2	089CX5	089DX5
	0 to 1000	400K	Y	098A	098B	098C	098D	098E	098E2	098CX5	098DX5
0 to 600	0 to 50	40K	W	054A	054B	054C	054D	054E	054E2	054CX5	054DX5
	0 to 100	80K	W	063A	063B	063C	063D	063E	063E2	063CX5	063DX5
	0 to 200	160K	W	072A	072B	072C	072D	072E	072E2	072CX5	072DX5
	0 to 400	320K	X	081A	081B	081C	081D	081E	081E2	081CX5	081DX5
	0 to 600	480K	X	090A	090B	090C	090D	090E	090E2	090CX5	090DX5
	0 to 1000	800K	Y	099A	099B	099C	099D	099E	099E2	099CX5	099DX5

MODEL PC5 SPECIFICATIONS

INPUT

VOLTAGE: See tables
CURRENT: See tables
FREQUENCY RANGE: 48 to 70 Hz.
RESPONSE (Transient 90%):
With integral sensors: Less than 100 microSeconds
With current transformers W,X, and Y: 1mS
BURDEN:
Voltage: 1.25VA
Current: 1.25VA
Optional output amplifier: 2 Watts
CURRENT OVERLOAD:
2 times full scale (cont.); 6 times full scale (10 Sec.)
DIELECTRIC TEST (Input/Output/Case): 1500VAC (RMS)
SURGE: Withstands IEEE SWC test

OUTPUT

OUTPUT RIPPLE: Less than 1%
OUTPUT LOADING (OHMS):
Option: A-B: 0-10K
C-D: Greater than 2K
E-E2: 0-1.5K
CX5-DX5: Greater than 2K
RESPONSE TIME (90%): 250 mS
FIELD ADJUSTABLE CAL.: +/- 10%

ACCURACY +/- 0.5%

Includes combined effects of power factor, linearity, repeatability, and current sensor.
TEMPERATURE EFFECT (-10° to 60°C):
+/- 1.0% of reading
+/- 0.1% F.S. output

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WATT TRANSDUCERS

AC WATT TRANSDUCER — MODEL PC5

THREE PHASE-FOUR WIRE 50/60 HERTZ

MODELS WITH INTEGRAL CURRENT SENSOR (THREE ELEMENT)

INPUTS		F.S. IN	SENSOR	MODEL NUMBER PC5- STANDARD OUTPUTS							
VOLTAGE	CURRENT	(WATTS)	SIZE	0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 5	1.5K	NOT APPLICABLE	007A	007B	007C	007D	007E	007E2	007CX5	007DX5
	0 to 5	1.5K		7.5A	7.5B	7.5C	7.5D	7.5E	7.5E2	7.5CX5	7.5DX5
	0 to 10	3.0K		016A	016B	016C	016D	016E	016E2	016CX5	016DX5
	0 to 15	4.5K		025A	025B	025C	025D	025E	025E2	025CX5	025DX5
	0 to 20	6.0K		115A	115B	115C	115D	115E	115E2	115CX5	115DX5
0 to 300	0 to 5	3.0K		008A	008B	008C	008D	008E	008E2	008CX5	008DX5
	0 to 5	3.0K		8.5A	8.5B	8.5C	8.5D	8.5E	8.5E2	8.5CX5	8.5DX5
	0 to 10	6.0K		017A	017B	017C	017D	017E	017E2	017CX5	017DX5
	0 to 15	9.0K		026A	026B	026C	026D	026E	026E2	026CX5	026DX5
	0 to 20	12K		116A	116B	116C	116D	116E	116E2	116CX5	116DX5
NOTE: PART NUMBERS 7.5 AND 8.5 DENOTE 2 1/2 ELEMENT UNITS											

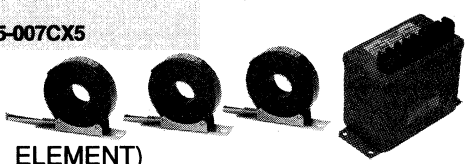
ADDITONAL OUTPUTS AVAILABLE- CONSULT FACTORY

Highlighted models, (5A), can be used with customer's existing current transformers.
All voltage specifications are **line-to-neutral voltage**.
*Denotes self-powered unit, limiting input voltage ranges to:
85-135 for 150V models
200-280 for 300V models
380-550 for 600V models
**4-20mA loop-powered unit (15-40Vdc).
All others require 115VAC (+/-10%) instrument power (50/60Hz.).

ORDERING INFORMATION

Example: Self-powered, three phase-four wire, 120V, 5A input with 0-5Vdc output.

PC5-007CX5



MODELS SUPPLIED WITH EXTERNAL SENSORS (THREE ELEMENT)

INPUTS		F.S. IN	SENSOR	MODEL NUMBER PC5- STANDARD OUTPUTS							
VOLTAGE	CURRENT	(WATTS)	SIZE	0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 50	15K	W	055A	055B	055C	055D	055E	055E2	055CX5	055DX5
	0 to 100	30K	W	064A	064B	064C	064D	064E	064E2	064CX5	064DX5
	0 to 200	60K	W	073A	073B	073C	073D	073E	073E2	073CX5	073DX5
	0 to 400	120K	X	082A	082B	082C	082D	082E	082E2	082CX5	082DX5
	0 to 600	180K	X	091A	091B	091C	091D	091E	091E2	091CX5	091DX5
	0 to 1000	300K	Y	100A	100B	100C	100D	100E	100E2	100CX5	100DX5
0 to 300	0 to 50	30K	W	056A	056B	056C	056D	056E	056E2	056CX5	056DX5
	0 to 100	60K	W	065A	065B	065C	065D	065E	065E2	065CX5	065DX5
	0 to 200	120K	W	074A	074B	074C	074D	074E	074E2	074CX5	074DX5
	0 to 400	240K	X	083A	083B	083C	083D	083E	083E2	083CX5	083DX5
	0 to 600	360K	X	092A	092B	092C	092D	092E	092E2	092CX5	092DX5
	0 to 1000	600K	Y	101A	101B	101C	101D	101E	101E2	101CX5	101DX5

MODEL PC5 SPECIFICATIONS

INPUT

VOLTAGE: See tables
CURRENT: See tables
FREQUENCY RANGE: 48 to 70 Hz.
RESPONSE (Transient 90%):
With integral sensors: Less than 100 microSeconds
With current transformers W,X, and Y: 1mS
BURDEN:
Voltage: 1.25VA
Current: 1.25VA
Optional output amplifier: 2 Watts
CURRENT OVERLOAD:
2 times full scale (cont.); 6 times full scale (10 Sec.)
DIELECTRIC TEST (Input/Output/Case): 1500VAC (RMS)
SURGE: Withstands IEEE SWC test

OUTPUT

OUTPUT RIPPLE: Less than 1%
OUTPUT LOADING (OHMS):
Option: A-B: 0-10K
C-D: Greater than 2K
E-E2: 0-1.5K
CX5-DX5: Greater than 2K
RESPONSE TIME (90%): 250 mS
FIELD ADJUSTABLE CAL.: +/- 10%

ACCURACY +/- 0.5%

Includes combined effects of power factor, linearity, repeatability, and current sensor.
TEMPERATURE EFFECT (-10° to 60°C):
+/- 1.0% of reading
+/- 0.1% F.S. output

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WATT TRANSDUCERS

PRECISION AC WATT TRANSDUCER MODEL GW5

ACCURATE TO 0.2% OF READING

FEATURES

- Accurate regardless of variations in voltage,current, power factor, or load.
- Available with 1, 2, 2 1/2, or 3 element configurations. Provides bi-directional operation.
- Accuracy maintained over wide temperature range, **factory calibration traceable to NBS.**

APPLICATIONS

- Equipment monitoring for process control.
- Integration into energy management systems, or a variety of sub-metering applications.
- Measurement using direct-connection, current tranformers, or potential transformers.

AC WATT TRANSDUCER-INTEGRAL CURRENT SENSOR

INPUTS		F.S. IN (WATTS)	PHASE CONFIG.	MODEL NUMBER GW5- STANDARD OUTPUTS							
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 6.25	500	1 Ph.-2W	001A	001B	001C	001D	001E	001E2	001CX5	001DX5
		1000	3Ph.-3W	004A	004B	004C	004D	004E	004E2	004CX5	004DX5
		1500	3Ph.-4W	007A	007B	007C	007D	007E	007E2	007CX5	007DX5
		1500	3Ph.-4W	7.5A	7.5B	7.5C	7.5D	7.5E	7.5E2	7.5CX5	7.5DX5
	0 to 10.00	1000	1Ph.-2W	010A	010B	010C	010D	010E	010E2	010CX5	010DX5
		2000	3Ph.-3W	013A	013B	013C	013D	013E	013E2	013CX5	013DX5
		3000	3Ph.-4W	016A	016B	016C	016D	016E	016E2	016CX5	016DX5
	0 to 20.00	2000	1Ph.-2W	019A	019B	019C	019D	019E	019E2	019CX5	019DX5
		4000	3Ph.-3W	022A	022B	022C	022D	022E	022E2	022CX5	022DX5
		6000	3Ph.-4W	025A	025B	025C	025D	025E	025E2	025CX5	025DX5
0 to 300	0 to 6.25	1000	1Ph.-2W	002A	002B	002C	002D	002E	002E2	002CX5	002DX5
		2000	3Ph.-3W	005A	005B	005C	005D	005E	005E2	005CX5	005DX5
		3000	3Ph.-4W	008A	008B	008C	008D	008E	008E2	008CX5	008DX5
	0 to 10.00	2000	1Ph.-2W	011A	011B	011C	011D	011E	011E2	011CX5	011DX5
		4000	3Ph.-3W	014A	014B	014C	014D	014E	014E2	014CX5	014CX5
		6000	3Ph.-4W	017A	017B	017C	017D	017E	017E2	017CX5	017DX5
	0 to 20.00	4000	1Ph.-2W	020A	020B	020C	020D	020E	020E2	020CX5	020DX5
		8000	3Ph.-3W	023A	023B	023C	023D	023E	023E2	023CX5	023DX5
		12000	3Ph.-4W	026A	026B	026C	026D	026E	026E2	026CX5	026DX5
0 to 600	0 to 6.25	2000	1Ph.-2W	003A	003B	003C	003D	003E	003E2	003CX5	003DX5
		4000	3Ph.-3W	006A	006B	006C	006D	006E	006E2	006CX5	006DX5
	0 to 10.00	4000	1Ph.-2W	012A	012B	012C	012D	012E	012E2	012CX5	012DX5
		8000	3Ph.-3W	015A	015B	015C	015D	015E	015E2	015CX5	015DX5
	0 to 20.00	8000	1Ph.-2W	021A	021B	021C	021D	021E	021E2	021CX5	021DX5
		16000	3Ph.-3W	024A	024B	024C	024D	024E	024E2	024CX5	024DX5

Highlighted models, (6.25A), can be used with customer's existing current transformers.

*Denotes self-powered unit, limiting input voltage ranges to:
85-135 for 150V models
200-280 for 300V models
380-550 for 600V models

**4-20mA loop-powered unit, (15-40Vdc).

All others require 115VAC instrument power (+/-10%).

ORDERING INFORMATION

Example: Self-powered, single-phase, 120V, 5A input with 0-5Vdc output.
GW5-001CX5

OPTIONAL 50 Hz. OPERATION- CONSULT FACTORY

MODEL GW5 SPECIFICATIONS

INPUT

SEE TABLE FOR VOLTAGE AND CURRENT RANGES
FREQUENCY RANGE: 58 to 62 Hz.
POWER FACTOR: Any
BURDEN:
Voltage: Less than 0.1VA
Current: Less than 0.28VA per element
OVERLOAD:
Voltage (cont.): Consult factory
Current (cont.): Consult factory
DIELECTRIC TEST (Input/Output/Case): 1500VAC

OUTPUT

OUTPUT RIPPLE: Less than 0.5%
OUTPUT LOADING (OHMS):
Option: A-B: 0-10K
C-D: Greater than 2K
E-E2: 0-1.5K
CX5-DX5: Greater than 2K
RESPONSE TIME (99%): Less than 400 mS
COMPLIANCE VOLTAGE: 12Vdc min.
OPEN CIRCUIT VOLTAGE: +/- 15Vdc
ACCURACY +/- 0.2% RDG. +/- 0.05% F.S.
TEMPERATURE EFFECT (-20° to 60°C): +/- 0.005%/°C

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WATT-HOUR TRANSDUCERS

OSI WATT/WATT-HOUR TRANSDUCER MODEL W

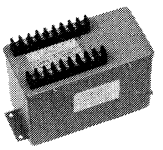
SINGLE PHASE 50/60 HERTZ

FEATURES

- Accurate regardless of phase, voltage unbalance, current unbalance, or power factor.
- Standard Analog outputs for Watts, relay contact or 5V pulse to indicate Watt-Hours.
- **Factory calibration traceable to NBS.**

APPLICATIONS

- Equipment power consumption.
- Can be easily integrated into building management systems.
- Pulse outputs interface with electronic or mechanical counters for accumulation of Watt-Hours.



MODELS WITH INTEGRAL CURRENT SENSOR (SINGLE ELEMENT)

INPUTS		F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER W- STANDARD WATT OUTPUTS					
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	0-5Vdc*	0-5Vdc
0 to 150	0 to 1.0	100		103A	103B	103C	103D	103CX5	103DX5
	0 to 2.5	250	N	106A	106B	106C	106D	106CX5	106DX5
	0 to 5.0	500	O	001A	001B	001C	001D	001CX5	001DX5
	0 to 10.0	1000	T	010A	010B	010C	010D	010CX5	010DX5
	0 to 15.0	1500		019A	019B	019C	019D	019CX5	019DX5
	0 to 20.0	2000		117A	117B	117C	117D	117CX5	117DX5
0 to 300	0 to 1.0	200	A	104A	104B	104C	104D	104CX5	104DX5
	0 to 2.5	500	P	107A	107B	107C	107D	107CX5	107DX5
	0 to 5.0	1000	P	002A	002B	002C	002D	002CX5	002DX5
	0 to 10.0	2000	L	011A	011B	011C	011D	011CX5	011DX5
	0 to 15.0	3000		020A	020B	020C	020D	020CX5	020DX5
	0 to 20.0	4000	I	110A	110B	110C	110D	110CX5	110DX5
0 to 600	0 to 1.0	500	C	105A	105B	105C	105D	105CX5	105DX5
	0 to 2.5	1000	A	108A	108B	108C	108D	108CX5	108DX5
	0 to 5.0	2000	B	003A	003B	003C	003D	003CX5	003DX5
	0 to 10.0	4000	L	012A	012B	012C	012D	012CX5	012DX5
	0 to 15.0	6000		021A	021B	021C	021D	021CX5	021DX5
	0 to 20.0	8000	E	111A	111B	111C	111D	111CX5	111DX5

MAX. COUNT PER HR	WATT HR. OUTPUTS	
	CONTACT	5V PULSE
100	STANDARD OUTPUT FOR WATT HOURS. N/O SPST RELAY CONTACT	TTL OUTPUT FOR WATT HOURS. 5Vdc PULSE. ADD SUFFIX "-T" TO PART NUMBER
250		
5000		
1000		
1500		
2000		
200		
500		
1000		
2000		
3000		
4000		
500		
1000		
2000		
4000		
6000		
8000		

Highlighted models, (5A), can be used with customer's existing current transformers.

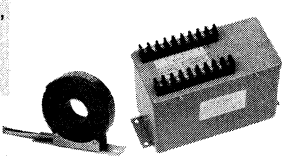
*Denotes self-powered unit, limiting input voltage ranges to:
103-135 for 150V models
215-280 for 300V models
395-550 for 600V models

All others require 115VAC (+/-10%) instrument power (50/60Hz.).
Optional 220VAC instrument power-Add suffix "**-22**" to part number.

CUSTOM COUNT RATES AVAILABLE- CONSULT FACTORY

ORDERING INFORMATION

Example: Self-powered, single-phase, 120V, 5A input with 0-5Vdc output for watts, TTL pulse for watt hours.
W-001CX5-T



MODELS SUPPLIED WITH EXTERNAL SENSOR (SINGLE ELEMENT)

INPUTS		F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER W- STANDARD WATT OUTPUTS					
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	0-5Vdc*	0-5Vdc
0 to 150	0 to 100	10K	W	058A	058B	058C	058D	058CX5	058DX5
	0 to 200	20K	W	067A	067B	067C	067D	067CX5	067DX5
	0 to 400	40K	X	076A	076B	076C	076D	076CX5	076DX5
	0 to 600	60K	X	085A	085B	085C	085D	085CX5	085DX5
	0 to 1000	100K	Y	094A	094B	094C	094D	094CX5	094DX5
0 to 300	0 to 100	20K	W	059A	059B	059C	059D	059CX5	059DX5
	0 to 200	40K	W	068A	068B	068C	068D	068CX5	068DX5
	0 to 400	80K	X	077A	077B	077C	077D	077CX5	077DX5
	0 to 600	120K	X	086A	086B	086C	086D	086CX5	086DX5
	0 to 1000	200K	Y	095A	095B	095C	095D	095CX5	095DX5
0 to 600	0 to 100	40K	W	060A	060B	060C	060D	060CX5	060DX5
	0 to 200	80K	W	069A	069B	069C	069D	069CX5	069DX5
	0 to 400	160K	X	078A	078B	078C	078D	078CX5	078DX5
	0 to 600	240K	X	087A	087B	087C	087D	087CX5	087DX5
	0 to 1000	400K	Y	096A	096B	096C	096D	096CX5	096DX5

MAX. COUNT PER HR	WATT HR. OUTPUTS	
	CONTACT	5V PULSE
10000	STANDARD OUTPUT FOR WATT HOURS. N/O SPST RELAY CONTACT	TTL OUTPUT FOR WATT HOURS. 5Vdc PULSE. ADD SUFFIX "-T" TO PART NUMBER
2000		
4000		
6000		
1000		
2000		
4000		
8000		
1200		
2000		
4000		
8000		
1600		
2400		
4000		

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WATT-HOUR TRANSDUCERS

OSI WATT/WATT-HOUR TRANSDUCER MODEL W

THREE PHASE-THREE WIRE 50/60 HERTZ

MODELS WITH INTEGRAL CURRENT SENSOR (DOUBLE ELEMENT)

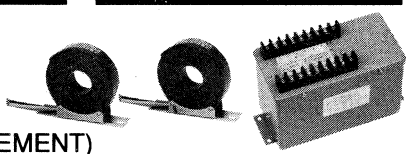
INPUTS		F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER W- STANDARD WATT OUTPUTS					
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	0-5Vdc*	0-5Vdc
0 to 150	0 to 5	1K	NOT APPLICABLE	004A	004B	004C	004D	004CX5	004DX5
	0 to 10	2K		013A	013B	013C	013D	013CX5	013DX5
	0 to 15	3K		022A	022B	022C	022D	022CX5	022DX5
	0 to 20	4K		112A	112B	112C	112D	112CX5	112DX5
0 to 300	0 to 5	2K		005A	005B	005C	005D	005CX5	005DX5
	0 to 10	4K		014A	014B	014C	014D	014CX5	014DX5
	0 to 15	6K		023A	023B	023C	023D	023CX5	023DX5
	0 to 20	8K		113A	113B	113C	113D	113CX5	113DX5
0 to 600	0 to 5	4K		006A	006B	006C	006D	006CX5	006DX5
	0 to 10	8K		015A	015B	015C	015D	015CX5	015DX5
	0 to 15	12K		024A	024B	024C	024D	024CX5	024DX5
	0 to 20	16K		114A	114B	114C	114D	114CX5	114DX5

MAX. COUNT PER HR	WATT HR. OUTPUTS	
	CONTACT	5V PULSE
1000	STANDARD OUTPUT FOR WATT HOURS. N/O SPST RELAY CONTACT	TTL OUTPUT. 5Vdc PULSE. ADD SUFFIX "-T" TO PART NUMBER
2000		
3000		
4000		
2000		
4000		
6000		
8000		
4000		
8000		
12000		
16000		

Highlighted models, (5A), can be used with customer's existing current transformers.

150V models may be used with single-phase, three wire, 120V Edison systems.

* Denotes self-powered unit, limiting input voltage ranges to:
103-135 for 150V models
215-280 for 300V models
395-550 for 600V models



MODELS SUPPLIED WITH EXTERNAL SENSORS (DOUBLE ELEMENT)

INPUTS		F.S. IN (WATTS)	SENSOR SIZE	MODEL NUMBER W- STANDARD WATT OUTPUTS					
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	0-5Vdc*	0-5Vdc
0 to 150	0 to 50	10K	W	052A	052B	052C	052D	052CX5	052DX5
	0 to 100	20K	W	061A	061B	061C	061D	061CX5	061DX5
	0 to 200	40K	W	070A	070B	070C	070D	070CX5	070DX5
	0 to 400	80K	X	079A	079B	079C	079D	079CX5	079DX5
	0 to 600	120K	X	088A	088B	088C	088D	088CX5	088DX5
	0 to 1000	200K	Y	097A	097B	097C	097D	097CX5	097DX5
0 to 300	0 to 50	20K	W	053A	053B	053C	053D	053CX5	053DX5
	0 to 100	40K	W	062A	062B	062C	062D	062CX5	062DX5
	0 to 200	80K	W	071A	071B	071C	071D	071CX5	071DX5
	0 to 400	160K	X	080A	080B	080C	080D	080CX5	080DX5
	0 to 600	240K	X	089A	089B	089C	089D	089CX5	089DX5
	0 to 1000	400K	Y	098A	098B	098C	098D	098CX5	098DX5
0 to 600	0 to 50	40K	W	054A	054B	054C	054D	054CX5	054DX5
	0 to 100	80K	W	063A	063B	063C	063D	063CX5	063DX5
	0 to 200	160K	W	072A	072B	072C	072D	072CX5	072DX5
	0 to 400	320K	X	081A	081B	081C	081D	081CX5	081DX5
	0 to 600	480K	X	090A	090B	090C	090D	090CX5	090DX5
	0 to 1000	800K	Y	099A	099B	099C	099D	099CX5	099DX5

MAX. COUNT PER HR	WATT HR. OUTPUTS	
	CONTACT	5V PULSE
10000	STANDARD OUTPUT FOR WATT HOURS. N/O SPST RELAY CONTACT	TTL OUTPUT FOR WATT HOURS. 5Vdc PULSE. ADD SUFFIX "-T" TO PART NUMBER
2000		
4000		
8000		
1200		
2000		
2000		
4000		
8000		
1600		
2400		
4000		
4000		
8000		
1600		
3200		
4800		
8000		

MODEL W SPECIFICATIONS

INPUT

VOLTAGE: See tables
CURRENT: See tables
FREQUENCY RANGE: 50 to 70 Hz.
POWER FACTOR: Unity to lead or lag 0
RESPONSE (Transient 90%):
With integral sensors: Less than 100 microSeconds
With current transformers W,X, and Y: 1mS
BURDEN:
Voltage: 1.25VA
Current: 1.25VA
Optional output amplifier: 2 Watts
CURRENT OVERLOAD:
2 times full scale (cont.); 6 times full scale (10 Sec.)
DIELECTRIC TEST (Input/Output/Case): 1500VAC (RMS)
SURGE: Withstands IEEE SWC test

OUTPUT

WH RELAY: N/O SPST; 150VAC, 0.5A
CONTACT CLOSURE PERIOD: 100mS
OUTPUT RIPPLE: Less than 1%
OUTPUT LOADING (OHMS):
Option: A-B: 0-10K
C-D: Greater than 2K
CX5-DX5: Greater than 2K
RESPONSE TIME (90%): 250 mS
FIELD ADJUSTABLE CAL.: +/- 10%

ACCURACY +/- 0.5%

Includes combined effects of power factor, linearity, repeatability, and current sensor.
TEMPERATURE EFFECT (-10° to 60°C):
+/- 1.0% of reading
+/- 0.1% F.S. output

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WATT-HOUR TRANSDUCERS

WATT/WATT-HOUR TRANSDUCER — MODEL W

THREE PHASE-FOUR WIRE 50/60 HERTZ

MODELS WITH INTEGRAL CURRENT SENSOR (THREE ELEMENT)

INPUTS		F.S. IN	SENSOR	MODEL NUMBER W- STANDARD WATT OUTPUTS					
VOLTAGE	CURRENT	(WATTS)	SIZE	0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	0-5Vdc*	0-5Vdc
0 to 150	0 to 5	1500		007A	007B	007C	007D	007CX5	007DX5
	0 to 10	3000		016A	016B	016C	016D	016CX5	016DX5
	0 to 15	4500	N/A	025A	025B	025C	025D	025CX5	025DX5
	0 to 20	6000		115A	115B	115C	115D	115CX5	115DX5
0 to 300	0 to 5	3000		008A	008B	008C	008D	008CX5	008DX5
	0 to 10	6000		017A	017B	017C	017D	017CX5	017DX5
	0 to 15	9000		026A	026B	026C	026D	026CX5	026DX5
	0 to 20	12000		116A	116B	116C	116D	116CX5	116DX5

MAX. COUNT PER HR	WATT HR. CONTACT	OUTPUTS 5V PULSE
1500	STANDARD	TTL
3000	OUTPUT	ADD
4500	N/O SPST	SUFFIX
6000	RELAY	"-T"
3000	CONTACT	TO
6000		PART
9000		NUMBER
12000		

Highlighted models, (5A), can be used with customer's existing current transformers.
All voltage specifications are **line-to-neutral voltage**.
*Denotes self-powered unit, limiting input voltage ranges to:
103-135 for 150V models
215-280 for 300V models
395-550 for 600V models
All others require 115VAC (+/-10%) instrument power (50/60Hz.).
Optional 220Vac instrument power-Add suffix **"-22"** to part number.

CUSTOM COUNT RATES AVAILABLE- CONSULT FACTORY

ORDERING INFORMATION

Example: Self-powered, three phase-four wire, 120V, 5A input with 0-5Vdc output for watts, TTL pulse for watt hours.

W-007CX5-T

MODELS SUPPLIED WITH EXTERNAL SENSORS (THREE ELEMENT)

INPUTS		F.S. IN	SENSOR	MODEL NUMBER W- STANDARD WATT OUTPUTS					
VOLTAGE	CURRENT	(WATTS)	SIZE	0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	0-5Vdc*	0-5Vdc
0 to 150	0 to 50	15K	W	055A	055B	055C	055D	055CX5	055DX5
	0 to 100	30K	W	064A	064B	064C	064D	064CX5	064DX5
	0 to 200	60K	W	073A	073B	073C	073D	073CX5	073DX5
	0 to 400	120K	X	082A	082B	082C	082D	082CX5	082DX5
	0 to 600	180K	X	091A	091B	091C	091D	091CX5	091DX5
	0 to 1000	300K	Y	100A	100B	100C	100D	100CX5	100DX5
0 to 300	0 to 50	30K	W	056A	056B	056C	056D	056CX5	056DX5
	0 to 100	60K	W	065A	065B	065C	065D	065CX5	065DX5
	0 to 200	120K	W	074A	074B	074C	074D	074CX5	074DX5
	0 to 400	240K	X	083A	083B	083C	083D	083CX5	083DX5
	0 to 600	360K	X	092A	092B	092C	092D	092CX5	092DX5
	0 to 1000	600K	Y	101A	101B	101C	101D	101CX5	101DX5

MAX. COUNT PER HR	WATT HR. CONTACT	OUTPUTS 5V PULSE
1500	STANDARD	TTL
3000	OUTPUT	OUTPUT.
6000	FOR	5Vdc
1200	WATT	PULSE.
1800	HOURS.	ADD
3000	N/O SPST	SUFFIX
6000	RELAY	"-T"
12000	CONTACT	TO
2400		PART
3600		NUMBER
6000		

MODEL W SPECIFICATIONS

INPUT

VOLTAGE: See tables
CURRENT: See tables
FREQUENCY RANGE: 50 to 70 Hz.
POWER FACTOR: Unity to lead or lag 0
RESPONSE (Transient 90%):
With integral sensors: Less than 100 microSeconds
With current transformers W,X, and Y: 1mS
BURDEN:
Voltage: 1.25VA
Current: 1.25VA
Optional output amplifier: 2 Watts
CURRENT OVERLOAD:
2 times full scale (cont.); 6 times full scale (10 Sec.)
DIELECTRIC TEST (Input/Output/Case): 1500VAC (RMS)
SURGE: Withstands IEEE SWC test

OUTPUT

WH RELAY: N/O SPST; 150VAC, 0.5A
CONTACT CLOSURE PERIOD: 100mS
OUTPUT RIPPLE: Less than 1%
OUTPUT LOADING (OHMS):
Option: A-B: 0-10K
C-D: Greater than 2K
CX5-DX5: Greater than 2K
RESPONSE TIME (90%): 250 mS
FIELD ADJUSTABLE CAL.: +/- 10%
ACCURACY +/- 0.5%
Includes combined effects of power factor, linearity, repeatability, and current sensor.
TEMPERATURE EFFECT (-10° to 60°C):
+/- 1.0% of reading
+/- 0.1% F.S. output

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WATT TRANSDUCERS

VARIABLE FREQUENCY WATT TRANSDUCER MODEL PC8

SINGLE PHASE DC TO 400 HERTZ

FEATURES

- **Factory calibration traceable to NBS.**
- Input/output isolation.
- Real-time indication of power, response time **less than 50 microseconds**.

APPLICATIONS

- Accurate monitoring of power that contains dc and non-sinusoidal AC components.
- Ideal for use in SCR and other AC or dc switching circuitry.
- Optional output for bi-directional indication.

SINGLE PHASE-VARIABLE FREQUENCY (SINGLE ELEMENT)

INPUT VOLTAGE	
RANGE	DESIGNATION
0- 25	001
0- 50	002
0-125	003
0-250	004
0-400	005
0-500	006
0-600	007

INPUT CURRENT		SENSOR SIZE
RANGE	DESIGNATION	
0- 5	08	INTEGRAL
0- 100	01	C
0- 200	02	D
0- 300	03	D
0- 400	04	D
0- 600	05	E
0-1000	06	E
0-2000	07	E

MODEL PC8 STANDARD OUTPUTS				
0-1mA	0-10Vdc	4-20mA	4-12-20mA	0-5Vdc
ADD SUFFIX "B" TO PART NUMBER	ADD SUFFIX "D" TO PART NUMBER	ADD SUFFIX "E" TO PART NUMBER	ADD SUFFIX "EM" TO PART NUMBER	ADD SUFFIX "DX5" TO PART NUMBER

Highlighted models, (5A), can be used with customer's existing current transformers.
All units require 115VAC instrument power (+/-10%).
Full scale power (Watts) can be determined by the product of full scale input voltage and full scale input current.

OPTIONAL SPLIT-CORE CURRENT SENSOR AVAILABLE WITH UNITS OF 100 AMPS OR GREATER-ADD SUFFIX "S". LOWER CURRENT RANGES AVAILABLE-CONSULT FACTORY

ORDERING INFORMATION

Example: 120V, 100A input with split-core sensor and 0-5Vdc output.
PC8-003-01-DX5-S

MODEL PC8 SPECIFICATIONS

INPUT
VOLTAGE: See tables
CURRENT: See tables
FREQUENCY RANGE: dc to 400 Hz.
POWER FACTOR: Any
RESPONSE (Transient 90%): Less than 50 microSeconds
BURDEN (OHMS):
Voltage:
Less than 50V: Greater than 100K.
Greater than 50V: Greater than 1M.
OVERLOAD:
Voltage: 2 times full scale.
Current:
Using integral sensor: 2 times full scale.
Using sensors C, D, E: 50 times full scale.
DIELECTRIC TEST (Input/Output/Case): 1000Vdc
SURGE: Withstands IEEE SWC test

OUTPUT
OUTPUT RIPPLE: Less than 1.0% at 60 Hz.
OUTPUT LOADING (OHMS):
Option: B: 0-10K
D: Greater than 2K
E-Em: 0-1.5K
DX5: Greater than 2K
RESPONSE TIME (90%):
Less than 250 mS.
FIELD ADJUSTABLE CAL.: +/- 10%
ACCURACY +/- 1.0% F.S.
Includes combined effects of voltage, current, load and power factor.
TEMPERATURE EFFECT (0°C to 40°C):
+/- 0.1% F.S.
+/- 1.0% RDG.
INSTRUMENT POWER:
115VAC, +/-10% (50 to 400 Hz.)

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VAR TRANSDUCERS

PRECISION VAR TRANSDUCER — MODEL GV5

ACCURATE TO 0.2% OF READING

FEATURES

- Accurate regardless of variations in voltage,current, power factor, or load.
- Available with 1, 2, 2 1/2, or 3 element configurations. Provides bi-directional operation.
- Accuracy maintained over wide temperature range, calibration traceable to **NBS**.

APPLICATIONS

- Equipment monitoring for process control.
- Integration into energy management systems, or a variety of sub-metering applications.
- Measurement using direct-connection, current tranformers, or potential transformers.

VAR TRANSDUCER-INTEGRAL CURRENT SENSOR

INPUTS		F.S. IN (VAR)	PHASE CONFIG.	MODEL NUMBER GV5- STANDARD OUTPUTS							
VOLTAGE	CURRENT			0-1mA*	0-1mA	0-10Vdc*	0-10Vdc	4-20mA	4-20mA**	0-5Vdc*	0-5Vdc
0 to 150	0 to 6.25	500	1 Ph.-2W	001A	001B	001C	001D	001E	001E2	001CX5	001DX5
		1000	3Ph.-3W	004A	004B	004C	004D	004E	004E2	004CX5	004DX5
		1500	3Ph.-4W	007A	007B	007C	007D	007E	007E2	007CX5	007DX5
		1500	3Ph.-4W	7.5A	7.5B	7.5C	7.5D	7.5E	7.5E2	7.5CX5	7.5DX5
	0 to 10.00	1000	1Ph.-2W	010A	010B	010C	010D	010E	010E2	010CX5	010DX5
		2000	3Ph.-3W	013A	013B	013C	013D	013E	013E2	013CX5	013DX5
		3000	3Ph.-4W	016A	016B	016C	016D	016E	016E2	016CX5	016DX5
	0 to 20.00	2000	1Ph.-2W	019A	019B	019C	019D	019E	019E2	019CX5	019DX5
		4000	3Ph.-3W	022A	022B	022C	022D	022E	022E2	022CX5	022DX5
		6000	3Ph.-4W	025A	025B	025C	025D	025E	025E2	025CX5	025DX5
0 to 300	0 to 6.25	1000	1Ph.-2W	002A	002B	002C	002D	002E	002E2	002CX5	002DX5
		2000	3Ph.-3W	005A	005B	005C	005D	005E	005E2	005CX5	005DX5
		3000	3Ph.-4W	008A	008B	008C	008D	008E	008E2	008CX5	008DX5
	0 to 10.00	2000	1Ph.-2W	011A	011B	011C	011D	011E	011E2	011CX5	011DX5
		4000	3Ph.-3W	014A	014B	014C	014D	014E	014E2	014CX5	014CX5
		6000	3Ph.-4W	017A	017B	017C	017D	017E	017E2	017CX5	017DX5
	0 to 20.00	4000	1Ph.-2W	020A	020B	020C	020D	020E	020E2	020CX5	020DX5
		8000	3Ph.-3W	023A	023B	023C	023D	023E	023E2	023CX5	023DX5
		12000	3Ph.-4W	026A	026B	026C	026D	026E	026E2	026CX5	026DX5
0 to 600	0 to 6.25	2000	1Ph.-2W	003A	003B	003C	003D	003E	003E2	003CX5	003DX5
		4000	3Ph.-3W	006A	006B	006C	006D	006E	006E2	006CX5	006DX5
	0 to 10.00	4000	1Ph.-2W	012A	012B	012C	012D	012E	012E2	012CX5	012DX5
		8000	3Ph.-3W	015A	015B	015C	015D	015E	015E2	015CX5	015DX5
	0 to 20.00	8000	1Ph.-2W	021A	021B	021C	021D	021E	021E2	021CX5	021DX5
		16000	3Ph.-3W	024A	024B	024C	024D	024E	024E2	024CX5	024DX5

Highlighted models, (6.25A), can be used with customer's existing current transformers.

*Denotes self-powered unit, limiting input voltage ranges to:
85-135 for 150V models
200-280 for 300V models
380-550 for 600V models

**4-20mA loop-powered unit, (15-40Vdc).

All others require 115VAC instrument power (+/-10%).

ORDERING INFORMATION

Example: Self-powered, single-phase, 120V, 5A input with 0-5Vdc output.
GV5-001CX5

OPTIONAL 50 Hz. OPERATION- CONSULT FACTORY
CONTACT FACTORY FOR COMPLETE PRODUCT CATALOG

MODEL GV5 SPECIFICATIONS

INPUT

SEE TABLE FOR VOLTAGE AND CURRENT RANGES
FREQUENCY RANGE: 60 Hz.
POWER FACTOR: Any
BURDEN:
Voltage: Less than 0.1VA
Current: Less than 0.28VA per element
OVERLOAD:
Voltage (cont.): Consult factory
Current (cont.): Consult factory
DIELECTRIC TEST (Input/Output/Case): 1500VAC

OUTPUT

OUTPUT RIPPLE: Less than 0.5%
OUTPUT LOADING (OHMS):
Option: A-B: 0-10K
C-D: Greater than 2K
E-E2: 0-1.5K
CX5-DX5: Greater than 2K
RESPONSE TIME (99%): Less than 400 mS
COMPLIANCE VOLTAGE: 12Vdc min.
OPEN CIRCUIT VOLTAGE: +/- 15Vdc

ACCURACY +/- 0.2% RDG.

TEMPERATURE EFFECT (-20° to 60°C): +/- 0.005%/°C

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VOLTAGE TRANSDUCERS

AC VOLTAGE TRANSDUCER — MODEL VT

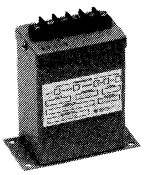
LOW COST AC VOLTAGE TRANSDUCER

FEATURES

- **Factory calibration traceable to NBS.**
- Input/output isolation.

APPLICATIONS

- Designed for use in OEM applications where inexpensive voltage measurement is required.
- Line voltage monitoring.



INPUT	MODEL NUMBER VT- OPTIONAL OUTPUTS			
AC VOLTAGE	0-1mA	4-20mA	0-10Vdc	0-5Vdc
0 to 150 0 to 300 0 to 600	120A 240A 480A	120E 240E 480E	ORDER WITH OSI RESISTOR MODEL LRB-10000	ORDER WITH OSI RESISTOR MODEL LRB-5000

Units with 0-1mA output are self-powered from measured voltage line.
Units with 4-20mA output require 115VAC (+/-10%) instrument power.
Models VT480A and VT480E include **OSI** 226-145 potential transformer.
NOTE: LOAD RESISTOR MUST BE ORDERED SEPARATELY.

ORDERING INFORMATION
Example: Single phase120VAC input with 4-20mA output.
VT120E

RMS VOLTAGE TRANSDUCER — MODEL VTR

ACCURATE TO 0.25% FULL SCALE

FEATURES

- Accurate measurement of the true RMS value of input signals over a wide frequency range.

APPLICATIONS

- For use in applications where measurement of non-sinusoidal waveforms is required.

INPUT	MODEL NUMBER VTR- OPTIONAL OUTPUTS			
AC VOLTAGE	0-1mA	4-20mA	0-10Vdc	0-5Vdc
0 to 150 0 to 300 0 to 600	001B 002B 004B	001E 002E 004E	001D 002D 004D	ORDER WITH OSI RESISTOR MODEL LRB-5000

All units require 115VAC instrument power.
NOTE: LOAD RESISTOR MUST BE ORDERED SEPARATELY.

ORDERING INFORMATION
Example: Single phase120VAC input with 0-10Vdc output.
VTR-001D

MODEL VT, VTR SPECIFICATIONS

INPUT
VOLTAGE: See tables
FREQUENCY RANGE: 50 to 400 Hz.
BURDEN:
Voltage: 2.8VA F.S.
Current: 1.0VA F.S.
OVERLOAD:
Voltage: Full scale rating.
DIELECTRIC TEST (Input/Output/Case): 1500VAC
INSTRUMENT POWER: 115VAC, (+/- 10%), 50-400Hz.

OUTPUT
OUTPUT RIPPLE: Less than 1.0% F.S.
OUTPUT LOADING (OHMS):
Option: A: 0-10K
E: 0-1.5K
RESPONSE: 400mS
FIELD ADJUSTABLE CAL.: +/- 10%
ACCURACY +/- 0.5% F.S. (at 25°C)
Includes effects of linearity.
TEMPERATURE EFFECT (-20°C to 60°C):
+/- 1.0% RDG.

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VOLTAGE TRANSDUCERS

AC/DC VOLTAGE TRANSDUCER — MODEL VT7

DC TO 5000 HERTZ FREQUENCY RESPONSE

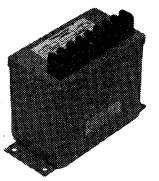
FEATURES

- Provides instantaneous output which is directly proportional to AC or dc input signal.

APPLICATIONS

- Designed for use in applications which require directly analogous voltage measurement.

INPUT	MODEL NUMBER VT7- STANDARD OUTPUTS			
DC VOLTAGE	0-1mA	4-20mA	0-10V	0-5V
0 to 0.050	015B	015E	015D	015DX5
0 to 0.100	016B	016E	016D	016DX5
0 to 12	001B	001E	001D	001DX5
0 to 25	002B	002E	002D	002DX5
0 to 50	003B	003E	003D	003DX5
0 to 100	004B	004E	004D	004DX5
0 to 150	005B	005E	005D	005DX5
0 to 200	006B	006E	006D	006DX5
0 to 300	007B	007E	007D	007DX5
0 to 400	008B	008E	008D	008DX5
0 to 500	009B	009E	009D	009DX5
0 to 600	010B	010E	010D	010DX5
0 to 700	011B	011E	011D	011DX5
0 to 800	012B	012E	012D	012DX5
0 to 900	013B	013E	013D	013DX5
0 to 1000	014B	014E	014D	014DX5



Highlighted models will be supplied with an externally mounted resistance box.

All units require 115VAC instrument power.

ORDERING INFORMATION

Example: 120VAC/dc input with 0-10V output.

VT7-005D

RMS VOLTAGE TRANSDUCER — MODEL VT8

DC TO 5000 HERTZ FREQUENCY RESPONSE

FEATURES

- Provides dc output which is directly proportional to RMS value of AC and/or dc input signal.
- Input/output isolation.

APPLICATIONS

- Accurate measurement of voltage that contains dc and non-sinusoidal AC components.
- Monitoring of RMS voltage.

ORDERING INFORMATION

Select input voltage range and output required from table shown above, (model VT7).

Example: 120VAC/dc input with 4-20mA output proportional to RMS value of input.

VT8-005E

MODEL VT7, VT8 SPECIFICATIONS

INPUT

VOLTAGE: See tables
FREQUENCY RANGE: dc to 5000Hz.
BURDEN (OHMS): Greater than 100K
OVERLOAD:
.05-700V: 2 times full scale rating.
800-1000V: 1500V
DIELECTRIC TEST (Input/Output/Case): 1500VAC
INSTRUMENT POWER: 115VAC (+/-10%) 50-70Hz.

OUTPUT

OUTPUT LOADING (OHMS):
Option: B: 0-10K
D-DX5: Greater than 2.0K
E: 0-1.5K
FIELD ADJUSTABLE CAL.: +/- 10%

ACCURACY +/- 0.5% F.S.

Includes effects of linearity and repeatability.
TEMPERATURE EFFECT (-10°C to 60°C): +/- 1.0% RDG.

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CURRENT TRANSDUCERS

AC CURRENT TRANSDUCER — MODEL CT5

LOW COST AC CURRENT TRANSDUCER

FEATURES

- Accurate, reliable current measurement over a wide frequency range.
  Factory calibration traceable to NBS.

APPLICATIONS

- Designed for use in OEM applications which require inexpensive current measurement.

MODELS WITH INTEGRAL CURRENT SENSOR

INPUT AC CURRENT	SENSOR SIZE	MODEL CT5- OPTIONAL OUTPUTS				
		0-1mA	4-20mA	4-20mA*	0-10Vdc	0-5Vdc
0 to 1.0	N/A	001A	001E	001E2	ORDER WITH OSI RESISTOR MODEL LRB-10000	ORDER WITH OSI RESISTOR MODEL LRB-5000
0 to 5.0		005A	005E	005E2		
0 to 10.0		010A	010E	010E2		
0 to 20.0		020A	020E	020E2		

Highlighted modes, (5A), can be used with customer's current transformers.

Units with 0-1mA output are self-powered from measured line.

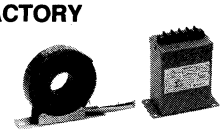
Units with swtandard 4-20mA output require 115VAC instrument power.

*4-20mA loop-powered unit, (15-40Vdc).

NOTE: LOAD RESISTOR MUST BE ORDERED SEPARATELY.

ORDERING INFORMATION
Example: 20Amp AC input with 4-20mA output.
CT5-020E

AVAILABLE WITH UP TO THREE UNITS IN A SINGLE ENCLOSURE CONSULT FACTORY



MODELS SUPPLIED WITH EXTERNAL CURRENT SENSOR

INPUT AC CURRENT	SENSOR SIZE	MODEL CT5- OPTIONAL OUTPUTS				
		0-1mA	4-20mA	4-20mA*	0-10Vdc	0-5Vdc
0 to 50	W	050A	050E	050E2	ORDER WITH OSI RESISTOR MODEL LRB-10000	ORDER WITH OSI RESISTOR MODEL LRB-5000
0 to 100	W	100A	100E	100E2		
0 to 200	W	200A	200E	200E2		
0 to 300	W	300A	300E	300E2		
0 to 400	X	400A	400E	400E2		
0 to 600	X	600A	600E	600E2		
0 to 1000	Y	1000A	1000E	1000E2		

MODEL CT5 SPECIFICATIONS

INPUT

CURRENT: See tables
FREQUENCY RANGE: 50 to 400 Hz.
BURDEN:
Voltage: 2.8VA F.S.
Current: 1.0VA F.S.
CURRENT OVERLOAD:
2 times full scale rating (continuous), except 20A model.
20A model: 1.25 times full scale rating.
50 times full scale (1 Sec. transient).
DIELECTRIC TEST (Input/Output/Case): 1500VAC

OUTPUT

OUTPUT RIPPLE: Less than 1.0% F.S.
OUTPUT LOADING (OHMS):
Option: A: 0-10K
E-E2: 0-1.5K
RESPONSE: 400mS
FIELD ADJUSTABLE CAL.: +/- 10%
ACCURACY +/- 0.5% F.S. (at 25°C)
Includes effects of linearity.
TEMPERATURE EFFECT (-20°C to 60°C):
+/- 1.0% RDG.

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CURRENT TRANSDUCERS

RMS CURRENT TRANSDUCER — MODEL CTR

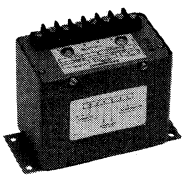
ACCURATE TO 0.25% FULL SCALE

FEATURES

- Accurate measurement of the true RMS value of input signals over a wide frequency range.

APPLICATIONS

- For use in applications where measurement of non-sinusoidal waveforms is required.



INPUT	MODEL NUMBER CTR- OPTIONAL OUTPUTS			
CURRENT (AMPS)	0-1mA	4-20mA	0-10Vdc	0-5Vdc
0 to 5.0	001B	001E	001D	ORDER WITH OSI RESISTOR MODEL LRB-5000
0 to 5.0	100B	100E	100D	
0 to 10.0	010B	010E	010D	
0 to 15.0	015B	015E	015D	
0 to 20.0	020B	020E	020D	

Highlighted 5 Amp models are **non-isolated** (input/output).

NOTE: LOAD RESISTOR MUST BE ORDERED SEPARATELY.

ORDERING INFORMATION
Example: 15 Amp AC input with 0-10Vdc output.
CTR-015D

MODEL CTR SPECIFICATIONS

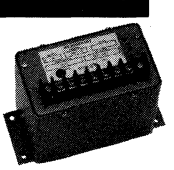
INPUT
CURRENT: See tables
FREQUENCY RANGE: 50 to 400 Hz.
BURDEN:
Voltage: 0.12VA F.S.
Current: 0.28VA F.S.
OVERLOAD:
Current: 50A (10Sec. transient)
250A (1 Sec. transient), isolated models only
DIELECTRIC TEST (Input/Output/Case): 1500VAC
INSTRUMENT POWER:
115VAC (+/-10%), 50-400Hz.

OUTPUT
OUTPUT RIPPLE: Less than 1.0% F.S.
OUTPUT LOADING (OHMS):
Option: B: 0-10K
D: Greater than 2.0K
E: 0-0.6K
RESPONSE: 100mS
FIELD ADJUSTABLE CAL.: +/- 10%
ACCURACY +/- 0.25% F.S. (at 60Hz.)
Includes effects of linearity.
+/- 0.5% over entire frequency range
TEMPERATURE EFFECT (-20°C to 60°C): +/- 1.0% RDG.

SETPOINT RELAYS

SETPOINT RELAY — MODEL CRC

ADJUSTABLE SETPOINT RELAYS



FEATURES

- Provides adjustable setpoint from 0-110% of rated full scale input.

APPLICATIONS

- Designed for use with **OSI** current, voltage, and Watt transducers.

MODEL CRC-005B, 0-mA INPUT SPECIFICATIONS

INPUT
SETPOINT RANGE: 0-1.1mA dc
SENSITIVITY: 2.0 microAmperes
MAX. OVERLOAD (without damage): 10mA
ISOLATION (Input/Output/Case): 1000VAC
INSTRUMENT POWER: 115VAC (+/-10%) 50-400Hz.

OUTPUT
RELAY: SPDT, 120VAC, 3Amp
TEMPERATURE EFFECT (-10°C to 70°C): 0.01%/°C

MODEL CRC-005D, 0-11Vdc INPUT SPECIFICATIONS

INPUT
SETPOINT RANGE: 0-11Vdc
SENSITIVITY: 20mV
MAX. OVERLOAD (without damage): 100V
ISOLATION (Input/Output/Case): 1000VAC
INSTRUMENT POWER: 115VAC (+/-10%) 50-400Hz.

OUTPUT
RELAY: SPDT, 120VAC, 3Amp
TEMPERATURE EFFECT (-10°C to 70°C): 0.01%/°C

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CURRENT TRANSFORMERS

CURRENT TRANSFORMERS

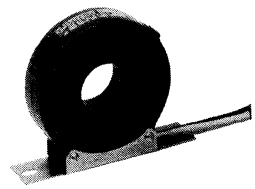
FREQUENCY RANGE 50 TO 400 HERTZ

FEATURES

- Manufactured to meet reqirements of UL1244 and revisions.
- Flexible leads are UL1015 105°C CSA approved.

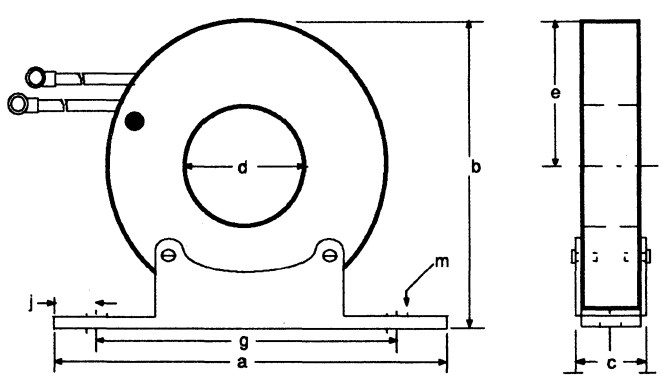
APPLICATIONS

- For use with **OSI** Watt, Watt/VAR, current and Watt/Watt-Hour transducers.
- Ideal for use with Ammeters, relays and cross current compensation.



50 TO 400 HERTZ CURRENT TRANSFORMER

CURRENT RATIO	ACCURACY AT 60HZ. (%)	BURDEN AT 60HZ. (VA)	PART NUMBER	WT. (LBS)	TRANSFORMER DIMENSIONS (INCHES)							
					A	B	C	D	E	G	J	M
50:5	3.0	2.5	10418	1.22	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
100:5	2.0	2.5	12276	1.29	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
	1.5	5.0	10424	1.28	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X .044
150:5	1.0	7.5	10421	1.35	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X .044
	1.0	5.0	12474	1.32	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
200:5	1.0	12.5	10425	1.37	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
	1.0	5.0	12277	1.35	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
250:5	1.0	20.0	12271	1.39	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
	1.0	5.0	12475	1.38	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
300:5	1.0	25.0	10417	1.41	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
	1.0	12.5	12278	1.41	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
400:5	1.0	30.0	12272	1.43	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
	1.0	15.0	10420	1.47	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
500:5	1.0	25.0	12273	1.13	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
	1.0	25.0	12279	1.53	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
600:5	1.0	30.0	12274	1.17	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
	1.0	30.0	10422	1.59	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
750:5	1.0	40.0	12478	1.22	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
	1.0	30.0	12476	1.60	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
800:5	1.0	45.0	12275	1.25	4.63	3.62	1.0	1.25	1.79	3.94	0.34	0.31 X 0.44
	1.0	35.0	12280	1.61	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
1000:5	1.0	35.0	12281	1.29	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
	1.0	20.0	10423	0.65	6.63	4.63	1.0	3.00	2.38	5.75	0.44	0.28
1200:5	1.0	40.0	12282	1.38	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
	1.0	25.0	11014	0.73	6.63	4.63	1.0	3.00	2.38	5.75	0.44	0.28
1500:5	1.0	50.0	12283	1.50	6.63	4.63	1.0	2.50	2.38	5.75	0.44	0.28
	1.0	30.0	10998	0.86	6.63	4.63	1.0	3.00	2.38	5.75	0.44	0.28
2000:5	1.0	40.0	12284	1.10	6.63	4.63	1.0	3.00	2.38	5.75	0.44	0.28



TRANSFORMER SPECIFICATIONS

FREQUENCY: 50 to 400Hz.
INSULATION CLASS: 0.6KV BIL 10KV full wave
LEADS: UL1015 105°C CSA approved, #16 AWG, 24In. length.
TERMINALS: No. 8 ring terminal.

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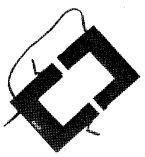
CURRENT TRANSDUCERS

CURRENT TRANSDUCERS MODEL CTL

FREQUENCY RANGE DC TO 1000 HERTZ

FEATURES

- Response time of less than **50 microseconds**.
- Available in split-core configurations.



APPLICATIONS

- For use with **OSI** model CTA dc or RMS signal conditioners.
- Ideal for use on variable frequency AC systems with dc components, and/or chopped waveforms.

CIRCULAR WINDOW MODELS (0.5% LINEARITY)

RMS CURRENT (A)	EXCITATION (mA)	OUTPUT (mV)	TEMPERATURE		RESISTANCE (OHMS)		SENSOR SIZE	PART NUMBER
			EFFECTS	RANGE(°C)	INPUT	OUTPUT		
50	100	30	-0.15%/°C	-40 to 65	4.0	3.0	A	CTL-50
	100	20	+/- 1.0%	0 to 40	4.0	25.0	A	CTL-50TT
	100	20	+/- 1.0%	-40 to 65	4.0	25.0	A	CTL-50T
100	100	50	-0.15%/°C	-40 to 65	4.0	3.0	C	CTL-100
	100	50	+/- 1.0%	0 to 40	4.0	25.0	C	CTL-100TT
	100	50	+/- 1.0%	-40 to 65	4.0	25.0	C	CTL-100T
200	100	75	-0.15%/°C	-40 to 65	4.0	3.0	D	CTL-200
	100	50	+/- 1.0%	0 to 40	4.0	25.0	D	CTL-200TT
	100	50	+/- 1.0%	-40 to 65	4.0	25.0	D	CTL-200T
400	100	50	-0.15%/°C	-40 to 65	4.0	3.0	D	CTL-400
	100	50	+/- 1.0%	0 to 40	4.0	25.0	D	CTL-400TT
	100	50	+/- 1.0%	-40 to 65	4.0	25.0	D	CTL-400T
600	100	75	-0.15%/°C	-40 to 65	4.0	3.0	E	CTL-600
	100	50	+/- 1.0%	0 to 40	4.0	25.0	E	CTL-600TT
	100	50	+/- 1.0%	-40 to 65	4.0	25.0	E	CTL-600T
1000	200	75	-0.15%/°C	-40 to 65	25.0	6.0	E	CTL-1000
	200	50	+/- 1.0%	0 to 40	25.0	25.0	E	CTL-1000TT
	200	50	+/- 1.0%	-40 to 65	25.0	25.0	E	DTL-1000T
2000	200	150	-0.15%/°C	-40 to 65	25.0	6.0	E	CTL-2000
	200	100	+/- 1.0%	0 to 40	25.0	25.0	E	CTL-2000TT
	200	100	+/- 1.0%	-40 to 65	25.0	25.0	E	CTL-2000T

OPTIONAL SPLIT-CORE-ADD SUFFIX "S" TO PART NUMBER
NOTE: 50 Amp models not available in split-core configuration.

MATCH TRANSDUCER EXCITATION REQUIREMENT AND mV OUTPUT TO MODEL CTA SIGNAL CONDITIONER SHOWN ON FACING PAGE, ORDER AS SEPERATE ITEMS.

RECTANGULAR WINDOW (BUS BAR) MODELS (1.0% LINEARITY)

PEAK CURRENT (A)	EXCITATION (mA)	OUTPUT (mV)	TEMPERATURE		RESISTANCE (OHMS)		SENSOR SIZE	PART NUMBER
			EFFECTS	RANGE(°C)	INPUT	OUTPUT		
1000	100	75	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-1000HT
1200	100	75	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-1200HT
2000	100	100	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-2000HT
2200	100	100	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-2200HT
3000	100	100	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-3000HT
4000	100	100	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-4000HT
	200	150	+/- 1.0%	-40 to 65	25.0	25.0	G	CTL-4000T
5000	100	75	+/- 1.0%	-40 to 65	25.0	25.0	Z	CTL-5000HT
	200	150	+/- 1.0%	-40 to 65	25.0	25.0	G	CTL-5000T
8000	200	75	+/- 1.0%	-40 to 65	12.0	25.0	H	CTL-8000T

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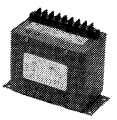
SIGNAL CONDITIONERS

SIGNAL CONDITIONER MODEL CTA

FOR USE WITH OSI MODEL CTL CURRENT TRANSDUCERS

DC MODELS
- Provide output which is directly proportional to AC or dc input signal.

RMS MODELS
- Provide dc output which is proportional to RMS value of AC and/or dc input signal.



DC MODELS

INPUT SIGNAL (MODEL NUMBER)				EXCITATION (mA)	OUTPUT	CALIBRATION ADJUSTMENT		INSTRUMENT POWER
+/- 50mV	+/- 75mV	+/- 100mV	+/- 150mV			AMP. GAIN	EXCITATION	
CTA101	CTA101H	CTA101P	CTA101K	100	0-10V	FIXED	+/- 30%	115VAC
CTA112	CTA112H	CTA112P	CTA112K	100	4-20mA	+/- 20%	FIXED	115VAC
CTA124	CTA124H	CTA124P	CTA124K	100	0-10V	FIXED	+/- 30%	24Vdc
CTA128	CTA128H	CTA128P	CTA128K	100	0-10V	FIXED	+/- 30%	28Vdc
CTA201	CTA201H	CTA201P	CTA201K	200	0-10V	FIXED	+/- 10%	115VAC
CTA212	CTA212H	CTA212P	CTA212K	200	4-20mA	+/- 20%	FIXED	115VAC
CTA224	CTA224H	CTA224P	CTA224K	200	0-10V	FIXED	+/- 10%	24Vdc
CTA228	CTA228H	CTA228P	CTA228K	200	0-10V	FIXED	+/- 10%	28Vdc
CTA1173	CTA1173H	CTA1173P	CTA1173K	200	+/- 4mA	FIXED	+/- 30%	115VAC

ORDERING INFORMATION

MATCH CTA SIGNAL CONDITIONER EXCITATION CURRENT AND INPUT mV RANGE WITH CTL CURRENT TRANSDUCER EXCITATION REQUIREMENT AND mV OUTPUT-SHOWN ON FACING PAGE, ORDER SEPERATELY.

EXAMPLE: 200 Amp split-core current transducer requiring 100mA excitation, with output of 75mV.

CTL-200-S

RMS signal conditioner, for use with CTL-200-S, with 4-20mA output.

CTA115H

RMS MODELS

INPUT SIGNAL (MODEL NUMBER)				EXCITATION (mA)	OUTPUT	CALIBRATION ADJUSTMENT		INSTRUMENT POWER
+/- 50mV	+/- 75mV	+/- 100mV	+/- 150mV			AMP. GAIN	EXCITATION	
CTA113	CTA113H	CTA113P	CTA113K	100	0-10Vdc	+/- 20%	FIXED	115VAC
CTA114	CTA114H	CTA114P	CTA114K	100	0-1mA	+/- 20%	FIXED	115VAC
CTA115	CTA115H	CTA115P	CTA115K	100	4-20mA	+/- 20%	FIXED	115VAC
CTA213	CTA213H	CTA213P	CTA213K	200	0-10Vdc	+/- 20%	FIXED	115VAC
CTA214	CTA214H	CTA214P	CTA214K	200	0-1mA	+/- 20%	FIXED	115VAC
CTA215	CTA215H	CTA215P	CTA215K	200	4-20mA	+/- 20%	FIXED	115VAC

MODEL CTA SPECIFICATIONS

INPUT
VOLTAGE: See tables
CONTROL CURRENT:
Regulation: Line/load +/- 0.01%
Voltage: 6Vdc at full load
FREQUENCY RANGE: dc to 5000Hz.
DIELECTRIC TEST (Input/Output/Case): 1500VAC
INSTRUMENT POWER: 115VAC (+/-10%) 50-60Hz.
24Vdc +/- 10%, 8W
28Vdc +/- 10%, 8W

OUTPUT
OUTPUT RIPPLE: Less than 0.25% F.S.
OUTPUT LOADING (OHMS):
Option: 0-1mA: 0-10K
+/- 10V: Greater than 2.0K
4-20mA: 0-500
RESPONSE (90%): DC Models: 40 microseconds
RMS Models: 200mS
LINEARITY +/- 0.1% F.S.
TEMPERATURE EFFECT (0°C to 70°C): +/- 0.005%/°C

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INTEGRATION DEVICES

ANALOG-TO-PULSE INTEGRATOR WITH DISPLAY MODEL PA

INTEGRATES ANY DC PROCESS VARIABLE ANALOG

FEATURES

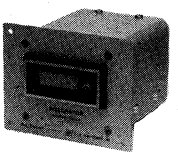
- Displays time integral of analog input signal.
- Current or voltage inputs.
- Count rates from 200 to 100000 counts/Hour.

APPLICATIONS

- Can be used with **OSI** Watt, VAR, or current transducers.
- Accumulate Watt-Hours, VAR-Hours, Amp-Hours, volume, weight, or distance.

INPUT		COUNTS PER HOUR AT FULL SCALE INPUT	MOUNTING CONFIGURATION	
RANGE	DESIGNATION		RACK	PANEL
0 to 50mV	001	SPECIFY REQUIRED	ADD	ADD
0 to 100mV	002	COUNTS PER HOUR,	SUFFIX	SUFFIX
0 to 150mV	003	FROM 200 TO 100000.	**"R"**	**"P"**
0 to 250mV	004	ADD SUFFIX	TO	TO
0 to 1mA	005	**"/(COUNT RATE)"**	PART	PART
0 to 20mA	008	TO PART NUMBER.	NUMBER	NUMBER
4 to 20mA	010	FOR COUNT RATES		
0 to 5Vdc	007	GREATER THAN 999		
1 to 5Vdc	009	SPECIFY USING K,		
0 to 10Vdc	006	(e.g. 2000=/2K).		

OPTIONAL 220V, 50 Hz. OPERATION-ADD "-52" TO PART NUMBER



ORDERING INFORMATION
Example: Panel mounted unit, full scale input of 10Vdc. Count rate of 5500 cts./Hr.
PA-006/5.5K-P

MODEL PA SPECIFICATIONS

INPUT
VOLTAGE: See table
CURRENT: See table
BURDEN (OHMS):
Voltage input models: Greater than 100K
0-1mA input models: Less than 1K
20mA input models: Less than 100
OVERLOAD: 1.25 times full scale
INSTRUMENT POWER:
Std.: 115VAC, +/- 10% (50-400Hz)
Option 52: 220VAC, 50Hz.

DISPLAY
COUNTER: 8 digit, 0.32 In. LCD
COUNTER BATTERIES: Internal Lithium
BATTERY LIFE: 8 yrs. (nom.)
RESET: Manual and/or remote
ACCURACY +/- 0.25% F.S.
LINEARITY: +/- 0.1% F.S.
TEMPERATURE EFFECT (-20°C to 60°C):
+/- 0.005%/°C

PRECISION INTEGRATOR MODEL VFC

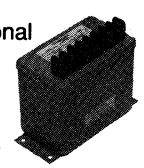
CONVERTS DC INPUT TO TIME-INTEGRATED PULSE

FEATURES

- Provides relay closure count which is proportional to the integral of the input signal.

APPLICATIONS

- Designed for use with dc, pulsating dc, or dc with AC components.



INPUT RANGE	CLOSURE RATE (COUNTS/HR.)	PART NUMBER
0 to 50mV	0 to 10000	VFC-010
0 to 100mV	0 to 10000	VFC-020
0 to 150mV	0 to 10000	VFC-030
0 to 250mV	0 to 10000	VFC-040
0 to 1mA	0 to 10000	VFC-050
0 to 10V	0 to 10000	VFC-060

MODEL VFC SPECIFICATIONS

INPUT
VOLTAGE: See table
OVERLOAD: 10Vdc max.
IMPEDANCE (Ohms):
Voltage input models: Greater than 1M
Current input models: Less than 200
FREQUENCY: dc with up to 100% ripple at 120 Hz. or higher.
OUTPUT
RELAY: N/O SPST, 120V, 0.3A contact rating
RELAY CLOSURE PERIOD: 100 mS
ACCURACY +/- 0.25% F.S.
LINEARITY: +/- 0.1% F.S.
TEMPERATURE EFFECT (-10° to 60°C): +/- 0.5%
INSTRUMENT POWER: 115VAC+/- 10%, 50-400Hz.

CUSTOM COUNT RATES AVAILABLE-CONSULT FACTORY

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FREQUENCY TRANSDUCERS

FREQUENCY TRANSDUCER — MODEL FT

ACCURATE TO 0.2% OF FULL SCALE

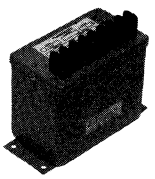
FEATURES

- Provides analog output which is proportional to the frequency range of the input signal.

APPLICATIONS

- For use on any application that requires indication or collection of frequency variations.

INPUT FREQUENCY (Hz)	MODEL NUMBER FT- STANDARD OUTPUTS		
	0-1mA	0-10Vdc	0-5Vdc
45 to 55	050B	050D	050DX5
55 to 65	060B	060D	060DX5
375 to 400	400B	400D	400DX5



ADDITIONAL FREQUENCY RANGES AVAILABLE
CONSULT FACTORY

ORDERING INFORMATION
Example: 55-65Hz. input, with 0-5Vdc output
FT-060CX5

MODEL FT SPECIFICATIONS

INPUT
FREQUENCY RANGE: See table
VOLTAGE RANGE: 95-135V
BURDEN : 4.0VA
OVERLOAD: 150V
DIELECTRIC TEST (Input/Output/Case): 1500VAC

OUTPUT
OUTPUT LOADING (Ohms): 0-10K
RESPONSE TIME: 400mS
ACCURACY +/- 0.2% F.S.
TEMPERATURE EFFECT (-20°C to 60°C):
+/- 0.005%/°C

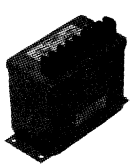
SIGNAL CONVERTERS

PRECISION CURRENT CONVERTER — MODEL SCE

ACCURATE TO 0.1% OF FULL SCALE

FEATURES

- Converts dc current or voltage output to 4-20mA output.



APPLICATIONS

- Interface with **OSI** transducers, or any with output signals listed in the table below.

DC INPUT	OUTPUT (mA)	BURDEN (OHMS)	PART NUMBER
0 to 1mA	4 to 20	1K	SCE-001
0 to 10V	4 to 20	10K	SCE-002
0 to 50mV	4 to 20	Grtr. than 100K	SCE-003
0 to 100mV	4 to 20	Grtr. than 100K	SCE-004
0 to 150mV	4 to 20	Grtr. than 100K	SCE-005

MODEL SCE SPECIFICATIONS

INPUT
VOLTAGE: See table
CURRENT: See table
OVERLOAD: 10 times F.S. input
ISOLATION: Input is not isolated from output
OUTPUT
OUTPUT: 4 to 20mA
OUTPUT LOADING: 0-1500 Ohms
RESPONSE TIME (99%): 100 mS
FIELD ADJUSTABLE CAL.: +/- 10%
ACCURACY +/- 0.1% F.S.
Includes effects of linearity.
TEMPERATURE EFFECT (-20° to 65°C):
+/- 1.0% F.S.
INSTRUMENT POWER: 115VAC+/- 10%, 50-400Hz.

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HALL EFFECT PROBES

PRECISION HALL EFFECT SENSOR — MODELS HR, HS

HALLTRON MAGNETIC FIELD SENSOR

FEATURES
- High accuracy, low noise.

APPLICATIONS
- Magnetic field sensing applications.

HALL OUTPUT* MILLIVOLTS (+/- 25%)	NOMINAL CONTROL CURRENT Ic, (mA)	OHMIC RESIDUAL, (mV) FIELD=0 Ic=10mA	OHMIC RESIDUAL, (mV) FIELD=0 Ic=100mA	NOMINAL INPUT RESISTANCE (OHMS)	NOMINAL OUTPUT RESISTANCE (OHMS)	DIMENSIONS (INCHES) L	W	T	LEAD INSUL. MAT'L.	TEMP. COEFF. % OUTPUT PER °C	MODEL NUMBER
350	350		0.15	1.5	1.5	0.625	0.375	0.028	PVC	-0.10	HR36
200	25	0.2		8.0	8.0	0.625	0.375	0.028	PVC	-0.25	HR38
500	200		0.50	5.0	4.0	0.200	0.250	0.028	Enamel	-0.15	HR66
340	200		0.50	2.0	2.0	0.200	0.250	0.028	PVC	-0.10	HR70
700	100	0.2		9.0	6.0	0.200	0.250	0.028	Enamel	-0.25	HR72
550	100		1.00	10.0	10.0	0.200	0.250	0.030	Enamel	-0.25	HR77
100	100		0.50	2.5	2.0	0.200	0.250	0.028	Enamel	-0.05	HR125A
250	100		0.50	1.2	1.0	0.500	0.375	0.025	PVC	-----	HS55

*** OUTPUT SPECIFIED WITH FIELD OF 10KG, AND CONTROL CURRENT AS LISTED IN TABLE.**
OPERATING TEMPERATURE RANGE: -65 TO 85°C

CURRENT CONVERTER

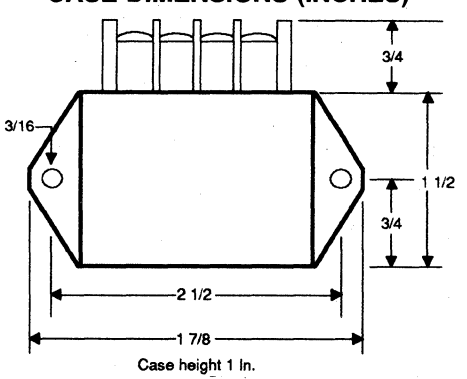
TRANSMITTER OUTPUT CONVERTER — MODEL PI

CONVERTS 4-20mA TO 0-1mA, OR 0-1V OUTPUT

INPUT	OUTPUT	PART NUMBER
4-20mA	0 to 1mA	PI8300B
4-20mA	0 to 10Vdc	PI8300D

NO EXTERNAL POWER REQUIRED

CASE DIMENSIONS (INCHES)

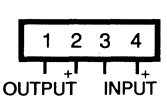


Case height 1 In.

MODEL PI SPECIFICATIONS

INPUT
CURRENT: See table
LOAD ON INPUT: 400 Ohms
OUTPUT
PI8300B: 0-1mA
PI8300D: 0-10Vdc
OUTPUT LOADING (Ohms):
0-1mA: 0-4K
0-10V: Greater than 10K
ACCURACY +/- 0.25% F.S.
Includes effects of linearity.
TEMPERATURE EFFECT (-20° to 65°C): +/- 0.005%/°C
GROUNDING: Converter is non-isolated. Ground either input or output, not both. If the 4-20mA loop is grounded, float both input and output.

CONNECTION DIAGRAM



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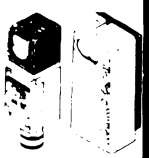
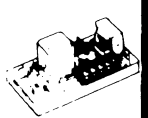
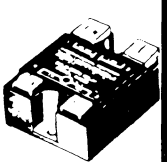
TOGGLE SWITCHES

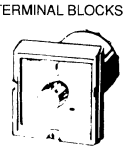

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS


TEMPERATURE CONTROLS

TIMERS

CABINETS
BUD

CIRCUIT BREAKERS
Airpax
Aromat
Heinemann
Potter & Brumfield

CONNECTORS & SOCKETS
AMP
Amphenol
Aromat
Curtis
Custom Connector
Idec
Lumberg
Master Electronics
Panduit
Potter & Brumfield
Souriau
Vernitron-Beau
Welcon/Wells

COUNTERS
Engler
Hecon
IVO
Kessler-Ellis
Master Electronics
Omron
Redington
Red Lion
Sodeco/Maxmar
Stemco
Veeder-Root

DIODES
General Instr.

FANS
Aromat
U.S. Toyo

FILTERS
Curtis

RELAYS
Aleph International
Allied Controls
American-Zettler
Aromat
AT&T
Bosch
C.P. Clare
Coto
Crydom Controls
EAC
Elec-Trol
Fujitsu
Gordos
Grayhill
Guardian
Hi-G
Idec
ITT
Line Electric
Magnecraft
Master Electronics
MEC
Midtex
Omron
Potter & Brumfield
RBM
Schrack
Siemens
Sigma
Stantel
Struthers-Dunn
Telemecanique
Theta-J
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FUSES
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KNOBS
Cosmo/Kurz-Kasch
Raytheon/Panel Products

INDICATORS, LAMPS & LED
IDI
IEE
JKL
Leecraft
Lumex
Stanley
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SWITCHES
Acro
Alco
American Switch
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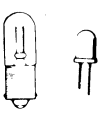
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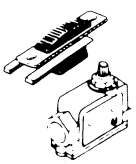
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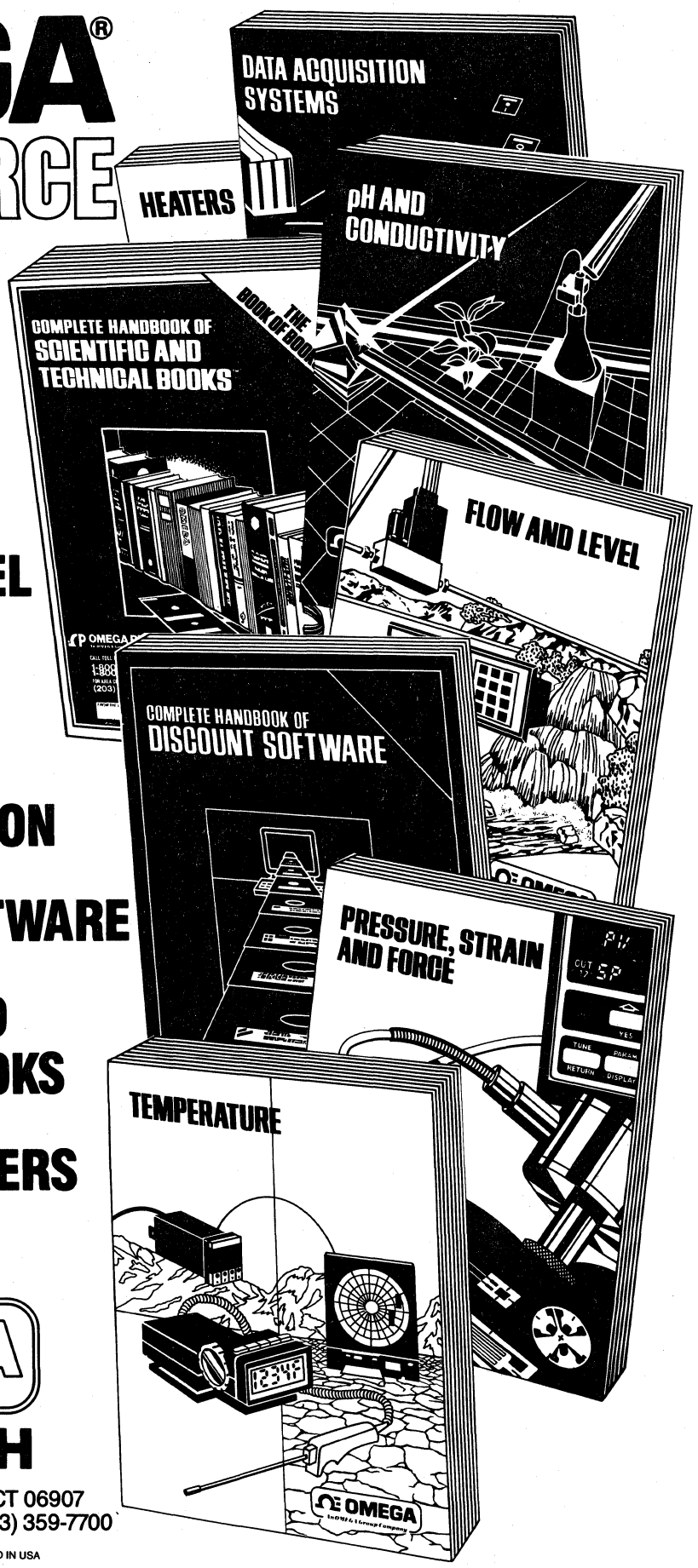

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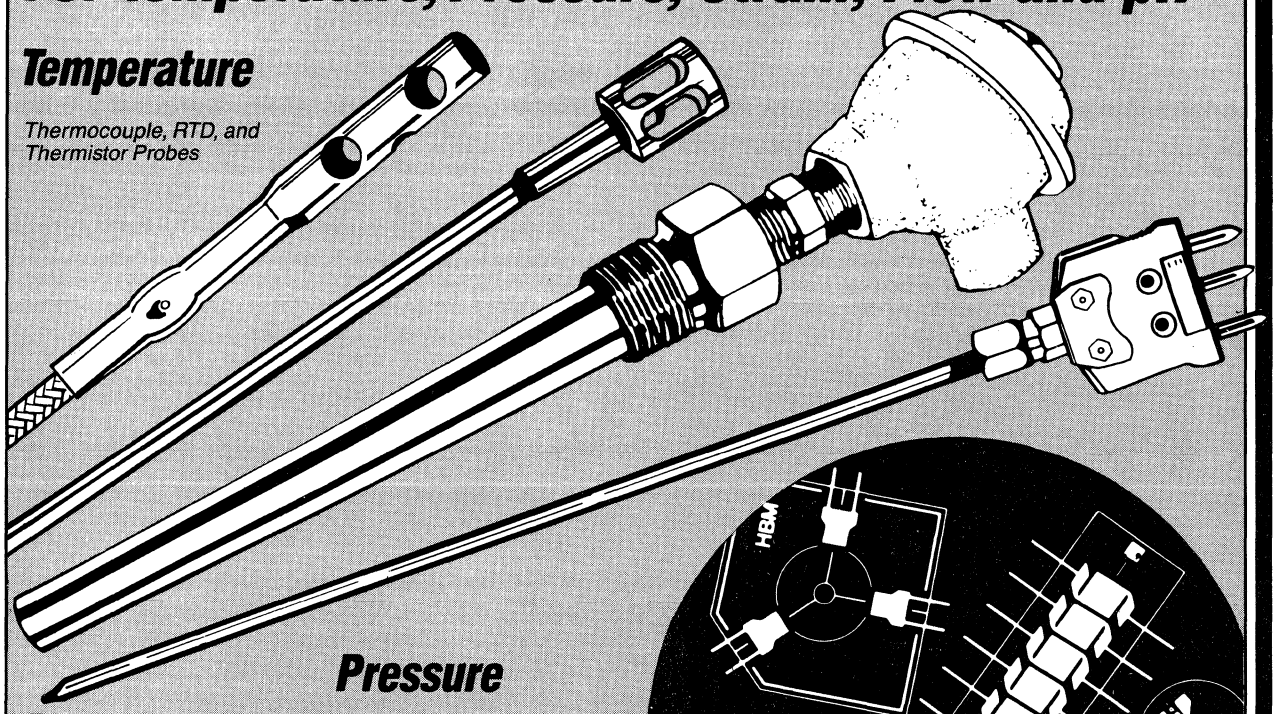
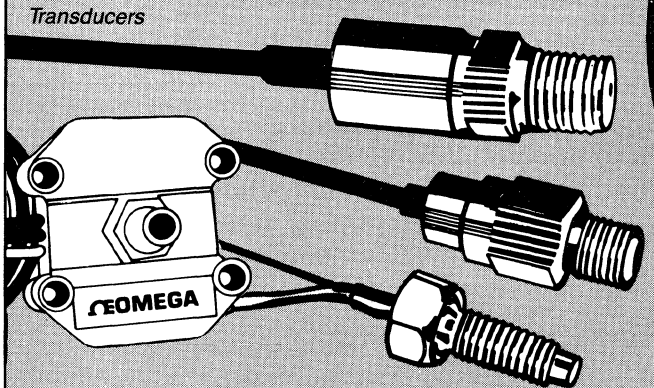
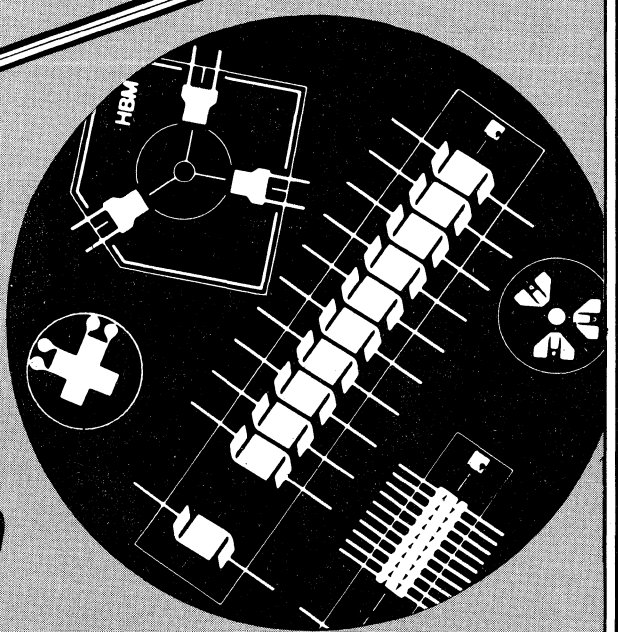


Pressure

Transducers





Strain Gages

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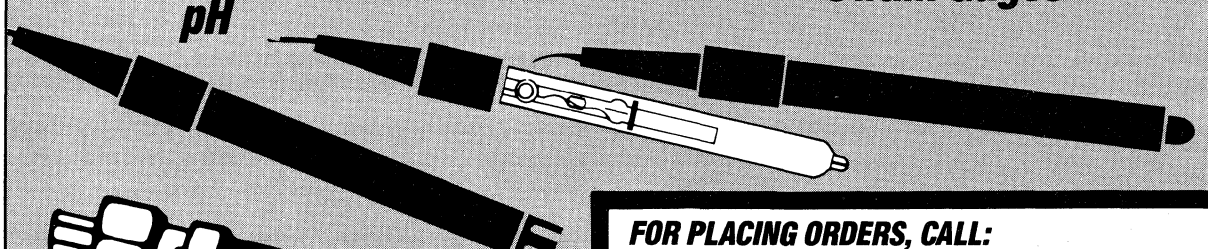

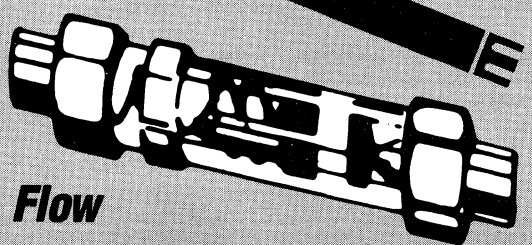

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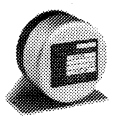
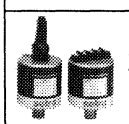
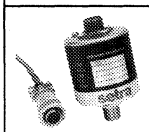
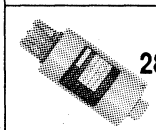
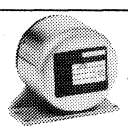
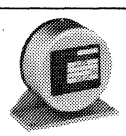
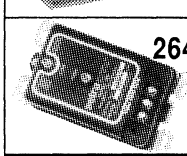
Product Line Summary

Gage - Absolute - Vacuum Transducers

Model	Applications	Type of Measurement	Pressure Ranges	Accuracy (RSS Method)	Thermal Effect ± % FS/100°F	Media Compatability	Output
 **204**	General Purpose Intrinsically Safe R & D Laboratories Vacuum Systems	Absolute Pressure Gage Pressure Vacuum Pressure	25 to 5000 psia 25 to 10000 psig 0-14.7 psiv	0.11%	0.4 max Zero 0.3 max Span	Gas or liquid compatible with Stainless Steel	**204** 0-5 VDC **C-204** 4-20 mA
 **206/207 OEM**	Equipment Automation Compressor Control Chillers Paper Converting Hydraulics & Pneumatics	Gage Pressure	25 to 5000 psig	0.13%	1.0 max Zero 1.5 max Span	Gas or liquid compatible with Stainless Steel	**206/207** 0.1-5.1 VDC **C-206/C-207** 4-20 mA
 **211**	Test & Measurement Engine Test Cells Prototype Analysis Metrology Laboratories Hydraulic Test Equipment	Gage Pressure	25 to 5000 psig	0.13%	0.5 max Zero 0.5 max Span	Gas or liquid compatible with Stainless Steel	**211** 0.1-5.1 VDC **C-211** 4-20 mA
 **280E**	General Purpose Hydraulics & Pneumatics Process Control P/I Range Level Measurement	Absolute Pressure Gage Pressure Pneumatic Pressure Compound Pressure	15 to 5000 psia 15 to 10000 psig 3-15 psig -14.7 to 35, 50, 100 psig	0.11%	1.0 max Zero 1.5 max Span	Gas or liquid compatible with Stainless Steel	**280E** 0-5 VDC **C-280E** 4-20 mA
 **270**	Weather Data Systems Laser Interferometers Altimeter Setting Indicators Transfer Pressure Standard	Barometric Pressure Absolute Pressure Gage Pressure	600-1100 mbars 800-1100 mbars 10 to 100 psia 5 to 100 psig	0.05%	0.1 max Zero (0.2 Barometric) 0.1 max Span	Wet or Dry Air	0-5 VDC

Differential Pressure Transducers

Model	Applications	Type of Measurement	Pressure Ranges	Accuracy (RSS Method)	Thermal Effect ± % FS/100°F	Media Compatability	Output
204D	General Purpose Intrinsically Safe High Differential Pressure	Differential Pressure	10 to 10000 psid	0.11%	1.0 max Zero 1.0 max Span	Gas or liquid compatible with Stainless Steel	0-5 VDC or ± 2.5 VDC
228-1	Process Control Filter Condition Monitoring Refrigeration Equipment Chillers	Differential Pressure (can be wet both sides)	Low diff. pres. 1 to 100 psid ± 0.5 to 50 psid	Low Ranges 0.15% High Ranges 0.25%	2.0 max Zero 2.0 max Span	Gas or liquid compatible with Stainless Steel (both pressure and reference sides)	**228-1** 0-5 VDC or ± 2.5 VDC **C-228-1** 4-20 mA
 **239**	HVAC Control Leak Detection Environmental Testing R & D Scientific	Differential Pressure	0.5"WC to 10 psid ± 0.25"WC to ± 5 psid	0.14%	1.0 max Zero 1.0 max Span	Gas compatible with Stainless Steel, Aluminum	**239** 0-5 VDC or ± 2.5 VDC **C-239** 4-20mA
 **264**	HVAC and VAV Control Energy Management Systems Clean Room Control Medical Instrumentation Filter Condition Monitoring	Very low Differential Pressure	0.1 to 25 in. WC	1.0%	3.3 Zero 3.3 Span	Air or Inert gases	**264** 0-5 VDC **C-264** 4-20mA

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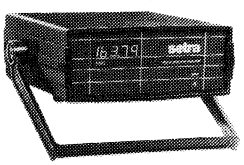
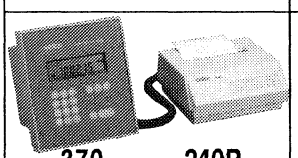
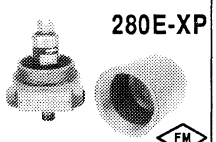
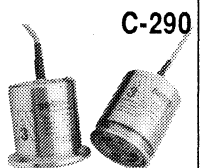
Digital Displays and Systems

Model	Applications	Type of Measurement	Pressure Ranges	Accuracy (RSS Method)	Analog Output
300	Panel Mountable Digital indicators for use with Setra transducers and Transmitters	Gage Pressure Absolute Pressure Differential Pressure Vacuum Barometric Pressure	All Pressure Ranges (4-1/2 digits)	Transducer Accuracy	0 to 5V or 0 to ±2.5V 4-20 mA
 304-1/339-1/350-1	Bench Top Digital Pressure - Manometers R & D Scientific Temporary Field Pressure - Monitoring Transfer Standards	Gage Pressure Absolute Pressure Differential Pressure Barometric Pressure Vacuum Pressure	5 to 100 psig 5 to 100 psia 0.5" to 30" WC ±0.25" to ±15"WC 5 to 100 psid ± 2.5 to ± 50 psid 600-1100 mbar 800-1100 mbar 0-14.7 psiv	± 0.11% (304-1) ± 0.14% (339-1) ± 0.05% (350-1)	0 to 5V or 0 to ±2.5V 6 to 11V (Barometric) 8 to 11V
360	Panel Mountable or BenchTop - Digital Pressure Gage R & D Scientific	Gage Pressure Absolute Pressure Vacuum Pressure	20 to 2000 psig 20 to 2000 psia 0-14.7 psiv	±0.1%	0 to 5V
 370 240P	Barometric Pressure Monitoring Altimeter Calibration Pressure Switch Setting Laser Interferometers Min/Max Tracking Hi/Lo Alarming Transfer Pressure Standard	Barometric Absolute Pressure	600-1100 mbars 800-1100 mbars 10 to 100 psia	± 0.02%	RS-232

Specialty Application Products

Model	Applications	Type of Measurement	Pressure Ranges	Accuracy (RSS Method)	Thermal Effect ± % FS/100°F	Media Compatability	Output
280E-XP  FM Approved	Explosionproof/Weatherproof Process Instrument Signals Natural Gas Lines Chemical Processing Off-Shore Drilling	Gage Pressure Absolute Pressure Compound Pressure P/I	15 to 10000 psig 25 to 5000 psia -14.7 to 35, 50 100 psig 3-15 psig	0.11%	**280E/C280E** 1.5 max Zero 1.0 max Span	Gas or liquid compatible with Stainless Steel	**280E** 0-5VDC **C-280E** 4-20mA
C-290 	Sanitary Pressure Lines Food & Beverage Processing Tank Level Measurement Pharmaceutical Processing Sanitary Filtration Systems	Gage Pressure	1 to 1000 psig	0.20%	2.0 max Zero 2.0 max Span	Gas or liquid compatible with Stainless Steel	4-20 mA

Accelerometer	Applications	G Ranges (Full Scale Ranges ± G)	Comment
141	Transportation Equipment Position Sensing Robotics Shock & Vibration Testing	2, 4, 8, 15, 30, 60, 150, 600	Hi Level Output EMI Filter Option

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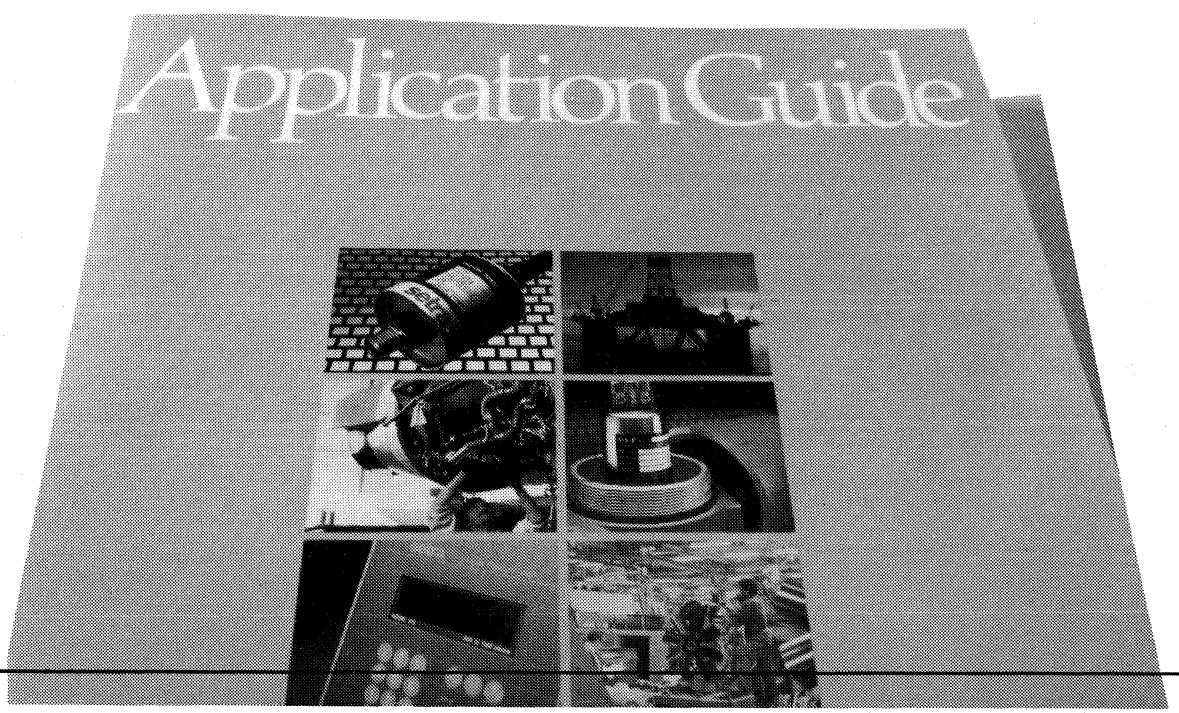


COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

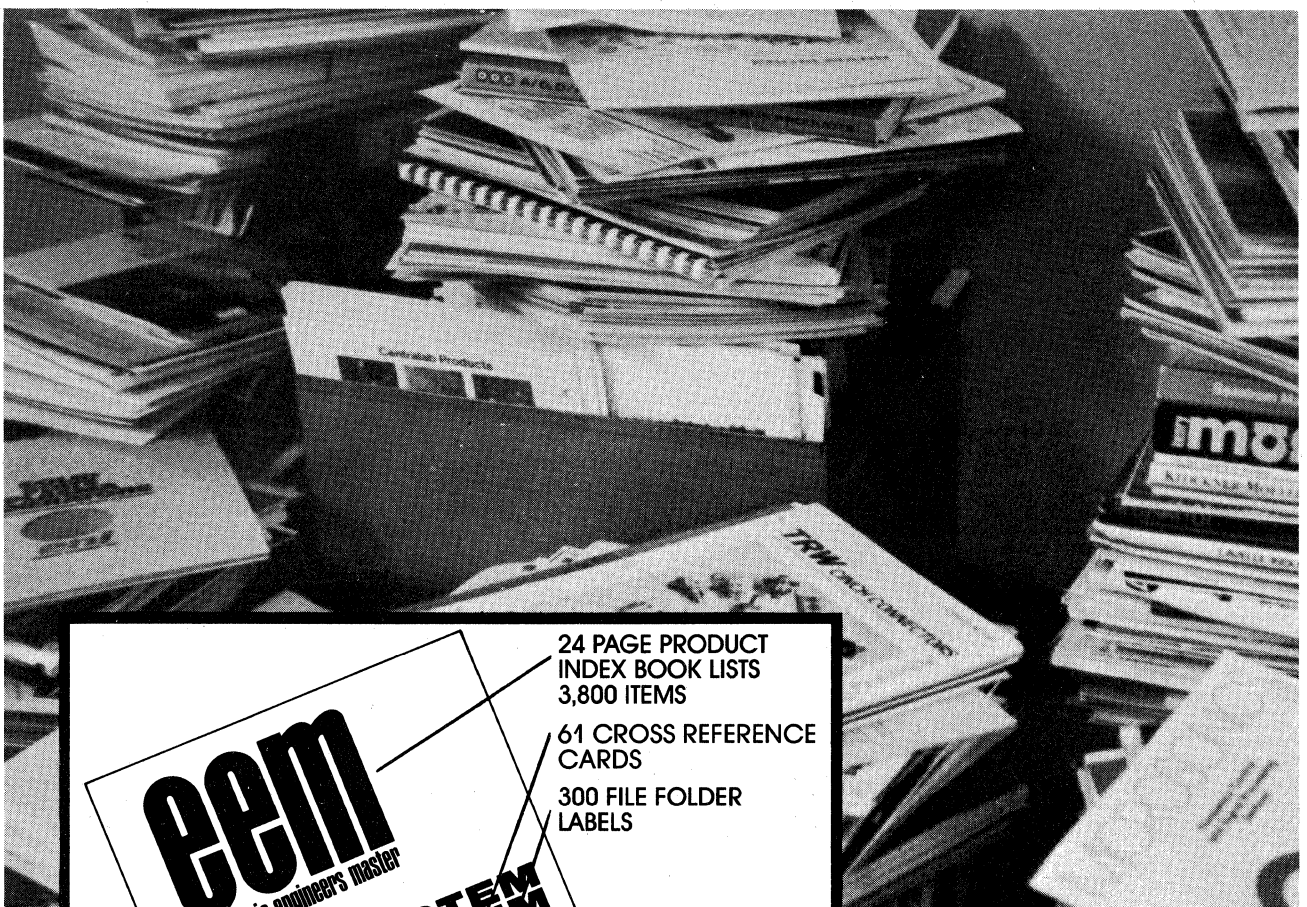
U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force



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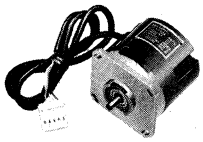
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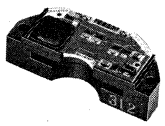

GP1R111

Optical Rotary Encoders

(Ta = 25°C)

Model No.	Absolute maximum ratings					Electrical characteristics				
	Vcc (V)	Topr (°C)	Tstg (°C)	R_L (kΩ)	I_{SINK} (mA)	Output signal	Resolution	Frequency (kHz) MAX.	Frequency R_L (kΩ)	Dissipation current I_{TOT} (mA) MAX.
GP1A13R	7	0 ~ +70	−40 ~ +80	—	—	Phase A (Digital output) Phase B (Digital output)	Disk slit pitch 1.14(mm)	10	I_F = 20(mA)	20
GP1A16R	7	0 ~ +70	−40 ~ +80	—	—	Phase A (Digital output) Phase B (Digital output)	Disk slit pitch 0.7(mm)	10	I_F = 20(mA)	20
GP1A30R	7	0 ~ +70	−40 ~ +80	—	—	Phase A (Digital output) Phase B (Digital output)	Disk slit pitch 1.14(mm)	5	I_F = 30(mA)	20
GP1A33R	7	0 ~ +70	−40 ~ +80	—	—	Phase A (Digital output) Phase B (Digital output)	Disk slit pitch 0.7(mm)	5	I_F = 30(mA)	20
GP1A35R	7	0 ~ +70	−40 ~ +80	—	—	Phase A (Digital output) Phase B (Digital output)	Disk slit pitch 0.22(mm)	tr(TYP.) 1.0μs	I_F = 30(mA)	20
GP1R04 Series	8	0 ~ +70	−40 ~ +80	5.0	—	Phase A (Approx. sine wave) Phase B (Approx. cos wave) Phase Z (Index output)	96/100/192/200 /360	20	10	70
GP1R14 Series	±15	0 ~ +70	−40 ~ +80	5.0	—	Phase A (Approx. sine wave) Phase B (Approx. cos wave) Phase Z (Index output)	96/192/200/360	20	10	75
GP1R34 Series	±15	0 ~ +70	−40 ~ +80	—	—	Phase A (Approx. sine wave) Phase B (Approx. cos wave) Phase Z (Index output)	96/192/200/360	20	10	75
GP1R11	7.0	0 ~ +70	−40 ~ +80	—	20	Phase A (Digital output) Phase B (Digital output)	48/60/75/100	tr(TYP.) 0.2μs	10	70
GP1R21	7.0	0 ~ +70	−40 ~ +80	—	20	Phase A (Digital output) Phase B (Digital output)	120/200	tr(TYP.) 0.2μs	10	70
GP1R111 Series	8.0	0 ~ +70	−40 ~ +80	—	16	Phase A (Approx. sine wave) Phase B (Approx. cos wave) Phase Z (Index output)	96/200/360	tr(TYP.) 0.3μs	0.3	80
GP1R23	6.0	0 ~ +70	−40 ~ +80	—	16	Phase A (Digital output) Phase B (Digital output)	500	tr(TYP.) 1.0μs	4.7	50
GP1R52 Series	8.0	0 ~ +70	−40 ~ +80	5.0	—	Phase A (Approx. sine wave) Phase B (Approx. cos wave) Phase Z (Index output)	96/200/360	20	10	70

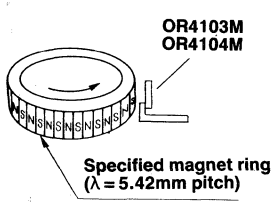
*Disk hub is optional. (GP1R52 has built-in disk hub.)

OR103M1

OR4103M

OR4104M

OR4108M



MR-CUE Head

(Ta = 25°C)

Model No.	Absolute maximum ratings			*2Cue signal playback output Vp-p (mV)						DC resistance Ro(Ω) TYP.
	Sensing current Is (mA)	Operating temperature Topr (°C)	Storage temperature Tstg (°C)	*32H record			*46H record			
				MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
OR103M1	10	+5 ~ +40	−30 ~ +60	3	10	60	1.3	3.0	—	400

* MR: Magneto-Resistance *2 Condition: is = 5.0mA Cue signal: f = 30Hz for 0.5 sec.
*3 Evaluate with a standard tape for 2H record. *4 Evaluate with a standard tape for 6H record.

MR Sensors

(Ta = 25°C)

Model No.	Absolute maximum ratings			Total resistance Ro (kΩ) TYP.	Resistance change ratio @ (%)		Middle-point voltage V_1, V_2 (V)		
	Vcc (V)	Topr (°C)	Tstg (°C)		TYP.	Is*5 (mA)	TYP.	H (Oe)	Vcc (V)
OR4103M	6	−20 ~ +80	−30 ~ +100	0.85	3.3	1	2.5	0	5
OR4104M	6	−20 ~ +80	−30 ~ +100	2.7	3.7	1	2.5	0	5
OR4108M	6	−20 ~ +80	−30 ~ +100	1	3.3	1	2.5	0	5

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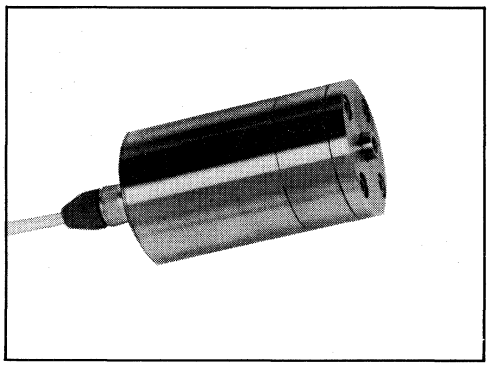
TRANSDUCERS & SYSTEMS

Specialists in transducers and systems for low range force/weight measurements

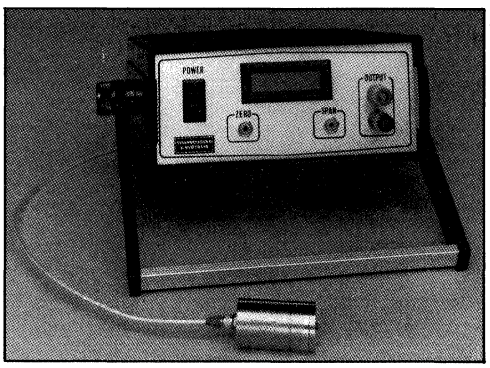
A PRIME TECHNOLOGY COMPANY



LOW RANGE FORCE/WEIGHT TRANSDUCERS

- **Highly repeatable — .02% F.R.**
- **Frictionless sensing**
- **Virtually indestructible**

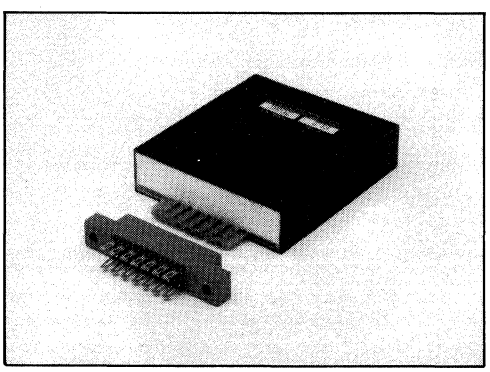
A virtually indestructible frictionless spring-loaded design has been proven in a wide range of applications — from demanding high volume arm flexture gram force calibration for disk drive manufacturers where durability and dependability are required . . . to sophisticated medical laboratory developments where pinpoint accuracy and precise repeatability are a must.



SIGNAL CONDITIONING CONTROL BOXES

- **Push-button Zero**
- **4½ Digit Display**
- **Span Adjustment**
- **AC Power Line Operation**

The CB14 control box is a highly flexible bench-top AC line-operated system. A 4½ digit LCD indicator and standard calibrations give a direct visual representation of measurement in grams of force or inclination related to the sine of the angle. Front panel accessible offset and scale potentiometers allow adjustment of any deviation experienced through mounting.

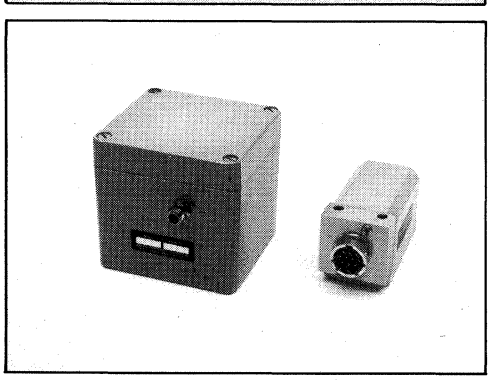


SIGNAL CONDITIONING MODULES

- **Flexible**
- **High resolution output**
- **Designed for use in existing OEM applications.**

These EL Series modules eliminate the need for developments of custom circuitry where DC to DC operation is desired. They provide a carrier-oscillator-demodulator filter and amplifier to provide a sharp, high resolution output. The unique EL2 has provision for remote offset and scale potentiometers as opposed to the more conventional EL3 with on-board adjustments.

Note: AC line, cord-operated, ±15VDC output power modules are available for use with EL2 and EL3 units.



INCLINOMETERS

- **From ±5° to ±90° with 360° axial capability**
- **Resolution of 0.1 arc-second**
- **Fast response, low hysteresis, high stability, high accuracy**

The HO Series of inclinometers utilizes a frictionless assembly for measuring deviation from horizontal, with immediate response, virtually infinite resolution and no cross-axis sensitivity. It is an LVDT-based spring mass system with core material centered on a non-magnetic stainless steel shaft with two mass weights equidistant on either end. The HO-C Series is a more moderately priced alternative to the HO inclinometer that meets the performance standards of most applications.

TRANSDUCERS & SYSTEMS
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CALL **203 481-5721**

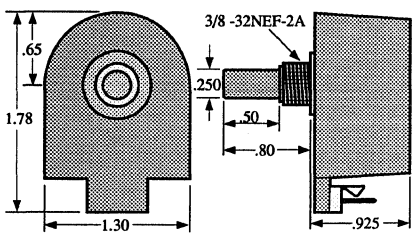
US DIGITAL Softpot™ Optical Shaft Encoders

The Softpot optical shaft encoder is a **non-contacting rotory to digital converter.** Useful for **position feedback** or **manual interface**, the Softpot reports realtime shaft angle, direction and speed. It is a practical solution to the wear, contact bounce and digit bobble problems associated with pots and A/D converters.

The Softpot utilizes an **unbreakable** disk, **metal** shaft and bushing, **LED** light source and operates from a single **+5** volt supply.

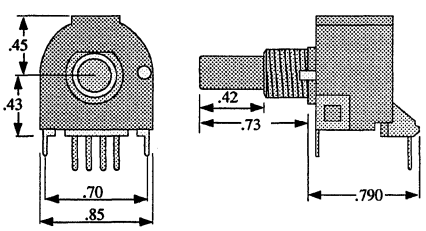
Available with **ball bearings** for motion control applications or **torque-loaded** to provide the feel of a limitless potentiometer for front-panel manual interface.

Call for updates on our **index, through-shaft** and **motor mount** versions. We have no minimum orders. Engineering orders (including special shafts) normally **ship within 24 hours.**



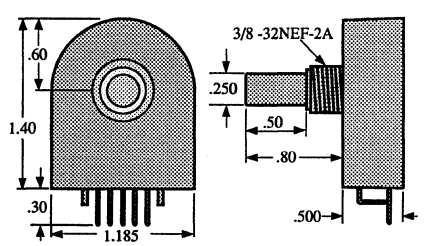
SP-16 Series

- 16 cycles/rev yielding 64 codes per rev.
- Quadrature outputs interface to TTL via 74LS244
- -20 to +85°C operating temp.
- $29/1's, $25/10's, $22/50's, $20/100's, $18/500's
- $16/1,000's, $13/5,000's, $10/10,000's, $9/20,000's



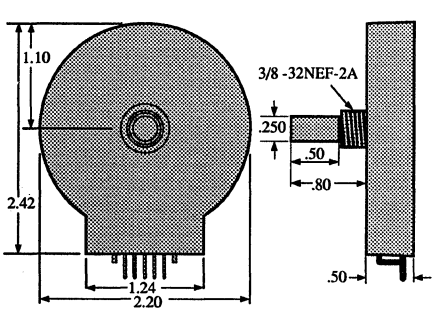
SPM-50 Series

- 20, 50 or 100 cycles per rev.
- Quadrature, TTL compatible
- Metal housing
- PC board mountable
- Detents available
- $29/1's, $25/10's, $23/50's, $22/100's, $19/500's



SP-500 Series

- 100, 200, 256, 360, 400, 500, 512 or 540 cycles per rev.
- 400 to 2160 codes per rev.
- Quadrature, TTL compatible
- Ball bearing option to 10,000 RPM ($7.00 option)
- -40 to +100°C operating temp.
- $39/1's, $33/10's, $30/50's, $27/100's, $25/500's
- $23/1000's, $21/5,000's, $19/10,000's, $17/20,000's



SP-1000 Series

- 1000 cycles (4000 codes) per rev.
- Quadrature, TTL compatible
- Ball bearing option to 10,000 RPM ($7.00 option)
- -40 to +100°C operating temp.
- $40/1's, $34/10's, $31/50's, $28/100's, $26/500's
- $24/1,000's, $22/5,000's, $20/10,000's, $18/20,000's

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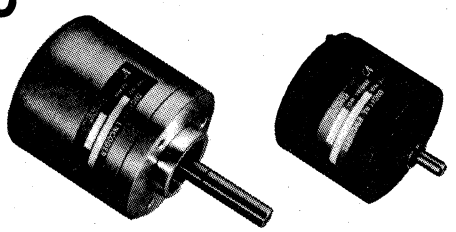
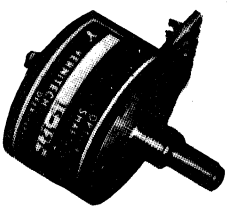
SHAFT ENCODERS

CONTACTING AND OPTICAL

INCREMENTAL/ ABSOLUTE



DIAL-CODER™



OPTICAL INCREMENTAL

* Dial-Coder Call Factory For Details

Size	Resolution	Diameter	Length	Features (Optical)	Options
5	To 256 Pulses	0.500	0.85	Only Available in Photo Sensor Output All Solid State Light Source High Reliability TTL, DTL compatible output.	• Sealed* • Index Marker • Quadrature Output • 1X-2X-4X Multiplier* • Extended Temperature Range • Non-Standard Supply Voltage • Photo Sensor Output • HTL Compatible Output* • Open Collector Output* • Rugged Construction* • Line Drivers* • Connectors • Direction Sensing
11	To 1024 Pulses	1.062	1.500		
23	To 1200 Pulses	2.250	1.875		
25	To 3000 Pulses	2.500	2.500		

* Not Available in Size 5

OPTICAL ABSOLUTE

Size	Output Code	Counts/Turn	Least Count Angle	Features	Options
23	Any	Up to 512	0.7°	† Quadrature Output on LSB Available TTL, DTL compatible Counting Speed 30 kHz max. Slew Speed 5000 RPM max. L.E.D. light source Output, parallel non-ambiguous	• Multiturn Available - Size 23 BCD Only - Size 30 - Any Code • **Rugged Construction** • **Extended Temperature Range** • **19 Bit Total Count** • **Other output levels available** • **Connectors**
30	Any	Up to 1024	.18°		

† On Selected Models

CONTACTING ABSOLUTE

Size	Code	Counts/Turn	Revolutions for Full Count	Full Count	Features	Options
11	Gray/Binary	To 256	1 to 64	To 2^{14}	Operating Speed: To 200 RPM DTL/TTL Compatible 5,000,000 Rev. — Life Slew Speed: 1000 RPM Output: Parallel Non-Ambiguous Most units contain internal logic circuits for DTL, TTL compatibility	• Operating Temp.: −55°C to 125°C • Various Output Voltage Ratings • 18 and 19 Bit Total Count • Connectors • Increasing Count — CCW Rotation
	BCD	To 100	1 to 100	To 9999		
18	Gray/Binary	To 512	1 to 2048	To 2^{19}		
23	Binary	To 256	1 to 2048	To 2^{19}		
	BCD	To 400	1 to 100	1 x 10^6 BCD		
31	Gray/Binary	1024	Single Turn	To 2^{10}		

OPTICAL INCREMENTAL MODULAR

Size	Resolution	Light Source	Construction	Features		Options
Unhoused 15 or 23	To 1024 Pulses	LED	Modular	Low Cost	TTL, DTL Compatible 2 Channel Output Index Channel Photo Sensor Output	• Squared Output - Size 15 & 23 • Operating Voltages: 5 to 15 VDC • Photo Sensor Output - Size 15 & 23
5	To 256 Pulses	LED	Modular	Low Cost		

Housed versions also available.

Refer to sections 2440, 3500, 4750 for additional product listings.

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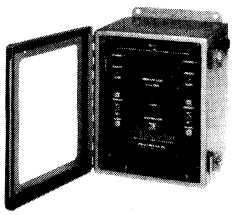
MACHINERY VIBRATION MONITORS



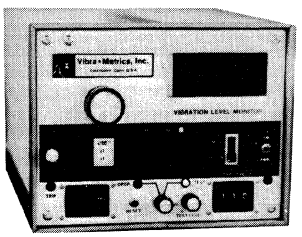
Monitoring Level: 0-1 ips RMS
Frequency Range: 5-3,000 Hz (3db)
Colored LED's: Alert—Amber, Danger—Flashing Red, Channel Status—Green to Red—Auto Guard Transducer malfunction
Trip Accuracy: 5% of setting
Two Trip Levels: Alert, Danger; adjustable front panel set pots
Internally Adjustable Trip Delays: 1-10 seconds—Factory set 8 secs.
Trip Level Calibration/Check via Level Meter
Reset Button (remote contacts available)
Digital RMS Velocity Level Indicating Meter
Channel Selector Switch for Level meter, Calibration & Velocity AC Output
115VAC Input Power (220V option)
Fail-Safe Power Loss Protection (disables Shutdown Relay)
Optional Filters: Low, High or Band Pass
Inputs for (1-6) Accelerometer Signals; rear panel BNC jacks
Outputs: A. AC Signal: 5VAC/ips (peak) BNC jacks (rear), (1) BNC jack (front) B. DC signal: 4VDC/ips RMS (1-6) BNC jacks (rear) C. Two DP/DT relays per channel—3 amps D. Remote Reset (option)

M8D DIGITAL VIBRATION METER [Battery Operated]

Metric scale optional

Functions: Velocity, Acceleration and displacement.
Ranges [Decade]: Velocity-Full scale .02 to 200 in/sec (PK)
Acceleration .002 to 20 g
Displacement to 2000 mils (PP)
Output: 2 Volts (Full scale) AC/DC Recorder option
Frequency Range [3db]:
Accel. 2HZ - 15KHZ
Vel. 5HZ - 3KHZ
Disp. 5HZ - 1KHZ
Accelerometer Power: 2 ma, 15 Volts (DC) from input connector
Filters [Front Panel Selectable]: Plug in optional High pass, low pass or band pass
Accelerometer: 7 - 14 mv/g
70-140 mv/g

M9D VIBRATION METER/MONITOR



Specifications same as M-8D with the following additions

Accelerometer: 100 mv/g

Trip Alarms: One or two

Set Points: Digital 0-200% of Full scale selected.
Outputs: Relay contacts NO/NC BCD (Option)
2 Volts (Full scale) DC Recorder option

VM-350 PREDICTIVE MAINTENANCE VIBRATION METER

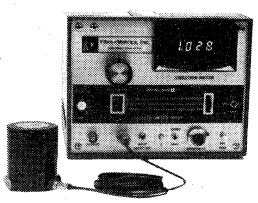
An accurate solid-state instrument for use in predictive maintenance and quality assurance

Velocity Ranges: 0.1 to 30 (I.P.S.)
Frequency Range: 3HZ-5 KHz
Input: Low impedance accelerometer included in vibration probe (VP 300) or individual sensor
Power: Battery
Size: 7" long x 2½" deep x 4" wide

SEISMIC VIBRATION METER SYSTEM

Consists of **M8DSP** Meter and 1030 Seismic Accelerometer

Most Sensitive Full Scale Range:
20 Micro g
200 Micro in/sec
20 Micro in (PP)



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	MICROMITE	MINIATURE	TRIAXIAL	GENERAL PURPOSE	HIGH OUTPUT	INDUSTRIAL	5 VOLTS
	0.7 GRAM	1.8 GRAM	10 GRAM			RUGGED	SEISMIC
MODEL	9001	1000/1001	3000	1018/1019	1020/1021	6022	1030
Sensitivity mv/g	7	10	10	10	100	100	5 Volt
Frequency Range [±5%]	5-10K	3-10K	3-10K	3-10K	2-10K	3-5K	.01-200
Noise g(rms)	.004	.0015	.0015	.0015	.00015	.00015	5X 10-6
Iso Shield	NO	YES/NO	YES	YES/NO	YES/NO	YES	YES
Pre-filter Option	NO	NO	NO	NO	YES	YES	YES
Temperature [F]	250	250	250	250	250	250	250
Weight [gms]	0.7	2/1.8	10	15	50	60	485
Dimensions [in]	.25 H x .25D	.4H x .25D	.75H X .5D	.75H x .5D	1.2H x .75D	.2H x .8D	2.5H X 2.5D

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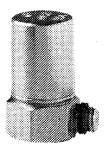

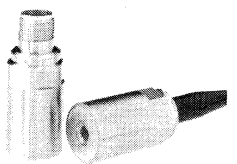

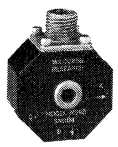

SPECIAL FEATURES	Miniature Triaxial	Low Mass High Sensitivity	Rugged Industrial	Industrial Low Frequency	Rugged Velocity Output	Industrial Triaxial	Handheld Probe
Model #	**733**	**736**	**793***	**793L***	**793V***	**993**	**HA8**
Sensitivity, mV/g	10	100	100	500	100 mV/in/sec	10	100
Frequency Range (±10%)	2 - 4k	4 - 20k	2 - 7k	0.4 - 1000	2.5 - 3.5k	2 - 2k	2 - 1k
Noise, µg	150	150	500	10	100	500	100
Ground Isolation	yes	no	yes	yes	yes	yes	yes
Temperature Limit, °C	120	120	120	120	120	120	NA
Weight, grams	23	15	110	135	133	90	150
Dimensions, inches(H x D)	0.75 x 1.35	0.89 x 0.49	2.42 x 1.0	2.42 x 1.0	2.42 x 1.0	1.7 x 2.0	7.50L x 1.30D

- A major accelerometer supplier with high volume "OEM" capabilities, Wilcoxon Research is the choice of the leaders in the Predictive Maintenance Industry.
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- Kulka
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- Heli-Tube
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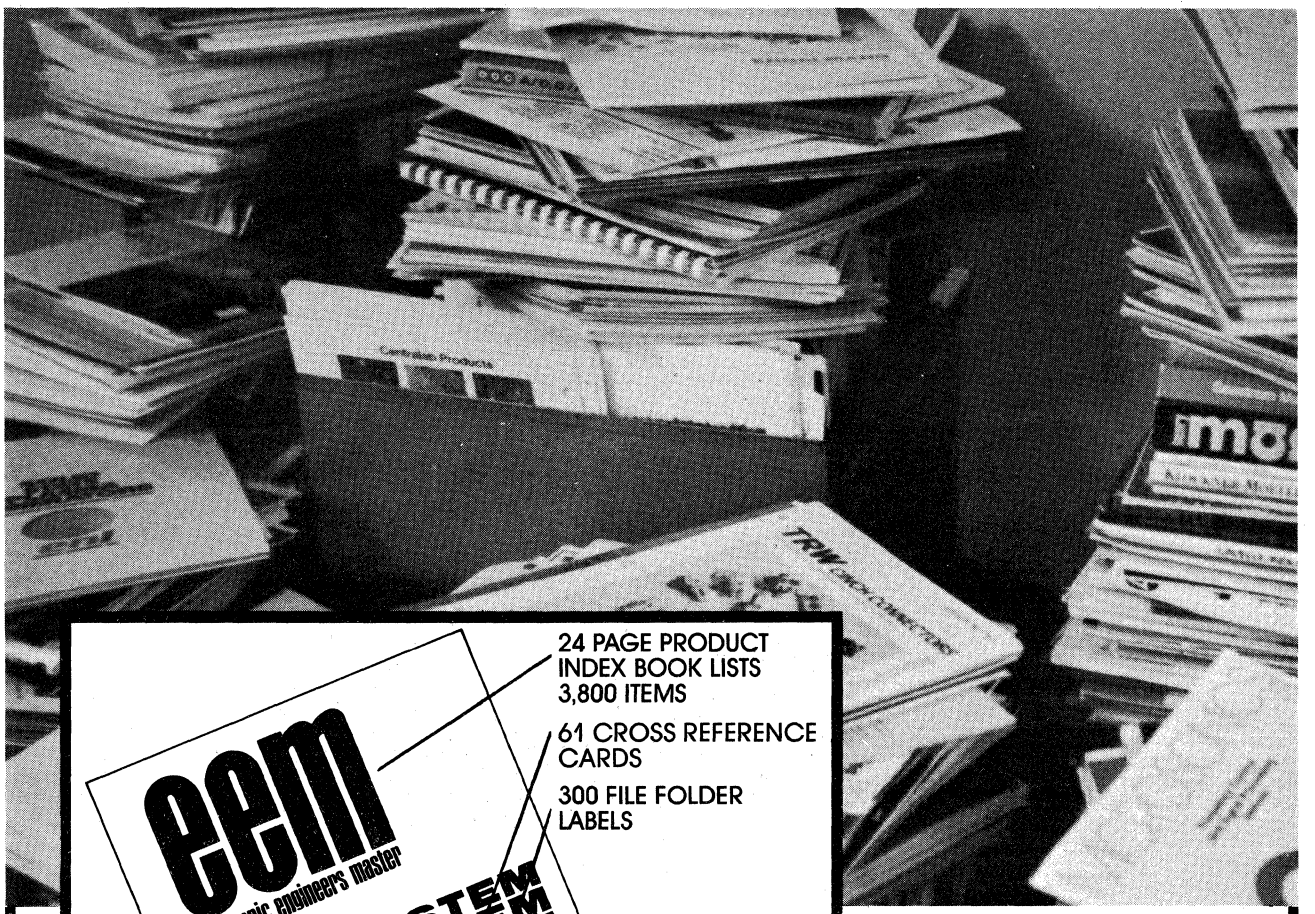

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These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States (ANSI) American National Standards Institute

United States (NEMA) National Electrical Manufacturers Association

Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

Yugoslavia Federal Institute of Standardization

SI UNITS

RELATIVE QUANTITY SYMBOLS

≠	not equal to
≈	approximately equal to
∝	proportional to
<	smaller than
≤	smaller than or equal to
«	much smaller than
>	larger than
≥	larger than or equal to
»	much larger than
≡	identical to or equivalent
↑	increases
↓	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

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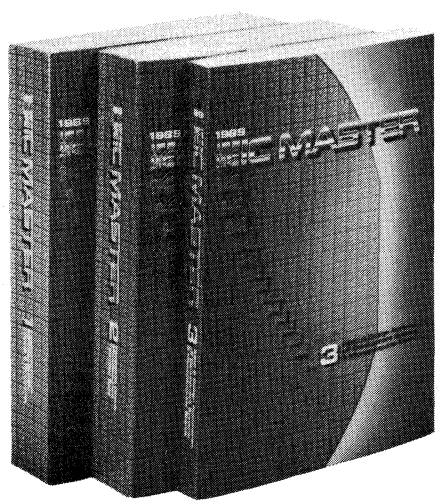

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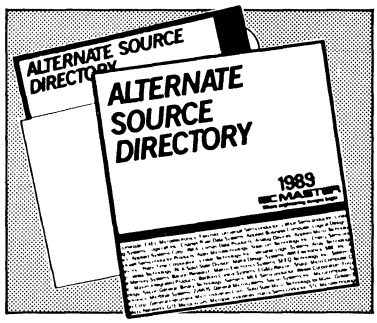

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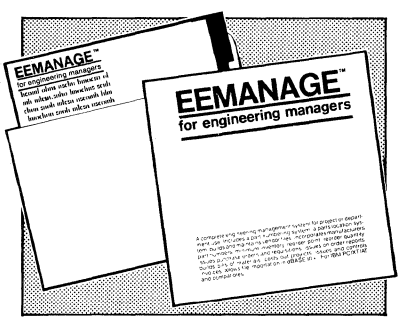

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ASCII Code ..... **D**•1080
Batteries, Product Selection Guide .... **D**•1447
Batteries & Fuel Cells, Characteristics ..... **D**•1450
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1093
Capacitors, Miniglossary ..... **A**•1066
Capacitors, Product Selection Guide . **A**•1002
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1197
Conductors, Maximum Current Capacity of Copper & Aluminum ... **A**•2272, **C**•1316
Connectors, Miniglossary ..... **C**•1271
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1339
DC Power Supplies, Product Selection Guide ..... **D**•1537
Delay Lines, Product Selection Guide ..... **A**•1503
Dielectrics, Thermal Conductivity ..... **B**•1916
Discrete Semiconductors, Product Selection Guide ..... **A**•2154
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1041
EBCDIC Code ..... **D**•1086
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Filters, Power, Product Selection Guide ..... **A**•1642
Filters, Signal, Product Selection Guide ..... **A**•1683
IC Master ..... **A**•1740
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1210
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Panel Meters, Analog & Digital, Product Selection Guide ..... **D**•1376
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Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1351
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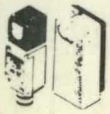

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- Omron
- Redington
- Red Lion
- Sodeco/Maxmar
- Stemco
- Veeder-Root

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- U.S. Toyo

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